

NUTRITION AND HEALTH COLLECTION

Patterns of food intake in schoolchildren



*Danone Vitapole
Research*

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Patterns of food intake in schoolchildren

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INTRODUCTION

Researchers in nutrition and clinicians from about twenty countries worldwide met in a workshop on eating patterns in school-age children, organized by the Danone company. A country's economic resources, genetic factors, cultural habits and life-styles affect eating behavior and, consequently, health. Concomitantly, knowledge in the field of nutrition continues to make rapid strides. As Akram Fazel pointed out «We've gone from the knowledge that the function of food is to provide energy to the concept that an adequate diet can ensure good health, and may even prevent certain diseases». Currently, research is seeking to identify which bodily functions could be improved by a balanced diet. How then can we reconcile our improved understanding of nutritional requirements and resultant recommendations with existing eating patterns ? The researchers present discussed this topic at the meeting plenary sessions and in inspiring and productive round table discussions. Starting with a baseline assessment of the present condition in each country and the latest knowledge in terms of physiological and nutritional requirements of children and teenagers, the participants reflected on the necessity, conditions and means for change, in order to maintain and even improve health and well being. They discussed the role of breakfast, snacks and changes in cultural patterns of eating. In a field which has not yet been completely investigated, for many the discussions, while highlighting the depth of available studies, opened up new ideas and avenues of research.

FOREWORD

A NOTE ABOUT DIETARY SURVEYS

How reliable are the data, collected on eating patterns and nutrient intakes, from surveys or self-recording procedures? How much faith should be placed on the outcomes of such methodology? Quite early in the workshop the participants made clear that we should tread carefully in making interpretations from surveys of large scale population studies.

It is remarkable that, although food consumption is apparently quite a simple act, it is extremely difficult to obtain reliable and accurate measures of human eating. When subjects are brought into a laboratory or placed in a calorimetric chamber it is relatively easy to control all access to food and to accurately measure the amount consumed. However, subjects living in a restricted environment or operating under a strict protocol, may not display their normal (i.e. habitual) patterns. On the other hand, eating patterns in free-living individuals in their natural environment are extremely difficult to measure precisely.

Measurement of habitual food intake in the real world relies upon some form of self report, recall of normal habits or the maintenance of diet records in diaries or log books. Nutritionists and others have known for years that, under these circumstances, subjects misreport their food intakes. Evidence for this can be assessed by comparing reported energy intake to the calculated basal metabolic rate. This formula provides a realistic expectation of energy intake for individuals with different levels of physical activity. More recently the technique called the 'doubly labeled water' method has been used to accurately evaluate energy needs in free living individuals. From investigations using these procedures it has become obvious that under-reporting is substantial and widespread. In some major surveys more than 50% of individual records do not reflect habitual intakes, and even the reliability of the rest cannot be guaranteed. This is quite worrying and poses a dilemma for scientists and others working with dietary data and eating patterns. It should not stop us from speculating or formulating policy, but we do have to take a careful approach in making our interpretations.

NUTRITIONAL REQUIREMENTS OF CHILDREN AND TEENAGERS

Energy requirements of children and teenagers differ from those of adults because of physiological processes related to growth in these age groups. In addition, energy requirements in small children differ from those of teenagers.

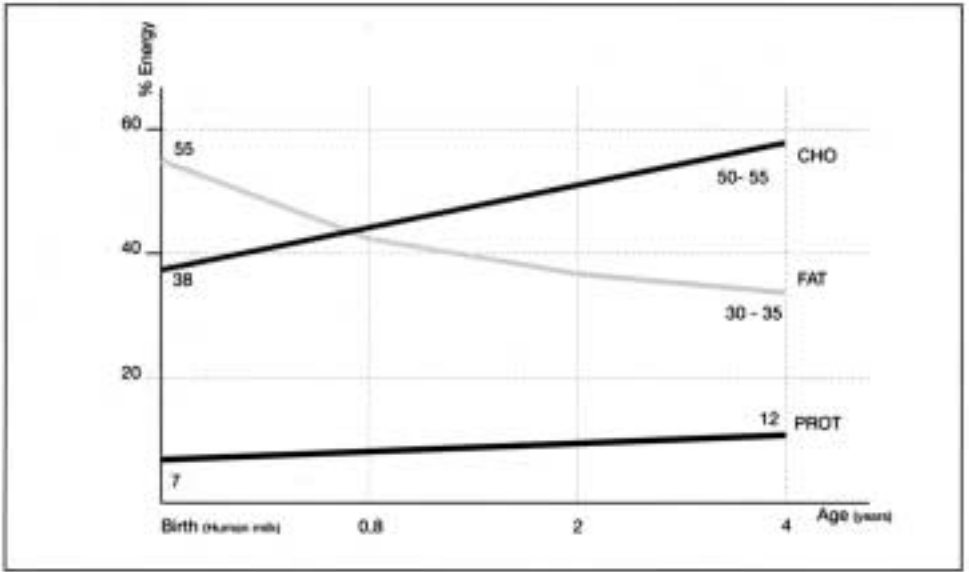
CHILDHOOD

Inadequate knowledge of the specific energy requirements of children carries a risk of major negative impact on their growth and future health.

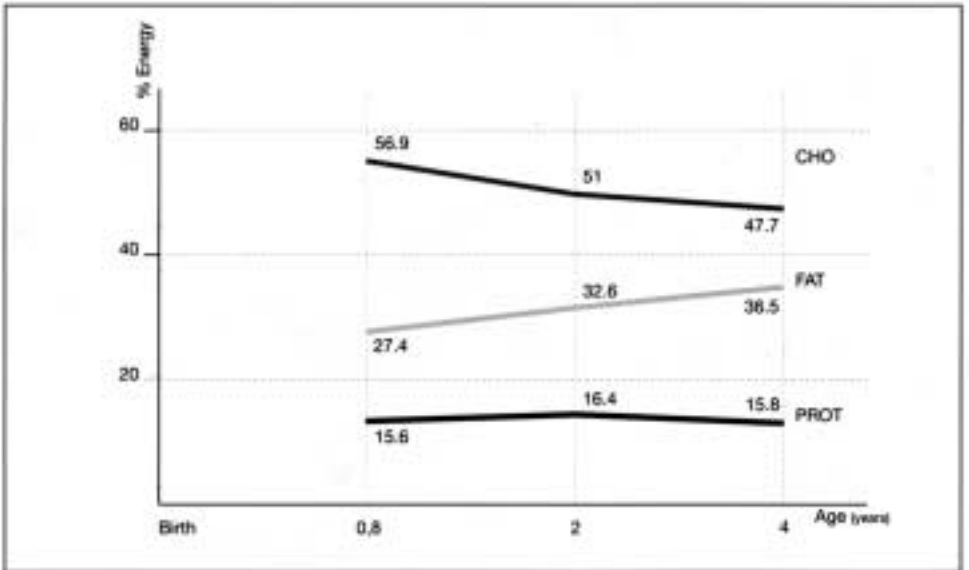
Early and late childhood : a nutrient balance for each period of growth.

