



Eating Patterns in French Subjects Studied by the “Weekly Food Diary” Method

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The “weekly food diary” was translated and adapted for use by French subjects. This validated method requires subjects to record every food and drink intake over 1 week, with several descriptors of the physical, psychological and social circumstances. Ten male [age 23.6 ± 2.3 years, body mass index (BMI) 20.7 ± 0.6] and 16 female (age 23.3 ± 0.6 years, BMI 20 ± 0.6) students completed four weekly diaries over 1 year, one per season. Data were processed using a specially designed software. Breakfast was important, (about 400 kcalories). Lunch and dinner were almost equal in energy content but alcohol was consumed mainly with dinner. Meal size correlated positively with premeal hunger, number of people present, duration of premeal interval and time of day. Postmeal satiety correlated positively with meal size, aftermeal stomach content, and negatively with time of day, postmeal hunger and duration of sleep the preceding night. These observations allow hypotheses to be developed about mechanisms of intake in a French population and cross-cultural comparisons to be made.

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INTRODUCTION

Over the last decade, the eating and drinking behaviours of free-living humans under natural, *ad libitum* conditions have been studied in North American subjects. A large number of factors have been demonstrated to influence ingestive behaviour including physiological, genetic, nutritional, psychological, social, developmental and environmental variables. These include the subjective states of hunger and thirst, the amount of food or fluid remaining in the stomach at the onset of ingestion and its composition, the time of day, day of the week, month of the year, the number of people present, the relationship of eating companions to the subject, interactions between food and fluid intake (de Castro, 1987, 1988, 1990, 1991, 1994; de Castro & Brewer, 1992; de Castro & Elmore, 1988; de Castro *et al.*, 1986; de Castro *et al.*, 1997). These influences were discovered through the use of a “weekly food diary”

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in which the subject notes all intakes during a whole week, along with ratings of subjectively experienced motivational states and information about the circumstances (time, place, etc.) of each ingestive episode.

Up to this year, such extensive data on meal patterns and intake were available exclusively for North American consumers. Although several epidemiological studies are realized each year on the composition of the French diet, they are typically analysed in terms of macro or micronutrients, and nothing is known about the actual circumstances of ingestive events in the French population. Interest in "the French paradox" as well as plain cross-cultural comparisons makes the use of the "weekly food diary" in French subjects a worthwhile enterprise. This is what our group has started doing, first in a group of healthy students and later in diabetics of all ages and middle-aged healthy persons. In addition to the variables studied in the North American studies, the French protocol included four weekly food diaries for each subject, to be completed throughout the year, one per season. In the present article, our method and the seasonal data obtained in students will be reviewed.

METHODS

Subjects

Data were collected from 10 male and 16 female French students recruited at the University of Paris. They answered a posted advertisement for an eating practice study. They were paid for their participation in the study.

Men were 23.6 ± 2.3 years old and had a body mass index (BMI) of 20.7 ± 0.6 kg/m², which is normal for this population and this age (Rolland-Cachera, 1988). In females, mean age was 23.3 ± 0.6 years and the BMI, 20 ± 0.5 kg/m², was also normal for French women of this age.

Procedure

The weekly food diary procedure has been described extensively in earlier papers (de Castro, 1987). For the French study, the diary was translated into French with little modification to allow subjects to rate the palatability of each food in addition to the original parameters. The subjects were instructed to record in as detailed a manner as possible every item that they either ate or drank, the time they ingested it, the amount ingested, and how the food was prepared, and the nature of the other people eating with them, number of males and females and their relation with the subject. Self-ratings were obtained of the subject's degree of hunger at the beginning and again at the end of the meal on a 7-point scale from very satiated to very hungry. The subjective appreciation of all foods and drinks consumed was also rated on a 7-point scale.

The subjects recorded for a day and were contacted by the experimenter to review the information, correct any problems and answer any questions. Then they recorded their intake for seven consecutive days. After this recording period, the subjects were contacted by the experimenter and reviewed the diaries, clarifying any ambiguities or missing data. In French subjects, a weekly food diary was completed by all subjects four times a year, once in every season.

Data Analysis

The foods reported in the diaries were assigned codes from a computer file containing the nutrient compositions of common food items in France. French food contents were obtained from the CIQUAL Repertory (1991) and from food industry nutritional data. Meals were identified and the compositions of the individual items composing the meal were summed. In order for a reported intake to be classified as an individual meal it had to contain at least 50 kcal, or more stringently 100 or 200 kcal. It also had to be separated in time from the preceding and following ingestive behaviours by at least 15 min. More stringent definitions of 45 and 90 min were also employed. Five different definitions of a meal were used combining these criteria. The meals were characterized by their total caloric content, carbohydrate, fat, protein and alcohol content, duration and rate of eating, and the amount of time between meals, the premeal and postmeal intervals, the premeal and aftermeal subjective states of hunger, the meal size divided by premeal interval (deprivation ratio), and the aftermeal interval divided by meal size (satiety ratio). The estimated premeal and postmeal stomach contents were calculated with a computer model (Hopkins, 1966).

