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Nutritional epidemiology during school age

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Summary. - Nutritional research covers different fields, two of which are of particular interest: evaluation of the nutritional status, and epidemiology of food consumption. For many years, studies in these fields have been promoted by our research group, which bases its methodology on anthropometric measurements, bioelectrical impedance measurements, and check of nutritional habits. Our studies involve more than 2500 subjects from pre-school age to adolescence. This work represents the basis for an educational approach with the ultimate aim of improving life styles. One of our first studies on school meals during nursery period and composition and application of "dietary tables" showed inadequacies of energy intakes and macronutrients distribution. In another study, aimed to evaluate the intake of soluble sugars, more than 2/3 of participating school children were found to consume more than 70 g of soluble sugars per day, while 10% of them exceeded 150 g/day. Results of the following study, in which special attention was given to salted and sweet snacks, showed that snacks can account for 34% of the total daily energy intake; although its adequacy, the energy distribution per macronutrients showed a clear imbalance. As for adolescence, a very critical age, the evaluation of weight self-perception revealed that only 62% of them had a correct perception of their weight. This research also devoted special attention to home prepared breakfast, which is consumed by the vast majority of enrolled subjects, although only rarely it is nutritionally adequate. A double age-related trend could thus be drawn: on one side, there is the tendency of the "overweight status" to decrease (from a starting-point of about 20%); on the other side, this tendency is unfortunately compensanted by the increasing trend of "obesity" (which almost reaches 30%).

Key words: anthropometry, pediatrics, obesity, nutrition, adolescence.

Riassunto *(Epidemiologia nutrizionale in età scolare)*. - Tra le molte linee di ricerca nutrizionale, meritano particolare considerazione la valutazione dello stato nutrizionale ed il rilevamento dei consumi alimentari. In tale contesto si inserisce l'attività epidemiologica del nostro gruppo, la cui metodologia si basa sul rilevamento di parametri antropometrici, impedenza corporea e abitudini alimentari. I risultati offrono un quadro su oltre 2500 soggetti dall'età prescolare all'adolescenza, nella provincia di Roma. Essi rappresentano il presupposto ad un approccio educativo, inteso all'acquisizione stabile di abitudini alimentari meglio rispondenti al mantenimento di una salute ottimale. Una nostra prima indagine sulla refezione scolastica nella seconda infanzia, composizione ed applicazione delle tabelle dietetiche, ha evidenziato numerose inadeguatezze energetiche e di distribuzione dei macronutrienti. Abbiamo anche valutato il consumo di zuccheri semplici in varie fasce d'età pediatrica, rilevando consumi fino a 150 g/die nel 10% dei soggetti, ed alti comunque nei 2/3 dei ragazzi. Una successiva indagine ha voluto verificare il "peso" dei fuoripasto nell'alimentazione quotidiana: tra gli scolari dell'obbligo il consumo di fuoripasto (dolci e salati) può coprire fino al 34% dell'intake calorico totale giornaliero; nonostante questo fosse poi adeguato, la ripartizione per nutrienti maggiori appariva decisamente anomala. Per l'adolescenza, età assai critica, abbiamo verificato l'effettiva coscienza dello status ponderale e riscontrando che solo il 62% dei ragazzi/e aveva una corretta autostima del proprio peso. Nella stessa indagine è stata anche valutata l'abitudine alla prima colazione e la sua correttezza nutrizionale; sebbene quasi tutti i ragazzi consumino una prima colazione, questa è raramente adeguata. Le varie indagini hanno evidenziato che una tendenza alla progressiva diminuzione dei sovrappeso (partendo da oltre il 20%), fa purtroppo riscontro un trend in ascesa del fenomeno "obesità" (che arriva a sfiorare il 30%).

Parole chiave: antropometria, pediatria, obesità, nutrizione, adolescenza.

Introduction

Generally speaking, nutritional problems during school age are given special attention in international literature. The main reason for this is the major role that bad or simply incorrect nutritional habits can have in promoting the onset of illness, in the form of either children's diseases (such as obesity, constipation, dyslipidemia, marginal nutritional deficits) or degenerative diseases (such as atherosclerosis, heart disease, obesity, non-insulin-dependent diabetes, and some tumors), more frequently seen in adults, or even developmental personality diseases (body self-image, interpersonal behaviour, affective and cognitive disturbances).