Marie Françoise Rolland-Cachera (Hôpital St. Lazare, INSERM Unit 290, Paris, France) reminded her audience that nutrient balance varies with age, but not in the expected way. On the basis of the results of different studies, she noted that at all ages, the percentage of energy provided by protein was high, and that during infancy, the energy provided by fat was low and became excessive after the age of 4 years.

To illustrate her point, she referred to a study in France showing that children 10 months of age derive 27.6% of their energy from fat. Later on, at about age 6 years, children obtain 37.3% of their energy from fat. Yet, paradoxically, the percentage of fat in the diet is low at the start of human life and then increases with age, while, on the contrary, it should be higher during the first months of infancy and then gradually decrease. Later, in childhood and adulthood, the percentages of protein and fat generally are high in the diet. Energy provided by proteins is



Suggested intake changes with age (*Cahiers Nutr. & Diététique, Vol. 30, 1995, 167-171*)



Actual nutrient intake changes with age (*Cahiers Nutr. & Diététique, Vol. 30, 1995, 167-171*)

closer to 17% than to the 12% recommended and the energy intake supplied by fat, generally, exceeds 35%. Thus, nutritional advice should take into account changes in specific energy requirements associated with different age categories of children. She then presented the contributions of the different meals to the nutrient balance of the daily energy intake, in a sample of ten year

old French children. Breakfast, lunch, the afternoon snack (the «goûter») and the dinner represented respectively 18, 33, 17 and 31% of the total daily energy intake. The contribution of breakfast and the «goûter» are similar (18 and 17%), and both these meals were low in fat and high in carbohydrates, contributing to improve the nutrient balance of the day. Mrs. Rolland-Cachera described a previous study on physical activity, body composition and nutritional intakes. This study showed that in addition to improved body composition, the more active children had a larger breakfast and afternoon «goûter», and a better nutrient balance than less active children. She concluded that physical activity should be promoted not only for its positive effects on fitness, but also for its influence on meal pattern and improved nutrient balance.

Recommendations on fat intake for young children and teenagers

According to Daniel Brasseur (Children's University Hospital Queen Fabiola, Brussels, Belgium) an entirely unusual discovery, recently confirmed by observations and studies conducted in European countries, shows that children during the second semester of life, often receive a low-fat diet. Skim or partially skimmed milk replaces powdered milk. Fruits and vegetables, while not totally free of fat, are entirely low-fat. The reason of the turning point which results in a high-fat diet in adult subjects is not clearly determined. Young children 1 to 3 years of age, often ingest fewer essential fatty acids than recommended amounts. The gradual addition of fat to the diet in the form of meat, butter or other dairy products actually does not solve the problem. Early

Age (month)	6	12	24	36	48	Adult
Nordic C.	35 - 55	35 - 45	30 - 35	30	30	
Netherlands	50	35 - 40	30 - 35			
Germany	45 - 50	40 - 45	35 - 40		30 - 35	25 - 30
ESPGAN	No restriction		Progressive reduction from 2 to 3 years		to 30 - 35	
USA	> 30			< 30		< 30
Canada France	No restriction			Trend to 30 % when length growth stops		
Unit is % of Total Energy						

Fat intake recommendations (%)

introduction of a high-protein diet (most of the time in the form of animal-derived products, except for fish) goes together with intake of highly saturated fatty acids. Sometimes, trans fatty acids unduly replace saturated fatty acids. Thus, the relative deficiency in essential fatty acids can persist unless vegetable oils or margarine is introduced into the diet. From this standpoint, the example of Mediterranean countries is very typical. However, in Northern Europe, eating patterns of teenagers differ entirely. The situation is even more complicated by trying to follow recent recommendations on calcium intake in this age category. Only the intake of whole milk and cheese offers young people the possibility of following these recommendations, which inevitably are accompanied by a high load of highly saturated fatty acids.

Development of more appropriate nutritional products could help to resolve these differences between what is recommended and what actually is eaten.

Energy and nutritional requirements in primary schoolchildren

Growth in humans involves an extremely complex process. Important changes in body composition occur during fetal growth and the first few years of life.

Piedade Sande-Lemos (Fernando Fonseca Hospital, Amadora Sintra, Portugal), in particular focused on changes in body composition and on requirements of school-age children.

Over time, a child reaches a weight of 7 or 8 kg and the fluid/solid ratio of the body becomes similar to that of adults. The ratio between components of lean body mass in the newborn compared to that of adults is 1.10 for water, 0.73 for proteins, 0.74 for potassium and 0.96 for density. At age 10 years, these figures change and then become 1.04, 0.93, 0.99 and 0.98, respectively. These changes reflect modifications in the ratio between intracellular and extracellular water and the increase in the amount of muscle and bone mass in lean body mass.

Furthermore, the percentages of fat, protein and water which accompany changes in body composition are not constant. Many factors contribute to these variations, including the body's previous nutritional status, genetics, caloric intake, eating patterns, disease, sex, growth rate and physical activity. For example, studies conducted on nutritional status of certain groups of patients show that the relations between resting energy expenditure (REE) and body composition are very much altered in cases of anorexia, Crohn's disease, leukemia or cystic fibrosis.

Thus, the body should be considered as a «furnace» whose balance can be upset by different regulators including hormones, central nervous system, cytokines and others.

There is a strong, but non-linear relation between basal metabolic rate (BMR) and lean body mass (LBM). The slope of BMR/LBM is steeper during early childhood, and then gradually falls to adult levels. With increasing lean body mass, the percentage of muscle in comparison to that of the organs increases. Muscle is less metabolically active than internal organs, which accounts for the decrease in BMR which depends on LBM. During the period of childhood, energy and nutritional requirements for optimum growth and proper development have been determined. The number of calories necessary for growth decreases with increasing age and then increases during the teenage years. Mean energy expenditure of a 6 to 12-year old child can be ex-

pressed as follows : basal metabolism : 50%, growth: 12%, physical activity : 25%, fecal losses : 8% in the form of non-absorbed fat. Basal metabolism of 55 kcal/kg/day at birth decreases to 25-30 kcal/kg/day in adulthood. The primary objective of nutrition should be to meet the requirements of growth and intellectual development, but also to prevent dietary imbalances.