The amounts ingested over the entire 7-day periods were summed. The average of each of the meal characteristics and the meal daily intakes were then calculated for each subject. These individual means were then used to calculate overall group means. Individual comparisons were made with *t*-tests. Analysis was performed separately for bouts occurring during the morning period (0600–1100), bouts occurring during the afternoon period (1100–1700) and bouts occurring during the evening period (1700–2300), as well as for the four seasons.

For each subject, the correlation between meal size and each of a number of variables was examined using the Pearson Product Moment Correlation. In addition, for each subject, the correlation was calculated between the aftermeal interval and the endmeal time, the number of people present, the premeal interval, the aftermeal self-ratings of hunger, and the estimated contents of the stomach at the end of the meal.

RESULTS

The minimum 50 kcal, 45 min definition of a meal is presented as representative. There were substantial gender differences in intake levels; gender was therefore included as a variable in the analysis.

Alertness ratings were higher in males than females at wake-up, $F(1,91)=13.6$; $p<0.01$, and during the day, $F(1,91)=4.9$; $p<0.05$. The satiety ratio was higher in women $F(1,86)=9.7$; $p<0.01$. Men ate at a faster rate than women, $F(1,91)=32.3$; $p<0.01$.

Figure 1 presents the mean daily intakes in males and females over 1 year. Energy intake was diminished during the summertime in both female and male students: 33 ± 1.4 kcal/kg body weight as opposed to 36 ± 1.4 in other seasons, $F(3,63)=3.0$; $p<0.05$. The intake of protein (g/kg body weight) was also less during the summer ($4.9 \leq 0.2$) than other seasons ($5.4-5.7$), $F(3,63)=4.19$; $p<0.01$. Figure 2 displays the total daily intakes in males and females, all seasons combined, as well as the daily distribution of nutrients. The gender differences are obvious. In contrast to

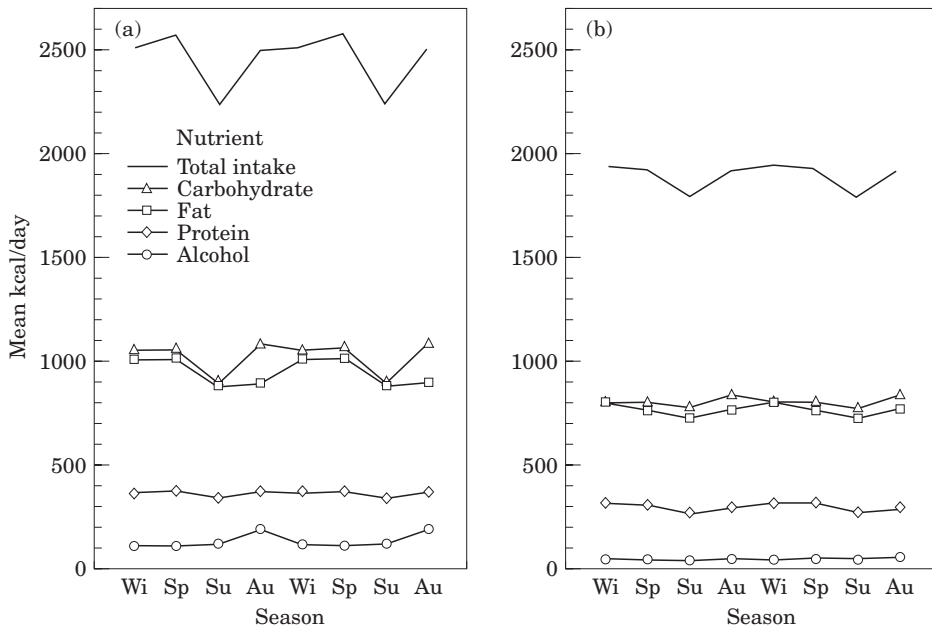


FIGURE 1. Mean daily intake in French male (a) and female (b) students, over four seasons. The data are longitudinal. $N=26$. W, winter; Sp, spring; Su, summer; Au, autumn.

