

Eating behaviour: research in Liguria on young, adult and elderly subjects

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Key words

Eating behaviour • Meal-cycle • Nutritional status

Summary

Eating behaviour was studied, between 1985 and 2000, in three groups of volunteers, homogeneous in age and sex. Groups comprised 320 young, 450 adult and 230 elderly University students. Frequency of meals, food portion consumption and preferences, nutritional status, anthropometric indices and physical activity were assessed by an interviewer-administered questionnaire. Dietary data included food and beverages, as well as the ingredients used to prepare the dishes, thus reflecting

regional habits. Nutritional data record the eating pattern of the subjects, as related to macro- and micro-nutrient intake. Results of this study show that the eating behaviour of the Ligurian population is in accordance with the recommendations in favour of the choice of the "Mediterranean Diet", which allows preferences of "orexigenic" foods, but also of satiating and high dietary fibre foods, while intakes of animal fats were acceptable.

Introduction

Eating behaviour is a composite of integrated physiological components including the impulse to search for food and the gratifying memory of food ("eating pleasantness"), with hedonic response [1]. These condition the food cycle that is determined by endogenous factors (e.g. the perception of thirst), circadian factors (time and settings of meals) [2] and variables induced by environmental, social and psychological conditions [3, 4]. The food cycle consists of different phases. The *pre-meal phase*, also called the "cephalic" phase [5], is initiated by appetite, a pleasant search for a palatable food or a "natural desire for food" [6, 7]. Food preferences and aversions are learned by experience [8]. Preferences are determined by taste. The most established taste is for food that is sweet. This taste is already regulated at birth by the genetic markers of the glycolytic enzymes. The second is for salty food, followed by bitter and sour, tastes which are preferences that are acquired later in life (e.g. coffee-bitter and wine- and beer-sour). The *intra-meal phase*, or the ingestive phase, influences the food cycle by means of regulating factors which both help (orexin, neuropeptideY) [9] and limit (endogenous opiate peptides and galanin) food intake. This phase ends with "satiating", a pleasant feeling of gastric plenitude, modulated by the volume and energy density of the meal. The best satiating foods are proteins, followed by carbohydrates, and fats. Satiating foods act through the neuropeptide cholecystokinin and enterostatin which can also reduce food in-

take at the next meal and are "preferred" when the resulting satiation lasts longer [10]. The *post-meal phase*, or post-absorptive phase, involves the intestinal digestion of food, the absorption and the bioavailability of the nutrients.

This phase or "satiety" assures a "homeostatic" nutritional status which meets the energy requirement for thermoregulation and stabilisation of energy in the adipose tissue. The nutritional status becomes "dynamic" when the request for energy increases and hunger appears (this impulse is induced by physiological fasting). The food cycle is the most important aspect for nutritional status and plays a primary role in the regulation of physiological weight, especially an adipose tissue. Healthy eating behaviour can prevent overweight and obesity [11, 12].

In this study:

- 1 eating behaviour was investigated in three groups of men and women (young students, adult students, active older students) in Liguria, Italy. Food consumption was checked throughout the food cycle: the number and size of the meals, selection of food and size of portions. The latter are considered to be the basis for eating motivation and habits. All subjects completed the questionnaires themselves, indicating fullness after a meal and duration of satiety;
- 2 the nutritional status was determined in terms of macro- and micro-nutrient intake and maintenance of body mass (BM) and body composition as an index of adaptation to needs [13-15];

- 3 a survey of dietary habits was made in order to establish when energy intake (EI) produces nutritional disorders: underweight, overweight or obesity. The latter is associated with insulin-resistance, non insulin-dependent diabetes, dyslipidaemia and hypertension [16-18].

Materials and Methods

STUDY DESIGN

The study carried out at the Human Physiology Institute of the University of Genoa in 1985 [19, 20] and completed in the year 2000 [21, 22] was divided into two parts: in the first part, meal cycle, food consumption and motivation were investigated; in the second, nutritional status, physical activity and macro- and micro-nutrient intake were studied.

PARTICIPANTS

A total of 3,000 volunteer university students, all apparently healthy, were initially recruited by personal contact. Subject selection was based on the criteria of an initial medical evaluation, which required fasting blood glucose levels < 6.0 mmol/L and diastolic blood pressure not > 90 mm Hg. Subjects who were currently dieting, or not maintaining a stable BM were excluded. Finally, 1,000 healthy subjects were selected. Approval for follow-up was obtained from the local Research Ethics Committee and an informed consent form was obtained from each subject.

Subjects were divided into three groups, based on age. Young student group: 320 healthy students, 192 female (mean age: 21.9 ± 4.8 yrs), 128 male (mean age: 23.2 ± 2.8 yrs), all attending the University Medical School. Adult student group: 450 adult subjects, including 100 working students, 280 female (mean age: 40.3 ± 8 yrs), 170 male (mean age: 42.5 ± 9 yrs).