Milk : 500 ml a day for schoolchildren with bone mass measurements

«Every effort should be made by nutritionists so that children achieve peak bone mass at 25 years of age», continued Ramon Tormo-Carnice, (University of Barcelona, Spain). Beyond this age, men lose 8% of their bone mass every ten years and women lose about 12%. If a boy or girl reaches age 25 with a low bone mass, he or she will be at a high risk of developing osteoporosis later. Even though drinking 500 ml of milk a day can provide a child with a sufficient quantity of calcium, nevertheless, bone mass should be measured in all children at regular intervals in order to possibly correct it, if it is too low, before age 25 by increased milk drinking, as one possible corrective measure.

The best method of proper bone mass follow-up may be to make repeat measurements of it regularly with ultrasonography, every 6 to 12 months. For physicians, the DBM 1200 SONIC X-ray densitometer appears to be the best device for measuring changes in bone mass in children, because this method avoids irradiation associated with dual X-ray conventional densitometry. In fact, the same results have been found in 17 children, comparing a DBM 1200 SONIC ultrasound device with a Dual X-ray conventional densitometry. Certainly, this sounds like an attractive project, but it met with resistance by a certain number of participants in the workshop, because of the high-cost of this examination.

THE TEENAGE YEARS

Recent studies have expanded knowledge on adolescent physiology and defined its specific nutritional requirements.

Measurement of body energy expenditures

Michel Vermorel (INRA, Human Nutrition Research Center, Clermont-Ferrand, France) expressed his regret that Recommended Dietary Allowances (RDA) generally do not take into account the wide differences in anthropometry, body composition and physical activity of adolescents. Thus, he conducted a study to measure body energy expenditures of teenagers according to age, gender, body composition, and physical activity, under standardized conditions and under unrestricted conditions.

His study involved body composition (Lean Body Mass, Free Fatty Mass and Fatty Mass) and the physical capacities of 101 healthy volunteers whose ages were 10.5 years (12 boys, 9 girls), 12.6 years (16 boys, 15 girls), 15 years (16 boys, 15 girls), and 23 years (9 boys, 15 girls). Daytime energy expenditure (DEE), sleep energy expenditure (SEE) and circadian ener-

gy expenditure (CEE) were determined under standardized conditions (using whole-body indirect calorimetry) to avoid the effect of changes related to physical activity. Lean body mass, peak VO₂ and gender proved to be major determinants of energy expenditures during the day and during sleep. The latter were significantly lower (about 5%) in girls than in boys, even after adjusting for lean body mass and peak VO₂ starting at age 12. DEE and SEE plateaued at 12.5 and 15.0 years of age in girls and boys, respectively, in spite of further increases in body weight and FFM. Daytime energy expenditure of 12 to 15-year olds was also investigated under conditions of un restricted living during 5 days, including a weekend. The cardiac recording method, validated by whole-body indirect calorimetry, was used. DEE was 13% and 22% lower in girls than in boys during a school day and at weekend at ages 12, 6 and 15 years, respectively. Two hours of physical training during a school day produced a mean increase of 16.3% in DEE.

DEE intra-group variability was 12.5% on average in boys and in girls, during the course of a school day, 17% in girls and 28% in boys on free days, showing a difference which arose from major differences in the type and duration of physical activity performed.

Regression equations can be computed from these data to predict mean weekly DEE and consequently RDA for individuals according to age, gender, anthropometry, body composition and detailed activities.

Could this lower energy expenditure in girls be a reason for the well known increased prevalence of obesity in women ?

Nutritional requirements in adolescence

Growth and development at puberty are the primary causes of the dramatic physical and psychological changes associated with the teenage years. At the same time, other psychosocial modifications occur which affect conduct relating to health and possibly the risks of chronic degenerative disorders.

Micheline Ste-Marie (IWK Grace Health Center, Halifax, Canada) discussed specific factors in adolescence which affect nutritional status at this age.

Apart from malnutrition which strikes disadvantaged children, other morbidity factors influence the nutritional status of teenagers. Among these, chronic disorders, rebellious behavior by teenagers which cause eating disorders, alcohol and illicit substance abuse, overeating and excessive practice of competition sports are potentially important risk factors. In addition, teenage pregnancy and intensive athletic activity increase energy requirements. For example, major energy expenditure can delay the onset of puberty if energy intake is not increased.

With regard to calcium requirements, current US and Canadian recommendations, specify an intake of 1300 mg a day of calcium from age 9 through 18 for boys and girls (Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, 1997).

Energy intake (% of total e.i.)	3 - 4 y		7 - 8 y		9 - 10 y		12 - 13 y	
	M	F	M	F	M	F	M	F
Breakfast	17	18	15	13	14	12	13	12
Snack	2	3	8	10	8	8	8	8
Lunch	32	33	32	33	35	35	37	36
Snack	17	18	14	15	13	15	13	15
Dinner	27	28	29	27	28	28	28	29
Snack	4	3	2	1	2	2	2	1

Patterns of food intake in Italian Schoolchildren. (Dr C. Maffei, personal communication)

INTERVIEW

STUDY ON CALCIUM IN TWINS : REPORT BY R. KLEINMAN

A study was conducted in 1992 on seventy pairs of twins. The purpose of the study was to determine whether calcium supplementation improves bone mineralization. One twin in each pair was given a standard dose of calcium, about 900 mg a day. The other twin was given a calcium supplement such that his daily intake was 1600 mg. The twins were then followed over a three year period. The twins were of different ages upon entry into the study such that some twins were prepuberal, other were experiencing puberty, and they then were followed up for three years. In the twins who were prepuberal, the twin in each pair who received the calcium supplement experienced significantly better bone density. In those twins who received calcium supplementation during puberty, no difference was observed in bone density between those who received standard amounts of calcium and those who took calcium supplements. The conclusion of this study was that administration of calcium supplements in prepuberal children up to a level of about 1600 mg a day significantly increased peak bone mass by about 3 to 5%, which represents a significant increase in bone mineral density.

The question remains : does this finding hold for all children or only for the seventy children studied here ? Second : is this the only period when it is possible to produce a significant increase in peak bone mass ? Third : once this peak bone mass has been achieved, does it last a lifetime ?

FOOD CHOICES : IMPACT ON HEALTH

Do children's and teenagers' food tastes and preferences affect their development? Several studies have sought to answer this question.

