

FOOD PREFERENCES AND AGE

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Abstract

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This lecture deals with the following aspects:

- * Rating and ranking methods for the measurement of food preferences in children, adolescents and adults.
- * The concept and the assessment of food aversions and dislikes.
- * A review of existing empirical results concerning the relationship between age and food consumption, preferences and dislikes.
- * Presentation of own empirical findings relating to the connection between age and food preferences and dislikes. In two samples of adults ($n_1=338$; $n_2=212$) the preferences for 157 and 331 foods respectively were factor-analysed and 9 respectively 13 food preference scales were derived. It is analysed, to what extent the preferences and dislikes for these food groups are related to age in males and females. Furthermore, the emerged sex differences are examined.
- * Relations between food preferences and actual consumption.
- * Methodological problems in the analysis of the age dependence of food preferences (age versus cohort effects).

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Introduction

The motivational attitude (preference) of a person towards a certain food or beverage can be represented as a point on a continuum ranging from aversion on the left side to a craving for this food or beverage on the right side. The preference of individuals or groups for certain types of foods can be measured in a number of ways (see Diehl 1981,1). As far as the actual consumption is not taken as an indicator of the preferences for foods or beverages, the rating method is the procedure applied most frequently in order to measure preferences (see Diehl 1983,2). As opposed to other techniques such as methods of comparison, ranking of foods according to their preference, listing of favourite foods, etc., a number of advantages is inherent (see Seaton 1974).

The rating method generally consists of giving subjects a more or less lengthy list of names of different foods or beverages and asking them to mark the degree of their preference for the individual item on a rating scale. The number of points used for the description of preferences ranges from the simple 2-point case (like-dislike) to the 9-point hedonic scale constructed to measure food preferences of the American Armed Forces (Jones et al. 1955, Peryam and Pilgrim 1957).

A compilation of the typical rating scales employed for various age groups is given in table 1 (see appendix, page 117). As one would expect, the number of judgemental categories which can be given to the younger

age groups would have to be more limited than that used for scales addressed to adolescents or adults. A number of studies has demonstrated, however, that the rating procedures can even be applied to 3-6 year old children (A in table 1); moreover, youngsters aged 9-12 years are even able to make preference judgements by means of a 5-point scale (C in table 1). In order to assess the food preferences of adults in English-speaking countries, the 9-point hedonic scale (D in table 1) is applied most frequently. In German-speaking countries, however, such preferences (for adults) have mainly been measured by means of the rating scale specified in E in table 1.

In the continuum of food preference ranging from extreme liking to extreme rejection, special attention has been given to the field of dislikes and aversions (see Diehl 1983,4). Food aversions have predominantly been measured by giving subjects a list of foods or beverages and instructing them to mark the items which they would refuse to consume (under ordinary conditions)¹. As opposed to an aversion, a food dislike represents a less intense degree of rejection as it (generally) doesn't include the component of refusal to consume the item in question.

Age and food preferences and dislikes: a review of the literature

A search for empirical findings on the relationship between age and food preferences (measured by means of rating scales or specification of 'favourite foods') revealed only 13 studies in which this relation has been analysed. The characteristics and main results of these investigations are summarized in table 2 (see appendix, page 118/119). It is evident that only one study (No. 1 in table 2) attempted to examine the age-related changes in preferences during childhood, and that three investigations analysed the same question with regard to adolescence (No. 2-4 in table 2). The vast majority (No. 5-13 in table 2) aimed, however, at determining the extent to which an increase or decrease in preferences for certain foods and beverages can be observed in the course of adulthood.

A number of factors considerably limits the degree to which empirically found conclusions about the age-related changes in food preferences can be derived. These include the lack of research studies on the whole, and specifically, the restricted number of investigations dealing with different age groups; the various kinds and numbers of food items used in the preference studies as well as the results in themselves.

One finding which emerges with a certain frequency implies that the preference for items of the food group 'vegetables' becomes more pronounced with increasing age. Likewise, an increase in the preference for the group 'fish/seafood' can repeatedly be observed. On the other hand, several studies point to the fact that the preference for sweets and sweet dishes decreases as an individual grows older. Furthermore, findings show that the preference for pizzas is not as strong for older persons as for younger individuals².

1) The instruction given by Wallen (1948) can be regarded as typical: 'Read over the following list of foods. After the names of any that you dislike so much that you refuse to eat them, make an X.'