Older student group: 230 active elderly subjects, all attending courses for senior citizens at the School of Medicine, 130 female (mean age: 60.8 ± 3.5 yrs), 100 male (mean age: 63.8 ± 3.8 years).

DIETARY DATA

The reliability of the reported eating habits, food selection and preferences was analysed and estimated for each subject. In order to determine overall food and nutrient intake, dietary habits were assessed according to the 24-hour food record method (estimated record). Nutrients estimated in this study from 7-day diet records were converted into data for one day simply by dividing by 7.

The dietary data, collected from individual report cards, included:

1. meal cycle, that indicated the number of meals (breakfast, lunch and dinner) and snacks (from one to three), food consumption and portion size (expressed as "natural" portions, e.g. a banana) or serving-size (e.g. a slice of pizza). Portion size was

recorded in grams (g) per serving or in millilitres (mL) of beverage, based on tabular standards (ARA., 1997); for a small subsample (10% of the subjects), portion size was weighed directly;

2. food selection: food palatability was measured by self-reported food preferences [23, 24]. Preferences and aversions for taste, flavour and texture usually affected eating habits [25]. Foods were classified on the basis of each subject's preference, rated on a 7-point empirical scale:
 - preferred, liked very much (+ 3) or appreciated (+ 2),
 - refused, indicated by at least 30% of the subjects and classified as disliked very much (- 3) or avoided (- 2),
 - customary food, regarded as liked a little (+ 1) or (0) acceptable (either salty, sweet, bitter or sour) or slightly disliked (- 1);
3. food frequency, based on a 2-wk food frequency questionnaire (FFQ), collected < 6 months apart during the year, included food items selected between meals [26]. The frequency was checked by the responses ranging from "very often" (mean frequency ≥ 14 times/wk) to "very rarely" (mean frequency < 7 times/wk). The food records were checked and translated into the quantities of 50 different foods. Individual mean daily energy intake and nutrient values, calculated using a food composition database for each subject [27, 28], were analysed using a software package prepared by the Department of Experimental Medicine, Unit of Metabolic Physiology, University of Genoa. The validity and reliability of the questionnaires, in terms of nutrient and food consumption, have been described elsewhere [29].

NUTRITIONAL STATUS

Physical activity

The physical activity level (PAL = TEE/RMR) expressed as hours of activity/day for the preceding seven days was assessed by an interviewer-administered questionnaire [30], using the Baecke physical activity scale [31]. Physical activity is expressed as work, sports and other leisure-time activities [32, 33]. For elderly subjects, physical activity included occupational activities, socially-desirable activities and health-promoting physical activities [34].

Anthropometric Assessment

Height, weight, body mass index (BMI; in kg/m^2), girth measurement, body fat distribution and body fat percentage (BF%) were evaluated. Trained persons carried out all the measurements using standardized procedures. Height was measured to the nearest 0.5 cm, using the Harpenden stadiometer while the subjects were standing, without shoes. Body weight was measured to the nearest 0.1 kg with subjects dressed in light clothing, using standard scales. Body mass index (BMI) cut-offs for under-nourished (< 18.5), well-nourished (18.5-24.9), over-nourished (25.0-29.9) and obese subjects (\geq

30) were established by the National Institute of Health and the World Health Organization (WHO). Waist circumference (WC), measured to the nearest 1 mm using a flexible tape-measure was defined as the smallest circumference at the navel, with the subject in the standing position and breathing quietly [35].

Hip circumference was measured between the hips and buttocks, above the gluteus. The waist/hip ratio (WHR) was calculated and considered to be an index of the pattern of body fat distribution [13]. WC is now accepted as a practical assessment of adipose tissue distribution, related to abdominal fat. WC is influenced by sex, especially in adult age, when visceral fat accumulation (central adiposity) is associated with an increased risk of cardiovascular diseases [36]. The mid-arm circumference (MAC) was measured at the midpoint of the left arm between the acromion and the olecranon. Using the arm circumference measurement and the triceps skinfold, the area of muscular and adipose tissue was obtained. Skinfold thickness (SFT) was measured at the triceps, biceps, suprailiac and subscapular level. The measurements were made to the nearest 0.2 mm with the use of a skinfold calliper (Holtain, Crymych, Dyfed, U.K.), on the left side of the body. The logarithm of the sum of the four SFTs was used in age- and sex-specific equations [37], to obtain an estimate of body density [38] and percentage of body fat [39], according to the guidelines of the World Health Organisation [40].

STATISTICAL ANALYSIS

Data for all dependent measurements are reported as the mean \pm SD, with the minimum and maximum values. Student t test was used to compare selected variables between groups. The differences between age groups were analysed by analysis of variance (ANOVA) with Fisher's protected least-significant-difference comparison. The elaboration of data and statistical analyses were carried out using the software Statistica 5 for Windows (StatSoft, Inc, Tulsa, Okla., USA). $P < 0.05$ was accepted as statistically significant.