Big eaters are not fatter than small eaters

The question arises as to whether a child's food choices affect his/her development. France Bellisle (Hôtel Dieu, INSERM Unit 341, Paris France) presented several lines of evidence. Indeed, longitudinal studies on nutrition and growth in children show a certain number of associations between certain body features and the quantity and composition of the daily diet. Longitudinal follow up study of children over many years confirms the lack of a consistent correlation between energy intake and different measurements of body proportions, in particular, Body Mass Index (BMI). Big eaters are not fatter than small eaters. Carbohydrate intake is often found to be inversely correlated with adiposity, despite parents' fears that sweets can be the cause of fat deposition. Very active children may need a lot of energy, readily found in the form of tasty sweet foods. With the passage of time, children do not remain stable in their food choices and, between ages 2 and 10 years, the content of their diet can vary greatly.

Evidence indicates that very high protein intake at the age of 2 years is accompanied by accelerated growth and an increase in body adipose tissue at ages 8 and 10 years.

It is important to put knowledge on food choices and children's eating habits in the context of their life style. This is necessary to better understand the different factors which contribute to healthy development or, on the contrary, disharmonious development.

The taste for sweets : young children prefer higher concentrations of sugar than young adults

Babies and the majority of adults like sweets. However, less is known about changes in optimum levels of sugar and their relation with the detection of sweetness intensity in young children and adults. A recent study conducted by Zandstra and De Graaf (Wageningen, Netherlands), on the intensity of sweetness and the palatability of a type of orangeade in 6 age categories ranging from 9 to 70 years, suggests that young children prefer higher concentrations of sugar than young adults. 3 groups of 30 subjects were studied in detail: children 9 years of age, 15-year old teenagers and young adults. The sugar concentration in the water and the orangeade varied. All subjects rated the perception of the intensity of sweetness and palatability on a 5-point scale. In addition, preferences were also taken into account by classifying pleasant stimuli. Furthermore, discriminating capacity was tested using a stimulus classification system based on the intensity experienced. Results on sugar in water were qualitatively similar to results on sugar in orangeade. Children preferred a higher optimum sugar concentration level than that of teenagers and adults, and were less able to discriminate between different concentrations of sugar. Do children perhaps prefer higher quantities of sugar in their food than adults because they are less capable of detecting the taste ? Or because they have a higher requirement for readily available energy ?

CHAPTER II

NUTRITIONAL PATTERNS IN THE WORLD

This workshop also provided its participants with an opportunity to learn about the eating habits and requirements or deficiencies which exist in countries different from their own.

NUTRITIONAL HABITS OF SCHOOLCHILDREN IN ITALY

A nation-wide study on eating patterns was undertaken by Silvia Scaglioni (Sao Paolo Hospital, Milan, Italy) with a large sample size ($n = 35072$ children) in a population of school-age children in Italy (7-11 years). The regions of Friuli, Piedmont, Lazio and Sicily were selected as being representative of all socio-economic regions of Italy.

Analysis of results revealed that the average diet of Italian schoolchildren is marked by very high intake of protein and lipids (in particular animal protein and fat) and a lower intake of carbohydrates than that recommended, with a relative excess intake of sugar. Furthermore, ingestion of calcium is relatively low, while iron intake is more adequate.

Analysis of results by gender shows that caloric intake is higher in boys and that protein intake is higher in girls (82.5 g/day vs. 76.9 g/day) with the difference due mainly to ingestion of animal proteins. Fatty acid intake is also slightly higher in girls; saturated fatty acid and cholesterol intake is 30% higher in girls than in boys. With regard to calcium and fiber intake, no significant gender difference was observed.

On a regional basis, the highest intake of proteins, lipids and cholesterol expressed as nutrient density was observed in Lazio.

Milk drinking is especially low in Lazio, but this is compensated by cheese; this region has the highest meat consumption which accounts for excessive intake of animal protein. Foods eaten in suboptimal quantities than those recommended include fish, in particular in Northern Italy, and fruits and vegetables, in the entire population. Eating of pasta or rice ranged from 4.2 to

5.7 portions a week on average and even bread is eaten less than once a day. Sweets and pastries are eaten more frequently. Thus, the eating habits of Italian schoolchildren do not coincide with national dietary recommendations and are similar to the diet of adults in other industrialized countries. Therefore, in Italy, there is a real need to develop strategies to improve eating habits.

Eating habits of Guatemalan schoolchildren have changed

As Noel W. Solomons (Center for Studies of Sensory Impairment, Guatemala City, Guatemala) reminded his audience, Guatemala is a Central American country which is mainly rural, agricultural and the majority of its 10 million population is native-born. In light of its high birth rate, one-quarter (2.5 million) of the population is of school-age.

Studies on food systems in Guatemala, conducted over the last 50 years, show that the conventional dietary model is based on a triad : corn, beans, and squash.

Coffee, the main export crop, is the major beverage. In essence, schoolchildren in this country share the same diet as adults living under the same roof, with the only difference being the meals or snacks served in school during the school year.

Several aspects of this country's children's diet have been studied, including : measurement of nutritional status of schoolchildren, determination of the gradient of difference in nutritional opportunities and eating habits between the most isolated rural communities and metropolitan areas (Guatemala City). And lastly, the possible consequences of change in access to food, in rural areas.

Regarding nutritional status, in a study conducted by the authors, it appears that problems which occur in school-age children are as follows :

small height (rate of arrested growth = 49%) ; disorders related to iodine deficiency (8-24%) and vitamin A deficiency (16%). The study also suggested that there is a prevalence of zinc and riboflavin deficiencies.

Urbanization, however, signifies something more than simply a move to the city. It corresponds to a process of change in the population gradient which begins in houses spread out over the most isolated agricultural areas and follows a continuous pattern to the hamlets, villages, towns and cities and finally the metropolitan areas. In Guatemala, this progression towards urbanization is associated with an increase in the variety of different food components in the diet, in particular, a change from the maize «tortilla» to white bread as the primary cereal food in the diet. Even in regions so far away as to be inaccessible during the rainy season, the availability of commercially-produced food increases.

The food situation of school-age children in Guatemala is a patchwork which is in a constant state of flux. In the Guatemalan diet, there are still factors that result in deficiencies in micronutrients and insufficient growth ; these are associated with other factors that predispose to the development of chronic diseases in the urban environment.

Snacking in American teenagers

The diets of US teenagers and young adults are characterized by a low number of food choices and a high percentage of calories from sugars and fats. The number of «core foods» is low: sweet drinks, pizzas, French fries, bread, milk, and yogurts (for women) are among the foods preferably chosen while these youngsters have a low intake of fruits and vegetables. Efforts made to provide nutritional education in children and teenagers have emphasized the need to replace fat and sugar by more energy dilute grains, vegetables and fruits. US experts have also suggested giving children skim milk and low-fat dietetic products. But, energy requirements are high in childhood and adolescence, due to the high level of physical activity and high energy expenditures in this age group. Thus, a high energy content cannot be derived from foods which do not have a high caloric content and it is important to encourage teenagers to supplement their diets with snacks. According to Adam Drewnowski (University of Michigan, US) snacks provide a valid means of increasing food choices and the nutritional content of the diet.