2) Compare with findings presented in the results section.

In addition to the age-related aspect of food preferences, the relation between age and the number of food aversions or dislikes expressed by the individual (usually by means of a list) has repeatedly been studied. The picture which emerges from the data appears to be quite consistent. As can be seen in the summary of results presented in table 3 (see appendix, page 120), the majority of the studies revealed a decrease in the number of food aversions or dislikes with increasing age.

Due to the fact that the degree of preference for certain food items correlates more or less significantly with the consumption level of these items, an analysis of the extent to which the actual consumption of certain foods and beverages respectively food groups or nutrients is consistently related to an individual's age can supplement the data from the very limited number of preference studies currently available. For this purpose 73 studies carried out with adults have been evaluated (Diehl 1983,1). Table 4 (see appendix, page 121) lists the food variables whose intake/consumption proved to be related to age in at least five studies; moreover for each variable, the number of investigations in which a positive or negative correlation between age and consumption is given, as well.

At the 'nutrient-level' as far as a relation between intake and age exists at all, a relatively consistent decline of the intake of energy, protein, fat, carbohydrates, iron, niacin, vitamin A, thiamin, riboflavin and vitamin C can be observed with increasing age. In the majority of the studies calcium intake was also found to decrease with increasing age. From the entire set of studies evaluated thus far, only a few foods or food groups have been analysed frequently enough to enable an estimation of the consistency of the relation between consumption and age. A decrease in the consumption of fish, potatoes, sugar, and sweets seems evident as individuals get older, whereas at the same time an increased tendency to consume bread, butter, eggs, and fruit appears to be more probable. With regard to beverages, a decrease in the consumption of alcohol, soft drinks, and milk with increasing age was apparent in most of the studies in which a relationship to age was observed. On the other hand, several investigations report that the consumption of coffee increases with age.

Age and food preferences and dislikes: new findings

The relation between age and food preferences and dislikes was analysed in two studies with samples of working adults. The most significant relations to age which were observed for the individual food items have already been given in table 2 (study No. 12/13). The following analysis examines, on the other hand, the extent to which the preference for certain food groups tends to change with increasing age.

In both studies subjects were given a list of food items and instructed to rate their preferences on the 7-point hedonic scale shown in table 2, (E) and 5 (see appendix, page 118/119 and 122). The sample of study No. 1 included 191 women and 147 men aged 17-64 years. The food list included 152 foods and 21 beverages. A detailed description of the sample and the food list has been given by Diehl (1981,2). The sample of study No. 2 included 113 women and 99 men aged 17-80 years. The food list which was presented to the subjects contained 331 foods, 64 spices and herbs and 20 national dishes. Detailed description of the sample and the entire list of foods has also been given by Diehl (1983,2). In addition, the items investigated in the current analysis of the preferences for food groups are listed

in table 8 (see appendix, page 124/125). Both groups of subjects were at random samples of persons who were willing to complete the questionnaire individually and return it (anonymously) by mail.

Data analysis: construction of food preference scales

The analysis of the relations between age and preference for specific foods leads to important findings, especially in terms of practical application. The great variety of food items in most lists produces a large number of individual results, however, so that the high degree of complexity inherent to these specific findings only allows the extraction of structures possibly underlying the relations between age and food preferences to a limited degree. Therefore, in order to analyse the age dependence of the preference for certain groups of foods, it seems advisable to begin first by classifying food items which 'belong together,' followed by the assignment of a numerical value which indicates the degree of the individual's preference for the investigated food group.

As the preference for certain foods is the variable of concern here, the given food items must be classified in such a way that in each case groups of foods are formed which are related in terms of their preferences (on the part of the subjects) or which contain an underlying dimension (see Diehl 1981,1,2). The factor-analysis represents one method which can be applied to reveal such patterns of food preferences (see Pilgrim and Kamen 1959, Diehl 1981,1,2).

For this purpose the preference ratings for the 152 foods given by the 338 subjects in study No. 1 were subjected to a factor-analysis. Based on the rotated 11-factor solution, nine scales of food preference were constructed. The additional four scales of beverage preference are not taken into consideration in the following description. The groups of items constituting the nine food preference scales are given by Diehl (1981,2); the aspects of preference which they measure will be considered in the results section.