Results

YOUNG SUBJECTS

Meal cycle, food selection and food frequency

Breakfast was considered suitable by 85% of the males and 80% of the females, followed by lunch and dinner. Customary foods were milk, coffee, biscuits or yoghurt, and a traditional salty, cheese bun, called "focaccia". About 60% of the volunteers had an afternoon snack, particularly the males, while the female students preferred an after-dinner snack. Overall, 10% of the males and 15% of the females had no breakfast. They had only lunch and dinner, followed by a small snack, while 5% of the volunteers had only one meal a day and many snacks. Overall, 10% of females had a dinner of milk and dairy products. The number of portions varied

greatly depending upon food, seasons and holidays. Food items, frequency of consumption and mean portion size of the customary diet are reported in Table I. Frequency values were considered high, if recorded more than 14 times/wk (e.g. cereals, dairy products, fruit and vegetables); average, if recorded 7-14 times/wk (e.g. meat and sweets) and low, if recorded 7 or < 7 times/wk (e.g. pulses, eggs and fish). The subjects reported light alcohol consumption (≤ 2 drinks/day); females had a lower alcohol intake than the males.

The frequency of food consumption per week is shown in Table II.

The common diet of the subjects included bread as the preferred food (about 280 for males and 200 g/day for females), pasta (about 140 for males; 100 g/day for females), the traditional "focaccia" (soft oven-baked bun, seasoned with salt and olive oil), the "genoise minestrone" (soup made with vegetables and herbs, such as basil, rosemary, thyme and marjoram), vegetables, about 250 g/day (does not include tubers) and fresh fruit (350 g/day). Local sea fish, although very much appreciated, was not frequent in the weekly diet (about 250 g), for economic reasons. Eggs were consumed three times a week, mostly with mayonnaise, in omelettes or vegetable pies. Olive oil was used in salads and cooking (35 g/day).

The most customary foods, appreciated by at least 70% of the subjects, were potatoes and rice. The most frequently disliked foods, included saltless bread, canned fish and broad beans. Food selection and preferences were used to establish the usual consumption patterns (Tab. III).

Nutritional status, dietary pattern and habitual physical activity

Based on the food consumption data, investigated by means of questionnaires, energy, mineral and other essential nutrient intake were estimated by computerised methods [19] using interactive databases.

The common diet for males contains 10.4 MJ, 84 g/day protein (about 14% of the EI), 360 g/day carbohydrates, (about 55% of EI, of which 4% is alcohol), 28.2 \pm 8.5 g/day dietary fibre, 84 g/day lipids, 30% of which are saturated fatty acids and 13% are polyunsaturated fatty acids. Calcium intake was estimated to be 840 mg (without the water), iron 14.2 mg, manganese 3.4 mg, zinc 12.9 mg, copper 1.2 mg, selenium 44.0 μ g, and iodine 85.0 μ g. Intake of micro-elements such as iron and zinc, as well as ultra-trace elements such as iodine, are often inadequate [34]. A lack was observed in the intake of n-3 fatty acids (particularly eicosapentaenoic acid and docosahexaenoic acid) and of iodine (100 g of fish accounts for 37% of the daily requirements [41]).

The mean energy intake of the female students was 8.9 \pm 0.84 MJ/d for short-term light physical activity (76% of subjects); the diet contains 78 g/day protein (15% of EI), 280 g/day carbohydrates and 22.2 \pm 6.5 g/day dietary fibre, alcohol accounts for 2% of EI and 72 g/day lipids (30% of EI).

In the self-reported Baecke questionnaire, students re-

Tab. I. Food items, frequency of consumption and mean portion size of diet by young students.

Food Items	very often	often	rarely	very rarely	portion size (g)
Breakfast					
Milk:	X				160 ± 35
Yogurt		X			130 ± 50
Coffee	X				30 ± 17
Tea		X [♀]			105 ± 15
Chocolate			X [♀]		100 ± 19
Sugar	X				15 ± 4
Bread		X [♂]			60 ± 20
Crackers			X		40 ± 20
Corn-flakes				X	20 ± 10
Biscuits	X				40 ± 15
Marmalade, Honey		X	X [♂]		20 ± 8
Fruit			X		90 ± 40
Snack					
Genoese focaccia			X		100 ± 50
Fruit juices			X [♀]		120 ± 40
Lunch					
Macaroni/rice	X [♂]				80 ± 30
Tomatoes Sauce/Pesto	X				30 ± 10
Sandwich/Pizza		X	X		200 ± 50
Meat		X			95 ± 20
Jam		X			40 ± 15
Eggs			X		50 ± 10
Fish				X	60 ± 35
Green salad	X [♀]				110 ± 30
Olive oil	X				15 ± 6
Potato Croquettes			X		180 ± 20
Parmesan cheese	X				10 ± 3
Cheese		X			45 ± 8
Bread	X				80 ± 25
Fruit and juices	X				140 ± 45
Sweets and desserts			X		60 ± 15
Beer, Wine				X [♂]	180 ± 50
Mineral water	X				500 ± 120
Snack					
Sweet-bread		X			40 ± 10
Salty		X			80 ± 15
Dinner					
Pasta/rice		X			60 ± 30
Vegetable soup	X				250 ± 30
Pizza			X		200 ± 30
Meat	X				120 ± 40
Jam		X			65 ± 20
Eggs		X			90 ± 30
Fish			X		140 ± 35
Cooked Vegetables/Legumes	X		X		160 ± 40
Cheese	X				63 ± 15
Olive oil	X				25 ± 6
Bread	X				100 ± 40
Fruit	X				100 ± 45
Beer, Wine		X [♂]	X [♀]		300 ± 80; 150 ± 30
Mineral water	X				400 ± 130
After dinner					
Sweet		X [♀]	X [♂]		40 ± 20
Salty		X [♂]	X [♀]		50 ± 15
Milk		X [♀]	X [♂]		120 ± 30