A type of milk specially developed for Chinese schoolchildren

Recent studies have demonstrated that zinc, iron, and vitamin A are the nutrients most lacking in school-age children, since grains have become the primary food component of China's population. The prevalence of zinc and calcium deficiency is 50% for each of these minerals and 30% and 29% of school-age children lack iron and vitamin A respectively. Inadequate intake of these nutrients may cause not only immunological dysfunction but also underdevelopment in schoolchildren whose intellect is under-used.

A particular type of milk for school-age children has been developed by the Zhoukou municipal milk processing factory. Results of this experience have been reported by Yue-Xin Yang (Institute of Nutrition and Food Hygiene, Beijing, China).

These children underwent a physical examination with anthropometric measurements (height, weight, and arm circumference). Biochemical parameters e.g. serum Vit A, Vit B, Zn, Fe, Ca, and levels of Zn, Ca and Fe in hair were measured.

Children were divided into two groups, Groups A and B, with reference to the two classes in which they were enrolled and based on economic status. 200 ml of enriched fermented milk was supplied to group A children in the form of a snack. The same amount, but of non-enriched milk, was given to each child in Group B.

Although the experimental conditions may not have been perfect, the conclusion of this study is that this fermented milk can also improve nutritional status as well as development of the child.

Furthermore, according to the speaker, this milk's formula proved to be appropriate. The 200 ml size (one container) satisfied the child's requirement. If, in addition, the child continued to drink this milk over a long period of development, body weight and height in particular, as well as intellectual development improved. Other benefits, especially, the effect on blood bio-

chemical parameters, immunity and prevention of some ordinary infectious diseases, prevention of zinc, calcium, and vitamin D deficiencies and prevention of anemia associated with inadequate iron intake have been reported, provided that the child drinks this type of milk over a long period. But, these results should be confirmed by a further study before they can be fully accepted.

REPORT ON SOME CHILDHOOD DISORDERS RELATED TO EATING

OBESITY

The chapter on childhood obesity, and later, adult obesity is undergoing major reevaluation. Genetics, the influence of life style with decreased physical activity, consumer products : many hypotheses have been formulated to account for a phenomenon which is on the increase, now affecting all western countries.

Ronald E. Kleinman (Massachusetts General Hospital, Boston, USA) noted that, although fat intake in the US has decreased over the past 25 years, caloric intake has increased slightly. He is concerned by the significant increase in childhood obesity, not observed solely in US children. Overweight and frank obesity have concomitant adverse long-term effects on health, i.e. cardiovascular, respiratory, orthopedic, dermatologic, immunologic, endocrine and psychological complications. Indeed, the retrospective Harvard Growth Study has shown that, with a BMI > 75% of normal during early adult years, for men, there is an increased risk of mortality (all causes combined) from colo-rectal cancer and the risk of gout. In obese women, morbidity associated with cardiovascular disease (coronary heart disease - CHD) is also increased.

In addition to this disorder of «too much», he emphasized the importance of disorders related to «too-little» and he focused on the question as to whether there are long-term consequences related to insufficient food intake in children. In fact, according to Ron Kleinman, the CCHIP study, a recent survey of food insufficiency and hunger in the USA, showed that 8% of children under 12 years of age are hungry (4.0 million), 21% are at risk of being hungry, for a total of 29% of children who are hungry or at risk of being hungry. National surveys of US children, in contrast, show that 30% of children are overweight or obese with possible deleterious effects on their health. The presentation of these results was followed by a controversial discussion. The in-

terpretation of this study in the context of a definition of hunger, applied on a world wide basis, would probably be different.

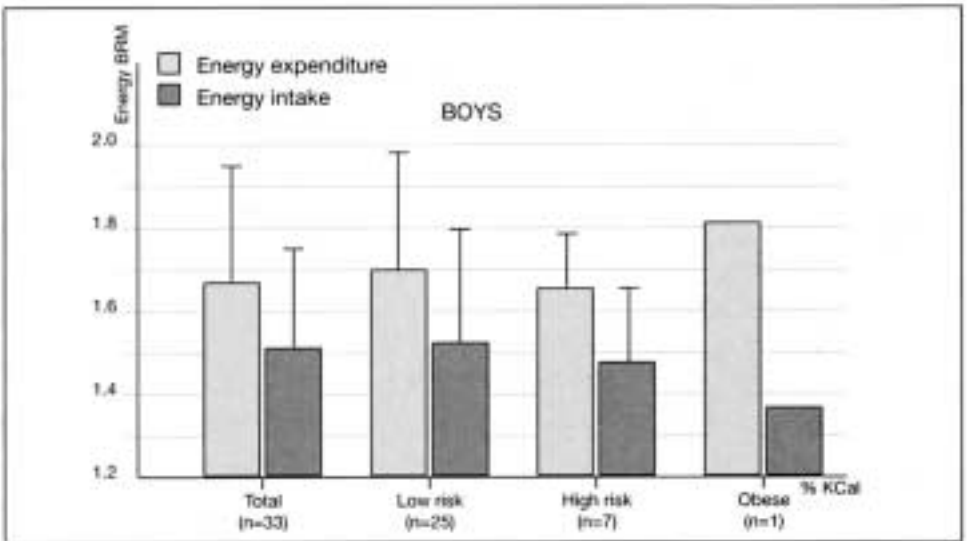
Without being able to establish a direct cause-to-effect relationship, it seems that children who have experienced hunger may be more likely to develop emotional disturbances and behavioral difficulties than children who eat a balanced diet (only 40% of US children).

Food intake and energy expenditure in children at low-risk and at high-risk for obesity.