In study No. 2 the preference ratings for the 331 foods given by the 212 subjects were factor analysed. Proceeding from the rotated 15-factor solution, 13 scales of food preference were constructed. The food items respectively food groups constituting these scales are listed in table 8.

The computation of the scale-value expressing the preference of a certain person for a certain food group shall be illustrated by means of the preference scale 'green salad/vegetable salads' given in table 5. Findings emerging from the factor-analysis indicated that a common dimension underlies the preference ratings of all 15 foods included, that is correlations between the preference ratings of the 15 items were high, but rather low with respect to the items of other food groups. In order to attain a scale-value which could function as an indicator of the individual's preference for the food group 'green salad/vegetable salads', the numbers assigned to the item responses of each subject were added up.

The computation of the (corrected) item-total correlations was carried out after this step, in order to test whether this summation across all items was 'meaningful'. Those items with item-total correlation coefficients which were too low were eliminated, as their preference ratings apparently did not correlate highly enough with the preference measured by the sum of the remaining items. In the preference scales finally the sum of an individual's item responses was divided by the number of scale-items. The person's

'mean item response per scale' generated in this manner enabled a numerical comparison of the values of scales with varying numbers of items. Moreover, the scale-values transformed in this way are within the range 1.0-7.0 and can be interpreted in terms of the rating scale given with the items.

The item-total correlations for the items of the 13 preference scales are shown in table 8. In addition, the Cronbach alpha-coefficient is stated for each scale as a measure of the internal consistency. Table 7 (see appendix, page 123) contains the intercorrelations of the 13 food preference scales. One part of the scales is practically independent of another. Correlation coefficients up to a value of 0.59 emerge to some extent, however, pointing to the fact, that significant (direct) relationships can be found between the preferences for certain food groups. As the negative coefficients observed do not exceed the value of 0.04, it can be concluded that whenever the preferences for different food groups are significantly related, the relationship is exclusively direct, that is strong preferences for one group of foods go along with high degrees of preference for the other food group. This fact had already been demonstrated by the 9 preference scales from study No. 1 (Diehl 1981,2).

The procedure described above led to the construction of 9 (study No. 1) respectively 13 (study No. 2) values for each person in which the degree of preference for the 9 respectively 13 groups of foods was expressed. In addition to food preference, the concept of food dislike is to be regarded as important. Therefore, the number of food dislikes in each of the 9 respectively 13 food groups defined by the preference scales was determined for each person by counting the frequency with which she or he had chosen the categories 'dislike very much' and 'refuse to eat' in each food group. The 'person X' exemplified in table 5 would receive the dislike-value '0' according to this procedure, as a dislike in the sense defined here was not expressed for any scale item. Moreover, along with the number of individual dislikes in the 9 respectively 13 food groups, the total number of dislikes for the 152 foods contained in study No. 1 respectively 331 foods in study No. 2 was determined for each person.

In order to make the dislike-values of the scales differing in 'length' numerically comparable to each other, these values were transformed into the 'percentage of scale items for which a dislike had been expressed' by the individual by means of the formula $(100) \times (\text{number of dislikes}) : (\text{number of scale-items})$. Accordingly 10 (study No. 1) respectively 14 (study No. 2) values of food dislike were generated in addition to the preference-values.

Data analysis: procedure for studying the age-relationships

In order to be able to reveal eventual non-linear relationships between age and food preferences or dislikes, three age groups were formed in each of the two studies and compared to one another with respect to their means in the preference and dislike variables. Due to the fact that sex differences proved to be significant in a series of food preferences and dislikes (see Diehl 1982 and 1983,3,4), sex was brought into the analyses as a second factor beside age.

The age of the sex groups from both studies is described in table 6 (see appendix, page 123) with respect to their age range, mean age and sample sizes. In both samples the subjects were divided into groups in such a way that for both women and men (three) groups emerged whose sizes equalled

each other as much as possible. In keeping with this condition, approximate equal distances of the age means of the two outer groups from the inner ones could not be realized, on the one hand. Secondly, it was not possible to apply the age range of the groups which arose in study No. 2 to study No. 1. The formation of more than three age groups would have been desirable, but would have led (partly) to groups which would have been too small for analysis, however.