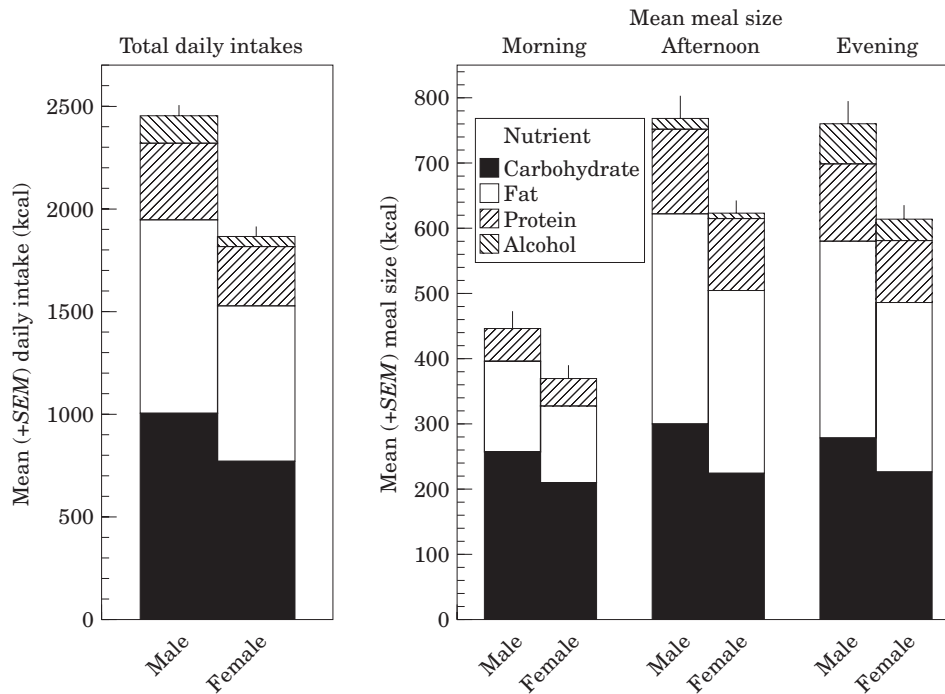


FIGURE 2. Total daily nutrient and energy in French male ($N=10$) and female ($N=16$) students.

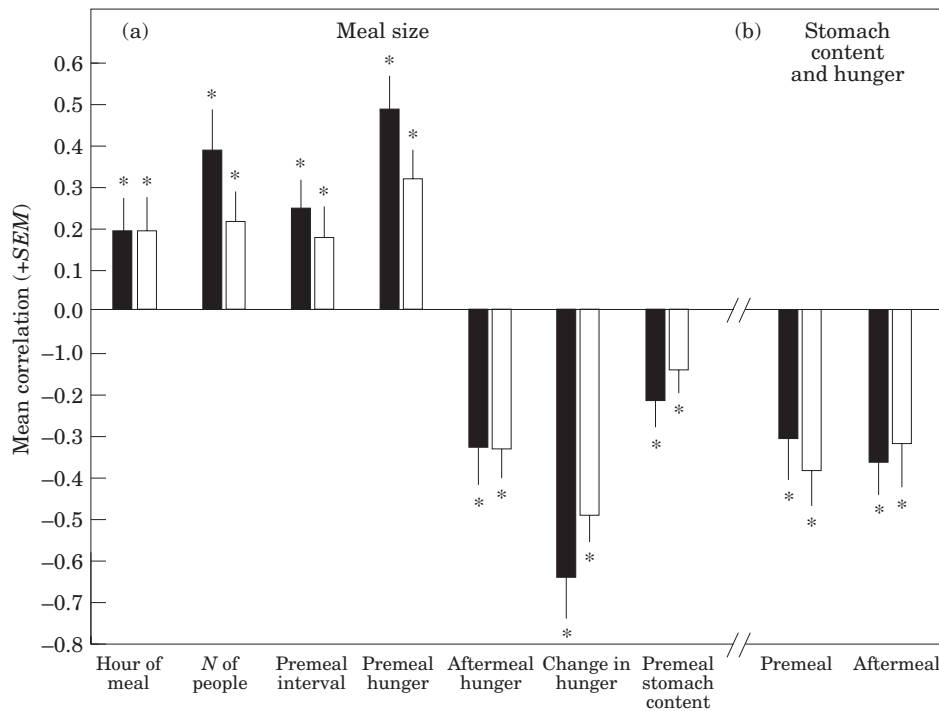


FIGURE 3. (a) Correlations between meal size and various parameters in French male (■) ($N=10$) and female (□) ($N=16$) students. (b) Correlations between hunger ratings and estimated stomach content in the same individuals.

preconceptions, the French breakfast is important (about 400 kcal). Lunch and dinner are almost equal in energy content but dinner is richer in alcohol energy, $F(2, 182) = 34.7$; $p < 0.01$. Spring and summer meals begin and end later in the day than autumn and winter meals, $F(3, 120) = 3.611$ and 3.166 , respectively; $p < 0.05$. More people were present in the afternoon and evening meals than at breakfast, $F(2, 182) = 52.6$; $p < 0.01$; this was true for males, $F(2, 182) = 56.9$; $p < 0.01$, and for females, $F(2, 182) = 28.5$; $p < 0.01$, separately. Premeal hunger was higher in the afternoon and evening than in the morning, $F(2, 182) = 19.2$; $p < 0.01$. The opposite was observed for thirst, $F(2, 182) = 19.9$; $p < 0.01$. The lunch meal appeared to induce a larger change along the hungry-sated scale than other meals, $F(2, 182) = 22.9$; $p < 0.01$.