Nutritional research covers different fields, from chemistry, biochemistry and genetics to epidemiology and its clinical aspects. Of these, two fields are of special

interest: evaluation of the nutritional status, and epidemiology of food consumption, which are strictly related to each other. The results of studies in these fields are particularly interesting for the pediatrician, especially because it is possible to actively correct bad eating habits and life styles during childhood and adolescence. These results, in turn, can contribute to reducing the negative effects of these, both early on and later in life.

For many years, studies in these fields have been promoted by our research group working in the first Pediatric Clinic of Rome University "La Sapienza". Research has been carried out by means of epidemiological studies in many schools located in or outside Rome.

Our methodology has been based, since 1985, on anthropometric measurements: weight, height, skinfold thickness, and circumferences. At the same time, we measure the bioelectrical impedance of the children and adolescents participating in the study, and check their nutritional habits, in order to evaluate the intake of nutrients as well as their behavioural patterns.

In this paper, we wish to report the results of our studies. They involve a large number of children of different ages (more than 2500 covering childhood from pre-school age to adolescence), and seek to give a realistic picture of both nutritional status and food habits in a varied socio-cultural context, such as Rome. Furthermore, since our aim is to help young people maintain good health, this work is the essential basis for an educational approach with the ultimate aim of improving life styles and eating habits.

When children start their social life, at pre-school and school age, they are exposed to a model which, if unsuitable, can easily contribute to creating bad eating habits.

Nursery school age

In 1988 we were requested by the Health Authority to verify if the so-called "dietary tables" used by Rome's nursery schools of 1st and 2nd level were correct and how they were used [1-3]. We also checked on their nutritional values and the weight of the servings, bearing in mind that the official tables prescribe that the energy offered by school meals must be 50% of the Italian 1986-'87 RDA (recommended dietary allowances, i.e. livelli di assunzione raccomandati di nutrienti, LARN [4]). The results of our study showed that these meals differed considerably from the RDA:

- the energy provided was sufficient in the 1st level schools, but too low in those of the 2nd level;
- protein content was too high;
- carbohydrate content was quite low, but with a high percentage of sugar and other disaccharides;
- cholesterol intake was excessive in a high percentage of children;
- fibre and iron intake appeared to be low.

These data deserve careful consideration, taking also into account that such discrepancies are not reduced but, instead, accentuated when analyzing children's *daily total consumption*. The total energy intake was slightly below the RDA, in spite of a nutritional status of normal-high level. On the other hand, the percentages of energy provided by the three major nutrients (proteins, lipids, carbohydrates) are not sufficient at all. The consumption of proteins exceeded the limits of the RDA as much as 40%, especially among 1st level nursery school children. In terms of proteins g/kg body weight, this means about twice the recommended level. Also for lipids, the energy provided was too high (33-38% of daily total energy), and cholesterol intake was an average of 250 mg/day (whereas 130-150 mg/day is the age-related recommended value). Carbohydrate-derived energy was below the usually accepted level of 55-65%. Furthermore, soluble sugars, which represented as much as 21-23% of the global energy (RDA: 10-12%), provided too many calories. The consumption of iron and fibre was low.

It is always difficult to compare nutritional and anthropometric data, since possible correlations may prove to be spurious. We would like to point out, however, that the obesity prevalence in this study was 6.5% (higher among females than among males), a very high value, considering the young age of our children (mean age 2.5 years for the 1st level nursery school, 4.7 years for the 2nd level). Another anthropometric result should be pointed out: the subscapular skinfold thickness seems to be the parameter which presents the best correlation with the RBW (real body weight, i.e., the percentage ratio between real and theoretical height-corrected weight). Since this result has been confirmed in other studies carried out by our group, we believe that the subscapular skinfold thickness, together with other parameters, can be useful for an easy and quick nutritional assessment of large populations.

Elementary and middle school age

The school meals system cannot be blamed for all the errors and inadequacies which occur during the elementary school period. Other incorrect nutritional habits appear that may have been acquired during infancy. It may be difficult to change these, since they started in a very early period of the children's life, and reflect attitudes their families hold concerning food and its effects on their bodies and/or on their image generally.