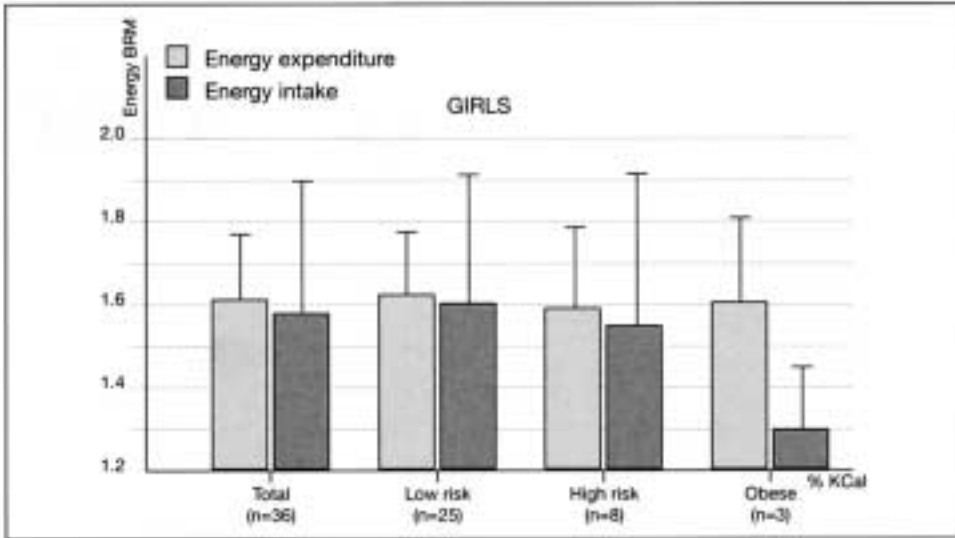
The causes of childhood obesity are complex and multifactorial. A certain number of mechanisms which could promote the development of childhood obesity have been identified but, currently, their interrelations have not been entirely elucidated. Passive excessive intake of total calories (fats in particular) may compromise appetite control systems and susceptible children might have to increase their oxidation of fats to equal their fat intake. These events may be worsened by low levels of physical activity and energy expenditure. The influence of children's parents, their attitudes and beliefs on diet, health and well-being could add to the effects of a very high-energy diet (high in fat) and a sedentary life style, thus increasing the risk of obesity in children.

A study by Barbara Livingstone (University of Ulster, Ireland) is currently trying to elucidate some of the mechanisms involved in childhood obesity.

Two variables, diet and life style, in children at low risk and at high risk for resultant obesity are being studied in order to evaluate the dominant factors involved in the causes of childhood obesity. Two groups of children (n = 50 per group), 7-8 years of age, both at low-risk or at high-risk of obesity (based on their parents' current weight) were recruited.



Mean \pm SD energy expenditure and energy intake expressed as a multiple of BRM for low risk, high risk and obese children.



Mean \pm SD energy expenditure and energy intake expressed as a multiple of BRM for low risk, high risk and obese children.

Measurements of body weight and its composition of total and basal energy expenditure, physical activity and energy intake are being conducted on each child.

In addition, other measurements are made on each child's parents: anthropometric measurements, and measurement of physical activity when they are occupied and when they are not. Their opinions and attitudes to sports, exercise and diet were also analyzed. Results are ongoing and the study will be completed in early 1998. However, preliminary results show that obese children spend less time watching television than lean subjects at risk for obesity. In addition, in obese subjects and in subjects at risk for obesity, mean energy expenditure is greater than reported caloric intake. These preliminary results suggest that under-reporting of energy intake by obese subjects is pervasive.

Cultural patterns of eating, risk factors and obesity in children

Obesity in children is also on the rise in Europe. In particular, the most overweight children are becoming even more obese. Yet, according to Inge Lissau (University of Copenhagen, Denmark) studies differ from the standpoint of methodology. Thus, they do not enable a direct comparison between different countries. It is necessary to clearly determine whether this disorder is increasing throughout Europe or whether it is more pronounced in some regions than in others. A comparison of different countries could provide improved understanding and new ideas on a subject with high priority, i.e. prevention of obesity.

Being obese as a child doubles one's risk of being obese as an adult. Childhood obe-

sity is also associated with increased morbidity and mortality in adult life, in addition to the fact that obesity is physically unattractive in modern society. It has a negative impact on psychosocial aspects of life in different ways.

Schoolchildren make fun of their obese classmates whom they do not regard as playmates. Overweight children are subject to discrimination, considered as lazy, having lower intelligence, and socially are loners. In addition, being very obese is accompanied by difficulties in participating in children's games, thus affecting their social life. Childhood obesity is accompanied by a higher risk of developing somatic disorders at a younger age. All these trials and tribulations of obesity make it an important problem of public health.

Are there psychosocial risks which predispose to obesity ?

Several decades ago, Buruch formulated a hypothesis according to which an only child, overprotected or neglected, had an increased risk of becoming obese. But, in prospective studies, it has been demonstrated that neither only children, nor overprotected children actually have such a risk. On the contrary, parental neglect of their children increased the risk of obesity seven to ten-fold in young adults.

How do psychosocial factors in nutrition play a part in obesity ?

In a prospective cohort study, it was shown that a mother who is not attentive to her child's sweet eating habits increases the child's risk of becoming overweight five times. (Lissau et al, Lancet, 1994).

The mechanisms which link psychosocial factors and obesity are not known. Animal studies have shown that those who experience stress or have difficulties in coping with stress have higher levels of cortisol and consequently, larger deposits of abdominal fat. By extrapolating from these results, the hypothesis was formulated that this process may be the same in humans.

Even though psychosocial factors are so important in terms of obesity, very few studies have taken them into account in the prevention of obesity. Improved understanding of these factors will enable development of programs of prevention in obese subjects with better long-term results than those obtained by different treatments of obesity.

Let it be !

M.L. Frelut (Centre Thérapeutique Pédiatrique de Margency, Hôpital Robert Debré, Paris, France) also underlined the fact that severe childhood obesity is increasing dramatically in western countries. However, there is no doubt that a certain genetic component enables the body to store an enormous quantity of fat. This leads to a vicious circle whereby a subject's ability to maintain physical activity is blocked and where he/she can no longer exert adequate control of food intake.

Some contemporary events can account for the increased rate of obesity. Energy expenditure associated with physical activity during the day has decreased. Severe obesity illustrates

how an imbalance both in energy expenditure and food intake can lead to this vicious circle and exclusion from society. Indeed, the majority of large cities appear to have passed the point where they can offer both security and space necessary to enjoy life and social/technological progress.

Food is now continuously much more available than in the past, at the same time as food quality continues to progress. Nevertheless, it seems that obesity is not simply an imbalance between energy intake and energy expenditure but rather the impossibility for many subjects to cope with major changes in their environment.

LIPID PROFILES OF SCHOOL AGE CHILDREN WITH A HEREDITARY PREDISPOSITION TO CARDIOVASCULAR DISEASE

In the prevention of atherosclerosis, early detection and lowering of coronary risk factors appear to be essential goals. A study of the lipid profile of schoolchildren with a family history of cardiovascular disease (CVD) was conducted by Ewa Malecka-Tendera (Silesian Medical Academy, Katowice, Poland).

Based on a questionnaire, filled out by 929 families, including the existence of a family history of myocardial infarction, angina pectoris or hypercholesterolemia before age 55 years, two groups of children were examined : one group had a positive family history for CVD and a control group had a negative history for CVD. The study group included 440 children, the control group consisted of 489. The mean age was 13 years. In all the children, total serum cholesterol (TC), high-density cholesterol (HDL-C), including subfractions HDL₂ and HDL₃ and serum triglycerides (TG) were measured. Low-density cholesterol (LDL-C) was calculated using Friedwald's formula.