Preferences: male: ♂; female: ♀

Tab. II. Frequency of food consumption (times/wk).

All subjects (n 1000)	≥ 14 (times/wk)	> 7 < 14 (times/wk)	≤ 7 (times/wk)
Young	Cereals, cheese, fruit vegetables	Meat, jam, milk, sweets beer, fruit-juice	Fish, eggs, yogurt, legumes, wine, coffee, tea
Adult	Cereals, vegetables, dairy products, wine	Meat, eggs, potatoes, tomatoes, sweets, sauces, fruit, coffee	Fish, milk, legumes, tea, chocolate
Older	Vegetables, fruit, dairy products	Cereals, meat, milk, sweets	Fish, eggs, legumes, wine, coffee, tea

ported the number of minutes spent each week in various common physical activities associated with work, sports, or leisure-time.

A typical student working-day includes 10 sedentary hours during lessons or study and 4 to 6 hours weekly of light physical activity. Subjects were divided into groups according to their energy expenditure: 20% of the males reported sports training more than 4 times weekly, while only 10% of the young females reported vigorous physical activity. Theoretically, the energy demands increased with respect to the average need of 1.26 ± 0.63 MJ/d. Motivation for physical activity was “fitness” for females and “physical appearance” for males. The energy intake percentages in the daily meals and snacks of the young people are shown in Table IV.

Anthropometric assessment

The following mean values were recorded: height (males 176.2 ± 6.4 , females 162.8 ± 4.7 cm), body mass (BM) (males 72.8 ± 7.9 , females 55.3 ± 7.8 kg),

BMI [males 22.7 ± 3.9 (range: 18-29), with 24% of the subjects being overweight, females 21.5 ± 4.2 kg/m² (range: 17-28), with 14% of the subjects being overweight]. BF% [males 16.0 ± 3.2 (11% to 27% of BM), women, 24.6 ± 5.35 (16% to 32% of BM)]. BFMASS (males 12.1 ± 4.1 , females 16.0 ± 5.12 kg). The percentages and distribution of both subcutaneous and visceral adipose tissue differed significantly between the sexes; well-nourished (males 66%, females 69%), undernourished (males 10%, females 17%). The FFM/BF ratio was significantly different ($P < 0.001$) between males and females, males 5:1, females 2.5:1 [42]. The waist/hip ratio (WHR): males 0.86 ± 0.06 , females 0.77 ± 0.07 . Risk factors were not determined since these data values were higher than 0.58, which is the cut-off for the appearance of gluteal/femoral obesity [13], and they were less than 1.02, the cut-off for abdominal obesity. MAC, males 27.9 ± 4.6 , females 24.9 ± 3.1 cm and triceps skinfold, males 12.2 ± 4.7 , females 17.8 ± 5.4 mm.

Tab. III. Food selection and preferences of young students.

Food groups	Customary food: 0 = acceptable ± 1 = slightly liked - 1 = slightly disliked	Preferred food: ± 2 = appreciated ± 3 = very much liked	Disliked food: - 2 = avoided - 3 = very much disliked
Cereals	Cookies, white bread, pasta, white rice	Genoese “focaccia”; pizza	Small pasta, saltless bread
Fruit	Bananas, citrus fruit, apples, pears	Seasonal fruit (70% of subjects)	Exotic fruit
Legumes	Beans	Peas	Chickpeas, broad beans
Vegetables	Lettuce, potatoes	Carrots, tomatoes	Chicory, turnips
Meat and poultry	Genoese “minestrone” with herbs	Lamb, salted pork	Horse, liver, tripe
Fish	Beef (70% of subjects)	Fresh fish	Canned fish, smoked cod
Eggs	Frozen fish	Mayonnaise	
Milk	Omelettes, vegetable pies	Cream	
Cheese	Whole milk, yogurt	“Mozzarella-cheese”	Sharp cheese
Sweets	Cream cheese, parmesan cheese	Cake, ice cream, chocolate	
Fat and oil	Biscuits	Butter	Margarine (80% of subjects)
Beverages	Olive oil	Fruit juice	
Alcoholic beverages	Mineral water, coffee, tea, Beer	Red wine	White wine

Tab. IV. % Energy intake from the daily meals (a) and snacks (b) of young students.