In a special study, aimed at evaluating the intake of soluble sugars in Italian children, we found that more than 2/3 of participating Roman school children (305 children of the 4th elementary class) consumed more than 70 g of soluble sugars per day, while 10% of them exceeded 150 g/day [5]. These very high intakes were mostly due to a high consumption of white sugar and soft

drinks. In this study, high intakes and overweight-obesity, prevalent in 16% of the children, did not correlate, but, nevertheless, we cannot exclude dangerous effects in the long term.

Another bad habit, typical of school age, is the frequent eating of snacks. These foods may have an unbalanced composition, which can easily affect the mean daily intake of energy and major nutrients. The evaluation of this habit was the aim of a further research we carried out in 1990 [6] on 547 elementary and middle school children. In this study, special attention was devoted to the evaluation of various snacks (pizza, sweets, soft drinks, sweet snacks, ice-creams, etc.). The results of our study showed mainly that the vast majority of children eat such foods/drinks, not only as a snack, but also during meals. The energy given by the snacks can account for 34% of the total daily energy intake. However, even considering the breaks alone, they provide for 21% of the daily energy intake. It was not our aim to analyse in detail the food composition of the snacks; there is no doubt, however, that such excessive consumption is a clear indication that nutritional education is lacking.

In the course of the same study, we also evaluated anthropometric parameters and daily global intakes of the enrolled children. In fact, earlier results were corroborated by the present study. Energy intake appeared to be quite adequate, while the energy distribution per single macronutrient clearly showed an imbalance: 15% of energy derived from proteins, 48% from carbohydrates (with excess of soluble sugars), 37% from fats (even though well balanced as for the polyunsaturated/saturated ratio). As far as the anthropometry is concerned, we can demonstrate an obesity prevalence rate of 19%; the same for the overweight children. On the whole, about 40% of these cases showed a non-physiological excess in weight. These data are very similar to those found in other studies carried out in different areas of Italy [7], and from another research completed more recently by our group in Grottaferrata (1994), a small town near Rome. In this study, among 600 young boys and girls aged 6 to 14 years, the obesity rate was as high as 26%, while those who were overweight accounted for 18% of cases. On the whole, therefore, much more than 40% of the population exceeded the above-mentioned rate of 40%. Since in former studies we were able to identify the subscapular skinfold thickness as a valuable anthropometric parameter, we tried to endorse this finding. Through the "manova" statistical method (multivariated analysis of variance), we were able to define the former result better: both the subscapular and the sovrailiac skinfold thickness, among males and females respectively, are parameters whose variance is best justified by the variable "weight". In other words, they can be considered as good indicators of body adiposity.

Adolescence

Adolescence is a very important evolutive phase, often critical from many aspects, such as growth, development of autonomy, sexual maturation, and psycho-emotional changes. During this period of life, nutrition must meet not only new physical needs related to growth but also behavioural needs. In fact, it must be borne in mind that deviations from correct dietary rules may be responsible for nutritional imbalances, the consequences of which can be serious.

The adolescent is particularly subject to age-specific risks, such as the emulation of wrong, or even harmful, behaviours or habits (involving junk food, alcohol, cigarettes, drugs, etc.). Among the different factors which explain this attitude, the most important one is the search of his/her own identity within the peer group. As a consequence, it is common for young people to diverge from what would have been their personal tendencies or code of behaviour, and instead, follow other fads or life styles from which they will gain immediate satisfaction. Their behaviour will also include a desire to break with their family and to rebel against their rules and customs.

Another factor which can affect the development of incorrect dietary habits is the change in their body self-perception which has a physiological value at this age, but which, nonetheless (and according to the results of other researches), tends to be wrong self-esteem [8]. In fact, this wrong perception is closely linked to the over-importance they give to the opinions of others (typical not only during adolescence, but common throughout our society). This, in turn, may give rise to anxiety and insecurity, frequently inducing adolescents to adopt unsuitable diets (vegetarian, slimming, etc.) which, theoretically, they think will make them conform to the so-called "ideal body image".

One of our studies was directed towards a precise evaluation of the prevalence of overweight/obesity and the self-perception of their weight in a group of Roman adolescents [9]. The results show that the prevalence rate of those overweight was 21%, which is similar to that of obesity (20%). A sub-group of the sample (102 adolescents) also received a self-evaluation questionnaire, concerning the item "slim/normal/fat", the results of which are compared to the real weight class. We found that only 61.7% of the young people identified themselves correctly, whereas only one out of six underweight adolescents did so and the others believed they were of normal weight. On the other end of the distribution curve, only 12 out of 41 overweight/obese adolescents identified themselves correctly. Among the normal ones, five out of 55 thought they were too slim.