Significantly higher levels of TC, LDL and TG were found in boys from families at risk as compared to the control group. HDL levels in boys in the study were significantly lower than those in boys in the control group. This was due mainly to lower concentrations of HDL₃ in boys in the study group compared to controls.

Girls from families at risk had significantly higher levels of TC and of LDL than girls from low-risk families. No significant difference between levels of HDL and TG was found in girls in both groups.

Prevalence of hypercholesterolemia was 15.9% in boys from high-risk families vs. 12.3% in boys from low risk families and 15.1% in girls from high risk families vs. 8.4% in girls from low risk families. The difference in prevalence was significant only in girls.

Results of this study demonstrate that all children from a high risk family should undergo measurement of their lipid profile with special attention paid to boys in so far as their lipid profile predisposes them to early-onset of atherosclerosis. Cholesterol levels should be measured in all children at puberty.

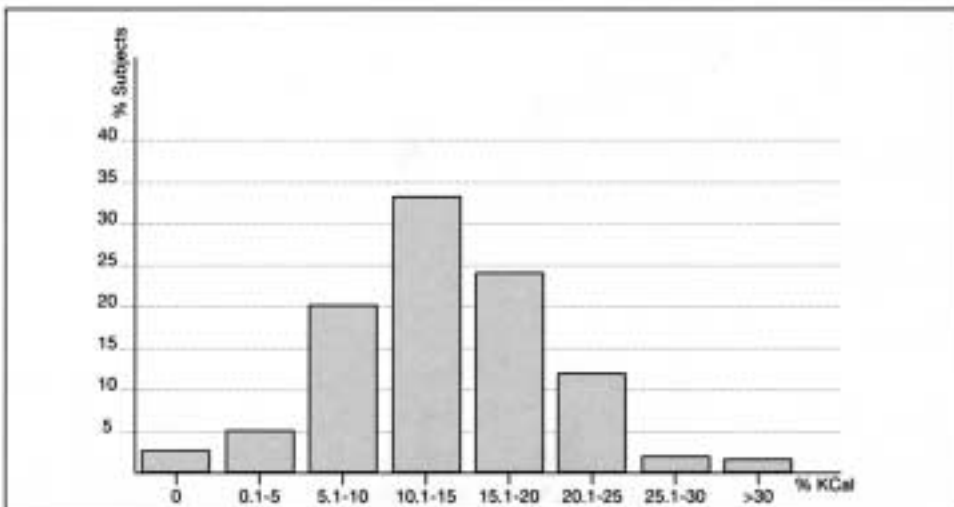
CHAPTER IV

ROUND TABLE DISCUSSIONS : SYNTHESES

Three round table sessions were held during this Workshop to discuss three topics : breakfast, a «fourth meal», and changes in cultural patterns of eating.

BREAKFAST : 10% OF CHILDREN «SKIP» BREAKFAST !

All participants observed that about 10% of children go without breakfast, independently of cultural background, and without our being able to understand the reason for this phenomenon. In China, where studies are available, it would appear that children may not have the time nor the appetite for a morning meal.



Daily calorie intake (%) with breakfast. (Pr Giovannini et.al.)

With regard to food content of breakfast, this varies from one country to another and the percentage of caloric intake of the day. It is suggested that breakfast should constitute about 15-20% of daily energy intake, but this value clearly varies with cultural eating patterns.

There are two types of effects of eating breakfast. First, there is an effect on total caloric intake. It should be kept in mind that eating breakfast decreases caloric intake during the remainder of the day while «skipping» breakfast does not necessarily lead to a reduction of total caloric intake during the day. Of note, 50% of obese children skip breakfast.

In addition, breakfast may have a positive effect on morning performance, by lowering the level of hunger which acts as a distracter.

Some studies of school performance interventions, involving comparison of substantial versus poor breakfast, have shown an improvement in some tasks but not all. In general, results on the effect of breakfast are mixed. Poorly nourished children can benefit from breakfast, but the evidence is not so strong for well nourished children. However, a higher incidence of hyperactivity (restlessness) is observed among children who do not eat breakfast, which is in keeping with a reduction in concentration and attention.

Breakfast may act as a compensatory mechanism for sleep deprivation as shown in a study by Didier Lagarde and Denise Batelat (CERMA, Test flight Center, Bretigny-sur-Orge, France).

These two researchers studied the influence of breakfast on ability to pay attention in 5877 schoolchildren 8 to 10 years of age, before and after a brief period of sleep deprivation.

They sought to determine whether such a lack of sleep (1 hour) could alter the relation between these children's ability to pay attention and food intake at breakfast. They used a questionnaire on lifestyle and a crayon test called a «sign cancellation test» to evaluate the children's attention at 4 different times in the morning and 4 times during the afternoon, between Monday and Friday. They compared the data obtained during the week before the annual change to daylight savings time (European summer time) with that of the following week.

Their results showed the following :

91% of children usually ate breakfast, while 9% did not.

The week before the short period of sleep deprivation, there was no statistical relation between having breakfast and level of attention ;

During the first day of school, after the change has been made to daylight savings time, a statistically significant difference was observed between results of attention level in pupils who had breakfast (85.16) and those obtained in children who did not (76.44) ;

Furthermore, the food content of breakfast was more or less modified on the Monday of Week 2.

The researchers concluded that, even though eating breakfast, in schoolchildren 8 to 10 years of age, does not appear to have a major influence on levels of attention, the presence of a slight disturbance, in this case a very short deprivation of sleep, alters this relation. Thus, these results demonstrate the importance of breakfast, especially in schoolchildren, when they cannot get enough sleep regularly.

Lastly, is there an ideal type of breakfast ?