A comparison of the age by sex groups was carried out by the analysis of variance with respect to their means in the 9 respectively 13 preference variables and the 10 respectively 14 dislike variables. In the analysis of the dislike variables, findings relating to the degree of statistical significance of the main and interaction effects can only be regarded as tentative, however, as due to the generally skewed distributions of the dislike values (see Diehl 1981,2 and 1983,4) the condition of normality required for the validity of the ANOVA significance test was not met.

Results

The results are presented graphically in the figures 1-4 (see appendix, page 126-129) using curves of mean values. In each case the means of the different age groups in the preference and dislike variables are plotted, separately for men and women. In the following discussion of the age-related changes in food preferences and dislikes references to identifiable (although statistically insignificant) trends are made along with the description of statistically significant relationships.

Food preferences and age

Results emerging from study No. 1 with regard to food preferences are shown in figure 1. The preference for the kind of meat contained in scale B (innards, poultry, roast knuckles, venison, mutton) increases for men and women from the younger to the middle age group. The preferences for cheese (E) increases across the entire age range for men, whereas this increase can only be observed for women from the lower to the middle age group. An (insignificant) trend can be seen in the case of the preference for fish/seafood (A). This food group is preferred by men with increasing age to a greater extent; the preference of women for fish fails to reflect an additional increase from the middle to the upper age group.

The mean preference for the food group F (vegetables I: lettuce, uncooked vegetables) decreases from the middle to the upper age group for both sexes. The preference for fruit (H) shows a decline from the lower to the middle age group, however mainly on the part of women.

The only statistically significant interaction between the factors age and sex which appeared in the analyses was observed in the case of the preference for the food group G (vegetables II: cabbage, legumes)³. A decrease in the preference of women from the middle to the upper age group is evident, whereas a weak trend in preference (across the entire age range) can be seen for men.

3) For the remaining variables the p-values for the interaction F-quotients did not exceed the value of 0.12. For this reason, the p-values for the interaction effects are not cited in detail in figure 1-4.

The results from study No. 2 with respect to food preferences are given in figure 2. For both men and women the preference for innards/hearty dishes (3) increases with age. This finding represents a partial confirmation of the age-related increase in the preference for meat (B) which was established in study No. 1. A significant increase in preference for familiar vegetable dishes (7) can be observed with increasing age; this increase is more pronounced on the part of men than of women. The mean preference for fish/seafood (5) increases from the middle to the upper age group; in this case, the increase is greater for women. This result partly confirms the tendency revealed in study No. 1 with regard to the preference for fish/seafood (A).

A preference which is found to decrease with age both for men and women is that for noodle dishes/pizzas (6). A trend pointing towards a decrease in preference from the lower to the middle age level is evident in the case of the food group 'sweet dishes' (11).

Food dislikes and age

The findings from study No. 1 pertaining to the age-related changes in the number of individual food dislikes are presented in figure 3. The mean number of dislikes in food group B (meat: innards, poultry, etc.) decreases both for men as well as for women from the lower to the middle age group. A similar age-related decline was revealed in the case of the food group 'cheese' (E).

The number of dislikes in group G (vegetables II: cabbage, legumes) shows a decrease for men across the entire age range, whereas this is only true in the case of women from the lower to the middle age group. The mean number of dislikes with respect to the food group 'fish/seafood' (A) indicates a decreasing trend for women with increasing age; this can only be observed for men from the first to the second age group. Similar findings emerge with respect to the total number of food dislikes (K); both for men as well as for women the mean number of dislikes expressed by the youngest group is greater than that for the two older groups.

The results from study No. 2 with regard to subjects' dislikes are shown in figure 4. A decline in the number of dislikes is evident in the case of innards/hearty dishes (3) both for men and women across the entire age range. This finding confirms (at least partially) the age-related decrease for the food group 'meat' (B) which was determined in the first study. Likewise, the number of dislikes observed for the food group 'familiar vegetable dishes' (7) diminishes with increasing age both for men and for women. This can also be viewed as a partial confirmation of a finding resulting from study No. 1 (decrease in the number of dislikes in the food group G 'cabbage/legumes'). With respect to the total number of food dislikes (14) the oldest group exhibits fewer dislikes than both of the younger groups. With regard to this characteristic, results from both studies concur in that the youngest age group manifests a greater total number of food dislikes than the oldest group.