The above figures differ greatly from those in similar studies on American adolescents [10]. According to these authors, many normal- and even under-weight children believed themselves to be obese and started

hypocaloric diets without any kind of medical supervision. Such variants could be due to different cultural backgrounds, which can still be found in spite of a considerable diffusion of imported cultural models.

This research also devoted special attention to home prepared breakfast [11]. As far as the consumption rate is concerned, the vast majority of enrolled children (91.1%) habitually had breakfast. The rate of 8.9% for non-consumers is slightly higher than that found in Milan (6.5-7.5%), Bologna (5%), and, again Rome (6.4%).

In spite of a very good consumption rate, breakfast appeared to have a low nutritional impact. Mean energy intake, was, in fact, 255 kcal, i.e., lower than 20% of daily energy intake, which is considered optimal at present. We must point out, however, that this is a global, intersex result, varying somewhat from reality. Indeed, males appeared to consume much more than females, even though about 92% of the children consumed less than 400-500 kcal/breakfast. No significant differences could be made among energy intakes in the three different weight classes (under-, normal-, and over-weight).

Data relating to nutrients in terms of energy showed slight deviations from RDA's suggestions: lipids and proteins appeared to be consumed in slight excess, and glycids (especially complex ones) were rather low. Although this could be regarded as a positive result, it should be pointed out that the body needs to quickly restore its energy deposits after night-fasting, which can only be obtained by a caloric intake consisting of 2/3 carbohydrates (mostly complex ones) and 1/3 proteins and fats together.

As far as the food choices for breakfast were concerned, the preferred food was milk; other children, however, consumed nutritionally inadequate foods/drinks, such as tea, or disliked nutritionally valid foods, such as fruit, however served.

Conclusive remarks

At this point, a global opinion about nutritional habits of Italian adolescents (which differs little from adolescents in other affluent countries) can be given, taking into consideration the results of other researches carried out in different parts of Italy. Their results concur on the following points, some of which we have already seen in adolescents:

- energy intake is usually adequate;
- protein intake is higher than that proposed by the Italian RDA;
- carbohydrate intake is low, on the contrary, but soluble sugar consumption is too high;
- fat intake is adequate, likewise the P/S ratio;
- cholesterol intake lies within the limit of 100 mg/1000 kcal;
- fibre consumption is insufficient.

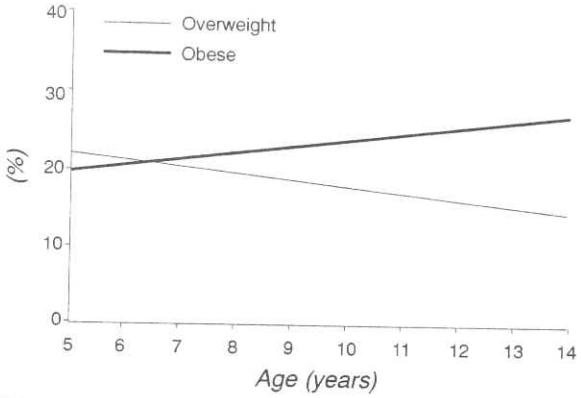

Fig. 1. - Prevalence trends in obesity from 5 to 14 years (no. 2514).

In conclusion, it may be useful to take note of the Fig. 1 which summarizes the prevalence trends in overweight and obesity, as seen in more than 2500 children (5-14 years). These trends are perturbing since the line for overweight children is becoming lower, while the line for obese children is rising. In any case, it can be seen clearly from this figure that there is a need to find a solution to this serious problem.

Education in nutrition obviously has a major role to play as a means of communication capable of making improvements in dietary habits on a long-term basis. Furthermore, it would bring about changes in the life styles of the community, with the pediatrician, family, teachers, national institutes, etc., as well as mass media, all contributing in this educational process. Of course, it should be said that the idea would not be to eliminate the recently acquired eating habits (which are undoubtedly here to stay), but rather to create a fresh outlook and an awareness of food and nutrition, along the lines of the saying "A man is what he eats": a paraphrase of a well known saying by Feuerbach ("A man eats what he is").

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