N° Meals (a) and snacks (b)	3 (a)	3 (a) ± 1 (b)	2 (a) [♀]	2 (a) ± 3 (b)	1 (a) ± 5 (b)
Breakfast	15-25%	12-20%			5%
Morning snack				5-10%	15%
Lunch	35-40%	36-38%	45-50%	40-45%	20%
Afternoon snack		6-12% [♂]		5-10%	10%
Dinner	40-45%	32-38%	50-55%	30-35%	45%
After dinner		2-6% [♀]		5-10%	5%

Preferences: male: ♂; female: ♀

ADULT SUBJECTS

Meal cycle, food selection and food frequency

Eating behaviour differed not only between adult and young subjects but also between males and females.

Overall, 95% of the males and 73% of the females had breakfast; 47% of the males and 37% of females had breakfast, lunch, dinner and a snack; 15% of the females had only lunch and dinner, while 12% of females had lunch, dinner and a snack; 5% of the males had one meal and 5 snacks.

Weekly frequency of food consumption: the highest frequency (≥ 14 times/wk) was reported for cereals, vegetables, dairy products, coffee and wine (90% of subjects), an mean frequency (> 7 but < 14 times/wk) was reported for meat, eggs, sweets and fruit. A low frequency (≤ 7 times/wk) was recorded for pulses, milk, fish, chocolate

and tea (about 30% of subjects). Subjects consumed an alcoholic beverage at lunch and dinner (5% of daily EI). Weekly frequencies of food consumption are shown in Table II.

Food selection

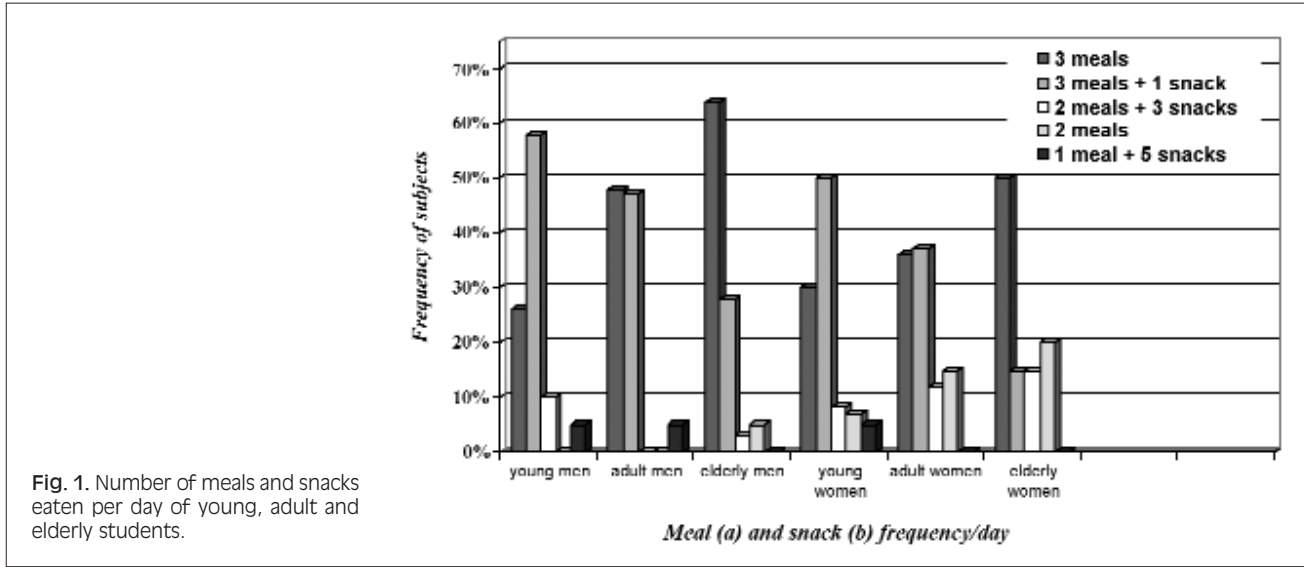
The preferred foods were potato gnocchi, "genoise cima" (stuffed veal roll), "ricotta", "gorgonzola" and fruit in season. Of the adult subjects, 35% showed a preference for sweets (e.g. sweets with chocolate, ice cream).

The customary foods were bread, pasta and parmesan cheese, olive oil and wine. The disliked food included whole meal pasta, horse meat, liver (30% of the subjects), tripe and rabbit (20%), fish (trout, smoked cod, sardines and red mullet, 30%), canned salmon (20%), vegetables (red cabbage, turnips, chicory, 20%), exotic fruit (40%), fruit (dried figs, plums, 20%), milk, eggs

Tab. V. Food selection and preferences of adult students.