Figure 3 presents correlation obtained in French male and female students between meal size and several parameters, as well as between estimated stomach content and hunger ratings. Meal size is positively correlated with premeal hunger, number of people present, the duration of premeal interval and the time of day. It is negatively related to the change in hunger ratings (from hungry to sated), the rating of aftermeal hunger, and the premeal stomach content. Premeal and aftermeal hunger are inversely correlated with the stomach nutrient content.

Figure 4 shows the duration of satiety after a meal was positively correlated with several parameters: aftermeal stomach content, meal size (in energy, carbohydrate, fat and protein); it was negatively associated to the time of day, the level of hunger after the meal and the duration of sleep on the preceding night.

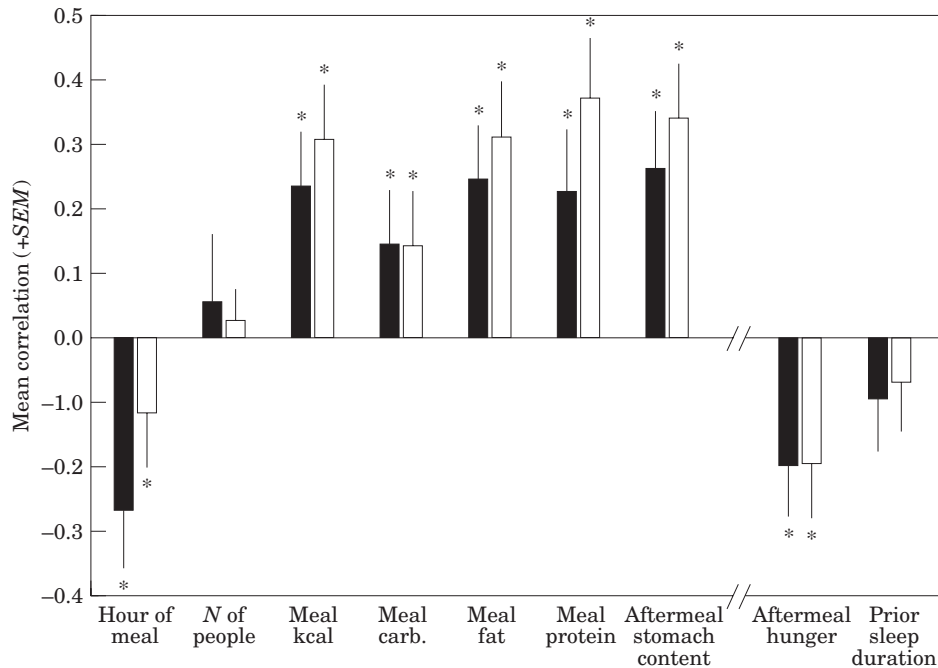


FIGURE 4. Correlations between the duration of the postmeal interval and various parameters in French male ($N=10$) and female ($N=16$) students.

As judged from palatability ratings, the later meals of the day were more palatable. Meals where only one female was present were rated higher in palatability than meals consumed in the presence of many women, $F(4,530)=2.7$; $p<0.05$, whereas the number of males present was not significantly associated to palatability ratings. High palatability ratings were associated with low premeal hunger, $F(4,509)=8.1$; $p<0.01$, and good mood, $F(4,510)=11.4$; $p<0.01$. An interesting result is that higher palatability meals had a lower satiety ratio, $F(4,513)=13.0$; $p<0.01$.

DISCUSSION

This short article presents a few of the observations made on the feeding behaviour patterns in French students, as investigated by using the weekly food diary. It has been possible to establish the parameters of basic feeding patterns in this population and to compute the relationships existing between many of them. A comparison of the French student data with North American and Dutch data has recently appeared in print (de Castro *et al.*, 1997). The originality of the French study is that feeding practices were studied over a year, by following behaviours for 4 weeks distributed in each of the four seasons and by including palatability ratings among the parameters. These additions to the original protocol appear to reveal additional links between the parameters under study.

More will be learned about the ingestive patterns of the French via the analysis of data obtained from middle-age healthy persons and diabetic patients of all ages.

Four weekly food diaries (one per season) have been collected in these two populations and will be analysed shortly. The comparison with French student data and with subjects of different nationalities will yield interesting and perhaps useful (for the diabetics for example) observations.

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