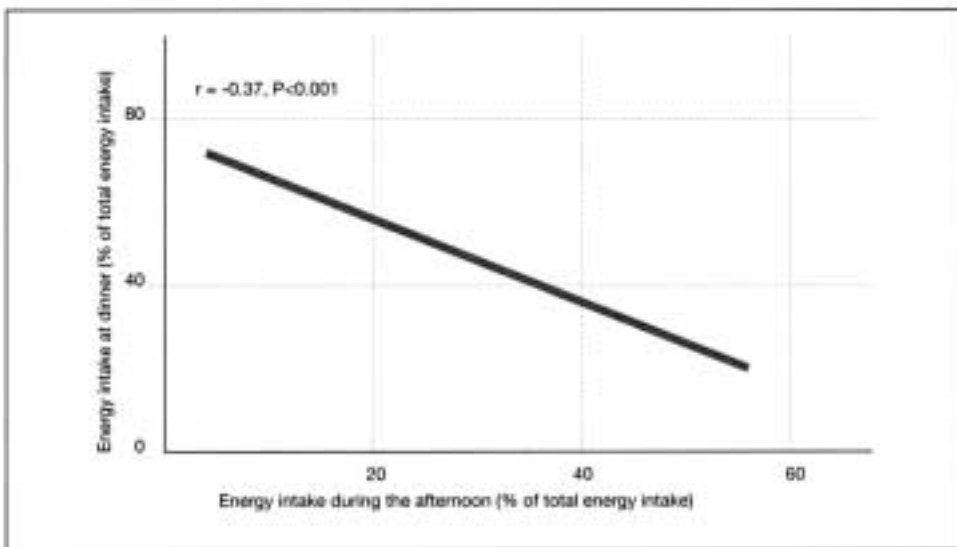
Everyone participating in the round table discussion seemed to agree that a breakfast high in carbohydrates is more appropriate than one consisting mainly of fat, and to suggest that variety is important and that the type of foods eaten at breakfast depend on cultural differences.

THE « FOURTH » MEAL : WHERE, WHEN AND WHAT ?

A question immediately arose among the participants at this round table session regarding its name and definition : how should this «fourth» meal be defined ? Is it a meal ? a light meal ? a big meal ? a snack ? In summary, what should it be called ? The «politically correct» name of «eating occasion» was chosen. Regarding its definition, it was determined that this meal should have been consciously prepared and/or under the responsibility of the caregiver, i.e. the person in charge of the child (to differentiate it from chocolate bars purchased after school and eaten while walking home), eaten by a child (not a teenager) seated at a table, at about the same time of day, between mid and late afternoon (depending, of course, on meal times in different countries). Furthermore, this meal should be part of the total daily caloric intake and provide a minimum of calories because daily dietary requirements cannot be provided solely by 3 meals, in school-age children. It helps in a more logical distribution of caloric intake.

This eating occasion should be varied and ideally include grains, fruits in the form of fruit juice, fresh fruit, applesauce and dairy products. Energy provided should be between 250 and 500 calories, i.e. cover 10 to 20% of energy requirements.

The advantages of this meal were pointed out. As a result of carbohydrate and protein intake during this meal, it could lower fat intake at dinner. It would replace snacking, which in



(Dr C. Maffei, personal communication)

some countries, such as the US and Canada is rife among young people and thus may help in appetite control.

Studies need to be conducted to better understand the impact of such food intake in the middle of the afternoon, specifically, does it really result in a decrease in the number of calories ingested at dinner in the evening and so decrease obesity, as suggested by a study in Italy ?

How does the fourth meal relate to patterns of physical activity ? Other research areas include relationship of distribution of needs to body size, influence of variety, energy density and taste on promoting a single eating occasion compared to multiple small snacks.

CHANGES IN CULTURAL PATTERNS OF EATING: INTEGRATING NEW CONCEPTS WITH TRADITIONAL VIEWS

Is it necessary for everyone to give up their own culture-related eating patterns in order to promote healthier models of eating ? It appears that there is no single answer to this question.

«Even though eating obeys biological and physiological factors, it is entirely dependent on specific cultural habits », emphasized Matty Chiva (University Paris X, Nanterre). This is exemplified on many levels, starting with consumer goods and values held in esteem by adults, as well as by the very large differences in school systems and community eating-places available in different countries.

Apart from the fact that institutional recommendations differ (in content and composition) from one country to another, it is difficult to apply them directly to separate individual cases : all the more so, because such standards are based on nutriments, while an individual reasons in terms of foods and eating habits.

The difficulty, in enforcing such standards of public health also arises from the fact that the references underlying these recommendations also involve, implicitly or explicitly, moral positions and cultural choices. Thus, it is possible to differentiate societies which are conceptually «diet-conscious» (for example, USA, northern Europe) from so-called «culinary-conscious» countries (for example, southern Europe).

Lastly, it is essential to keep in mind the fact that objective knowledge alone is not enough to induce changes in eating habits. Value judgments, beliefs (both logical and illogical ones), hedonistic and emotional factors are just as important as biological data and have a direct and major impact on cultural practices.

Indeed, this accounts for the absolute necessity to reappraise educational systems in this field, and also, to objectively evaluate their effectiveness.

In fact, many studies need to be conducted to determine the impact of programs and recommendations on eating. By making changes too frequently in a given country and from one country to the next, they are often a source of confusion.

P. Aggett (Institute of Food Research, United Kingdom), provided examples of changes in recommendations depending on different years and countries for certain nutrients such as iron, calcium, and vitamin D.

Iron (mg/24h)

Age (years)	3	6	10	14M	14F
France	10	10	12	15	18
Italy	7	9	9	12	18
Netherlands	7	7	11	15	12
Nordic country	8	8	10	12	12 - 18
UK	6.9	6.1	8.7	11.3	14.8
USA	10	10	10	12	15
EU (1993)	4	4	6	10	22

Calcium (mg/24h)

Age (years)	3	6	10	14
France (1992)	600	700	1000	1200
Italy (1996)	800	800	1000	1200
Netherlands (1989)	600	600	1200	1200
Nordic country (1996)	600	600	700	900
UK (1991)	350	450	550	1000
USA & Canada (1997)	500	800	1300	1300
EU (1993)	400	450	550	800-1000

Vitamin D ($\mu\text{g}/24\text{h}$)

Age (years)	3	6	10	14
France	10	10	10	10
Italy	10	10	10	10
Nordic country	10	5	5	10
UK	7	sun	sun	5
EU	10	0 - 10	0 - 10	sun
USA & Canada (1997)	5	5	5	5

In concluding this Workshop, Adam Drewnowski raised several issues, concerning the globalization of eating patterns and effect of food manufacturing and consumer habits on nutrient intake. These world wide trends should be kept in mind when we consider, and protect, the culturally appropriate eating habits in Europe.

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Patterns of food intake in schoolchildren

A innovative workshop on «Patterns of Food Intake in Schoolchildren» took place from 17-19 October 1997 in Saint-Paul-de-Vence, France.

It provided an opportunity for forty experts from all over Europe, as well as from Argentina, Canada, China, Guatemala, Mexico and the USA to participate in a series of multi-disciplinary panel discussions on the complex factors that influence the nutritional status of this age-group. The experts were drawn from the field of paediatrics, nutrition, psychology, physiology, gastro-enterology, neurosciences, anthropology and sociology.

Implications of nutrition for optimal development of the child and for long-term psychological and biological well-being were reviewed. This booklet provides a brief summary of the content of the workshop.

The Scientific Committee



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