Food groups	Customary food: 0 = acceptable ± 1 = slightly liked - 1 = slightly disliked	Preferred food: ± 2 = appreciated ± 3 = very much liked	Disliked food: - 2 = avoided - 3 = very much disliked
Cereals	Cookies, white bread, pasta, white rice	Gnocchi with pesto	Wholemeal pasta
Fruit	Citrus fruit, bananas, apples, pears	Seasonal fruit ^(*)	Exotic fruit
Legumes	Peas	Beans, French beans	Lentils
Vegetables	Carrots, onions, cauliflower, lettuce, spinach, potatoes, Genoese "minestrone"	Potatoes, tomatoes ^(*) , asparagus, artichokes	Chicory, turnips, red cabbage
Meat and poultry	Meat loaf, beef, processed pork, chicken	Turkey; sausage, goat meat, Genoese Cima	Horse, liver, tripe
Fish	Frozen fish, mussels, shellfish, canned tuna	Fresh fish, red mullet, shrimp, lobster, whiting	Canned salmon
Eggs	Pies, salad with eggs	"Pasqualina cake", "insalata russa"	
Milk	Whole milk, yogurt	Milk cream	
Cheese	Cream cheese, parmesan cheese	Mozzarella-cheese ^(*) , fontina, gorgonzola, parmesan cheese	Sharp cheese
Sweets	Sweet-bread	Cake; ice cream ^(*) , sweets with candied fruit	
Fat and oil	Olive oil	Butter, lard	Margarine (60% of subjects)
Beverages	Mineral water, coffee	Fruit juice, chocolate	
Alcoholic beverages	White wine and red wine		

^(*) to share with young students



or red meat (7%). Five percent of the young and adult students were vegetarians.

Food selection and preferences are listed in Table V.

Food in common with young students

The preferred foods were mozzarella cheese, tomatoes and fruit in season, and olive oil.

The customary foods were white bread, pasta, Genoese “minestrone” soup, biscuits, processed pork, eggs (vegetables pies) and parmesan cheese. The disliked foods were exotic fruit and smoked cod.

NUTRITIONAL STATUS

Dietary pattern and habitual physical activity

The males’ diet provided 10.6 MJ/d. Carbohydrates 340 ± 30 g/day (~ 55% of EI), simple sugars 55 ± 15 g/day; alcohol 21.9 ± 7.1 g/day, dietary fibre, 28.7 ± 6.8 g/day, proteins 94 ± 7 g/day (~ 14% of EI) and lipids 86 ± 10 g/day (~ 31% of EI). Saturated fatty acids 26 ± 5.6 g/day (the polyunsaturated + monounsaturated fatty acid to saturated fatty acid ratio was 2.4).

The females’ diet provided 8.8 MJ/d. Carbohydrates 310 ± 25 g/day (~ 57% of EI), simple sugars 40 ± 12 g/day, alcohol 12 ± 7 g/day, dietary fibre, 24.2 ± 4.7 g/day, proteins 79 ± 7 g/day (~ 15% of EI) and fat 65 ± 6 g/day (28% of EI).

Anthropometric assessment

The following data were collected: height (males 173.1 ± 5.5, females 160.1 ± 5.8 cm), BM (males 74.3 ± 10.7, females 61.0 ± 6.2 kg); BMI [males 24.6 ± 2.6 (range: 18.6-31.5), females 23.7 ± 4.6 kg/m² (range: 18.2-35)]. Normal BM were recorded for 57% of the males and 67% of the females. Thirty-four percent of males and 22% of females were overweight, due to a higher intake of fat-rich products and sugar and 6% of both males and females were obese. Three percent of males and 5% of females were underweight.

Skinfold-thickness (TSF + BSF) showed significant differences. BF %: males 23.0 ± 5.3, females 31.8 ± 6.2 (P < 0.001), WHR: males 0.89 ± 0.04, females 0.81 ± 0.05 (P < 0.001). MAC: males 27.5 ± 2.8, females 25.6 ± 3.7 cm.

OLDER SUBJECTS

Meal cycle, food selection and food frequency

Regularity in the meal cycle was the prevalent characteristic of this group: 60% of the subjects usually had coffee with sugar before breakfast, 64% of the males and 50% of the females had breakfast (8% of the daily EI). Overall, 35% of the females but only 8% of males reported two meals/day. The main meal was lunch and was prepared following regional traditions. Episodes of eating in young, adult and elderly subjects show significant differences (P < 0.01) between sex and age (Fig. 1).

Almost all subjects had biscuits, chocolate and jam (which were not regarded as “sweets” by 60%); 30% of the subjects had an afternoon snack consisting of jam, pastry or ice-cream, depending on the season.

Compared to the young and adult groups, the elderly subjects had limited energy intake and smaller sized portions of pasta (daily consumption: males, 80 ± 20, females, 60 ± 20 g) and bread (daily consumption: males 160 ± 40, females, 110 ± 30 g). They also had a lower frequency and consumption of eggs, fish and high-fat foods, whereas vegetable and fruit frequencies were comparable (but were better cooked than raw). Wine consumption was limited. The highest frequency was recorded for fruit and dairy product consumption, with a maximum of 7 to 14 times/wk (Tab. II). Overall 22% of the subjects had both hors d’ouvres and aperitives regularly, 68% of males and 18% of females appreciated the added value of the social interaction. The meal size increased as the number of other persons present increased.

Tab. VI. Food selection and preferences of elderly students.

Food groups	Customary food: 0 = acceptable ± 1 = slightly liked - 1 = slightly disliked	Preferred food: ± 2 = appreciated ± 3 = very much liked	Disliked food: - 2 = avoided - 3 = very much disliked
Cereals	White bread*, pasta*	"Ravioli"	Pizza
Fruit	Bananas, apples, pears, citrus fruit	Fruit in season	Pineapple, kiwi, dates
Legumes	French beans	"Farinata" (wheat chickpeas)	Broad beans, lentils
Vegetables	Courgettes; carrots, onions, potatoes	Tomatoes, artichokes, beets	Cabbage, chicory, turnips
Meat and poultry	Chicken, meat products*	White meat, beef*, "Genoese cima" ^(1*)	Horse, tripe
Fish*	Trout	Hake	Anchovies, dried cod
Eggs*	Vegetable pies	Omelettes	
Milk	Milk	Yogurt ^(2**)	
Cheese	Soft cheese	Parmesan cheese ^(1*)	"Gorgonzola" cheese
Sweets	Marmalade, pudding	Ice-cream, pastry, chocolate	Honey
Fat and oil	Olive oil*	Butter	
Beverages	Coffee, tea	Mineral water	
Beverages alcoholic	Wine*		Beer

* less consumption in comparison with young and adult students ^(1*) to share with adult students; ^(2**) to share with young students

Food selection

The preferred foods were "ravioli", stuffed pasta, parmesan cheese, vegetables (tomatoes, artichokes, beets), fruit in season, white meat, fresh fish and chocolate.

The customary foods were pasta, bread, cake, meat and dairy products, but the consumption frequency and portion size decreased. Use of salt, butter and olive oil also decreased (partly substituted with dietary margarine) compared to the adult diet. Milk and red meat were refused by 5% of subjects.

The disliked foods were pizza, rice (30% of subjects), pulses (chickpeas, broad beans, lentils), vegetables (cabbage, turnips 40%), chicory, dried figs, plums (20%) and exotic fruit (40%). Food selection and preferences in the elderly subjects are showed in Table VI.

Food in common with adult subjects

Preferred food: vegetables, genoese cima, fruit in season, parmesan cheese and olive oil.

Customary food: bread, pasta, dairy products and eggs (omelettes and vegetable pies).

Disliked food: horse meat.

For females, traditionally prepared food was more inviting than a larger variety or abundance of food. Seventy percent of the subjects referred to good digestion; males (77%) tended to mistake satiation with satiety (which occur 3 and 6 hours, respectively, after the beginning of the meal [43]).

Food in common with young and adult subjects

The preferred foods were fruit in season and olive oil. The customary foods were bread, pasta, vegetables, soft cheese, parmesan cheese and eggs (omelettes and

vegetable pies). The disliked foods were exotic fruit (pineapple, kiwi).

Food in common for all-age groups

The preferred foods were fruit, olive oil and fish. The customary foods were white bread, pasta, vegetables, parmesan cheese, soft cheese and eggs. The disliked foods were exotic fruit, pineapple, kiwi and dates.

NUTRITIONAL STATUS

Dietary pattern and habitual physical activity

The energy intake for the older active males was about 9.5 MJ/d and 8.2 MJ/d for females [44]. Responses to the physical activity questionnaires showed seasonally-related activities. Total time spent doing exercise was classified as < 120 min/wk or > 120 min/wk (males, 82% of the subjects; females, 68%).

Anthropometric assessment

Height (males 164.8 ± 4.4, females 157.7 ± 6.9 cm; BM (males 68.5 ± 8.2, females 61.3 ± 8.3 kg). Body mass and body composition change with aging, since lean mass loss is partly matched by fat mass gain [45].

Average BMI (males 24.8 ± 2.8 and females 24.5 ± 3.8 kg/m²). The difference between the young subjects and the elderly is about 2.1 in males and 3 kg/m² in females. About 12% of the males and 18% of the females were overweight, whereas 8% of the males and 12% of the females were underweight.

BF% was slightly higher in comparison to adult subjects: young males 16.0 ± 3.2, older males 28.2 ± 4, young females 22.6 ± 3.7 and older females 37.2 ± 5.4 (P < 0.001). Circumferential measurements are directly affected by

regional adiposity, giving a more precise estimate of BF%.

Waist circumference was correlated with BF% [for males, $r = 0.67$, for females 0.59 ; ($P < 0.002$)], and with BMI [for males, $r = 0.76$, for females, 0.78 ; ($P < 0.001$)]. For males WHR was 0.90 ± 0.07 , and 0.84 ± 0.09 for females.

MAC also decreased from 27.9 ± 4.6 in adults to 25.4 ± 2.58 cm in older males, and from 24.9 ± 3.1 to 24.4 ± 2.81 cm in females. Skinfold thickness of biceps and triceps were lower due to a reduction in the FFM related to age and was negatively associated with BF and BMI in males and in females [46].

Considerations and Conclusions

Eating behaviour is the control of one's appetite and is measured by energy density, frequency and size of individual meals. The cycle comprises two phases: the first ends with *satiation*, an internal state of fullness, the second ends with *satiety*.

Preferences, and to a lesser degree aversions, are derived from gratifying experiences and reinforced by the satisfaction induced by *satiation* [43]. The economic situation of the subject can influence vitamin and mineral intake (e.g. iron, zinc and iodine), confirming the risk of malnutrition in all age groups [41]. Ligurian eating patterns were related to anthropometry and health: waist-to-hip ratio, body fat, BMI were all associated with weight gain and ageing. Body fat, which was higher for females than for males, suggests the need to use age and sex-specific % BF ranges. All the examined groups were very co-operative, since they wanted to reach an optimal weight.

Student subjects were influenced by preferences that arose from hedonistic and cultural motivations, e.g. they showed an appreciation for traditional foods (such as "focaccia" and "minestrone"), they preferred the local vegetables (e.g. in making "genoise minestrone"), and fresh vegetables. Pulses were eaten in small quantities, but were neither appreciated nor rejected. They can be considered customary food. Subjects took the advice about limiting saturated fat intake and eating pre-packaged snacks (potentially co-factors of obesity). The eating behaviour of the adult subjects was guided by cognitive motivations (e.g. preference for olive oil and fruit in season), affective component (palatableness of regional food, e.g. pasta with tomato sauce, "potato gnocchi" with "pesto", stuffed courgettes), traditional practices such as the use of aromatic herbs, including basil or marjoram and the social-economic aspects of "food-symbol" (e.g. seasoned cheese and fish from the Ligurian sea). The nutritional status appeared to be satisfactory, physical activity was moderate, 65% of the subjects in this age group had average weight and BMI values. These subjects were especially aware of the need to restrain their consumption of "simple sugars" rather than eliminating them.

The older subjects ate fewer meals/snacks per day com-

pared to the young and adult subjects. Foods selected consisted of a limited number of preferences but few dishes were regarded as disliked. The preferences were for pasta with tomato or "pesto" sauce, while meat sauce was less appreciated. Of the dairy products soft cheese was preferred, but some subjects (10%) refused "mozzarella" cheese and yoghurt. Older people need a balanced intake of nutrients, which they tend to satisfy by eating ready-made food, which is properly labelled with indications regarding the chemical composition. This was more important for the females who are more in the habit of analysing food on a quality/quantity basis. Compared to a previous study [47], this age group expressed a greater preference for fresh salmon, whereas aversion to trout had almost disappeared. They did not appreciate anchovies, sardines or mackerel. It is interesting to note a conscious dietary restraint, after a big meal, that was observed by older subjects (Fig. 1) and a negative association ($p < 0.01$) between body fatness and daily consumption of a larger number of meals/snacks. It is interesting to note that the older subjects in 2000, compared with the subjects in the 1980 study [48], paid more attention to advice concerning healthy eating behaviour and were more careful when choosing vegetables, fruit, fish and cheeses. They consumed more low calorie sweeteners and consumption of soft drinks had nearly disappeared. In all the age groups, high preference scores were associated with higher mean frequencies of consumption; starch and saturated fatty acid intake increased in the winter ($P < 0.01$).

MOTIVATIONS IN EATING BEHAVIOUR

Eating behaviour in all age groups depends on subjective motivation based on experience, physiological aspects (such as eating pleasure, preferences) and environmental factors (mostly cultural and socio-economic).

FOOD EDUCATION AND METHODOLOGICAL RESEARCH STUDIES

The study groups did not demonstrate a prevalence of consumer behaviour. The cognitive component of the behaviour came from food education which influenced food preferences and prompted a limited consumption of animal fat, substituted by olive oil and a reduced intake of salt as well as high energy dense foods and simple sugars. The recent proposal to inform, spread and increase "Clinical Nutrition" courses for medical students seems to be appropriate [49]. Improved dietary patterns are the primary prevention of social disorders such as cardiovascular diseases, hypertension, diabetes, hypercholesterolaemia and breast cancer. For this purpose, a diet must be adapted to nutritional needs.

The Mediterranean diet is regarded as the best model since it meets "nutritional goals", and "policy decisions", high-lighting traditional food with its tastes and flavours. The results of this study were favourable for the Ligurian population with the recommendation of the Mediterranean Diet, which gives preference to "orexigenic" as well as "satiating" foods, to high-dietary fibre foods, while the content of animal fats in the diet is acceptable.

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