A trend towards an age-related decrease in the number of dislikes for fish/seafood (5) can be observed as in study No. 1, at least from the middle to the upper age group. The number of dislikes in the food group 'green salad/vegetable salads' (8) indicates a decreasing trend from the lower to the middle age group in the case of male subjects, whereas a similar reduction can be observed for women from the middle to the upper age group. Furthermore, there are indications that young male individuals

dislike items of the food group 'sweet dishes' (11) to a lesser extent than male subjects who are in the two older groups. In addition, the number of dislikes of certain egg dishes (12) decreases (possibly) with increasing age. In terms of snacks (13), it is evident that older persons tend to report fewer dislikes than subjects in the two younger groups.

Sex in relation to food preferences and dislikes

Despite the fact that the relationships between sex and food preferences and dislikes are not the topic of this lecture, the finding that significant sex differences can be seen for a considerable number of preference and dislike variables shall nevertheless be discussed.

For all age groups, dishes from the food classes: meat (B), sausages/cold cuts (D), less familiar meats (2), and fast food (4) are preferred to a greater extent by men. This can be regarded as a clear indication of a stronger preference for meat dishes on the part of men. On the other hand, women manifest a greater preference for items contained in the food groups: noodle dishes/pizzas (6), green salad/vegetable salads (8) and sweet dishes (11).

Compared to the female group, males tend to have stronger preferences for dishes of the classes: fish/seafood (A), familiar meats (1), and innards/hearty dishes (3). Women, on the other hand, tend to prefer items of the food group 'less familiar vegetable dishes' (9) more strongly.

Whenever sex differences emerge in the mean number of individual food dislikes which are either statistically significant or indicate a trend, the extent to which dislikes are expressed is generally greater for women. Thus a significant greater number of dislikes for items of the food groups: meat (B), less familiar meats (2), and mushrooms/asparagus/ham/egg dishes (10) is revealed by female subjects. In the same manner, the number of dislikes in the food groups: fish/seafood (A), innards/hearty dishes (3), fast food (4), and snacks (13), and in the total number of food dislikes (K) is tentatively greater for women.

Discussion

The findings confirm that it is meaningful and productive to analyse the age-relations of preferences for food groups formed on the basis of factor- and scale-analysis. It was possible to determine a number of food groups for which subjects' preferences were significantly related to their age, whereas the mean preference for other food classes failed to reflect significant age changes.

The analysis of the age-relations for different food groups proved to be especially advantageous in the field of food dislikes. In most of the previous studies, only the extent to which the total number of rejections given for a series of food items covaried with age had been investigated. Our findings clearly indicate, however, that the age-related decrease in the total number of dislikes (due to the aggregation of food classes with varying age-relations) does not adequately represent the age-related changes in the different food groups. In some groups, the decline in the number of individual dislikes is considerably more distinct, whereas the degree to which dislikes are expressed (in adulthood) remains relatively constant in other food classes.

The curves of means given in the figures demonstrate that part of the relations between age and food preferences and dislikes is non-linear. A

procedure which would enable the determination of such relations is therefore to be recommended for further analyses.

The significant sex differences which emerged for a number of the preference and dislike variables (as well with respect to their relations to age) further indicate that this factor either needs to be controlled or simultaneously analysed by means of appropriate design and evaluation strategies.

Relations between food preferences and actual consumption

The greater part of the research on food preferences (measured by rating scales) and their relationships to characteristics such as age, sex, etc. is carried out either explicitly or implicitly based on the hypothesis that the findings pertaining to the food preferences of individuals or groups also enable conclusions to be made as to the actual consumption of the food items being rated. It is assumed that a significant correlation exists between the stated food preference and the actual consumption which is high enough to be suitable for predictive purposes.

As might be expected the question of the degree to which preference and consumption correlate cannot be answered by means of a single coefficient which is (approximately) valid for all food items and consumption situations. An analysis of the relationship between preference and consumption must differentiate among other things between two situations:

- * The case of a more or less limited assortment of foods and beverages from which a certain group of persons selects its menu items at specific times (for example: group feeding in firms, institutions, schools, students' dining halls, and in the canteens for the armed forces). In such institutional feeding situations it is relatively easy to assess the preference as well as the consumption (either on an individual or on a group-basis) of all food items of interest.
- * The case of a more or less unlimited number of foods and beverages, in which the persons who are to be interviewed are not members of a specific institutional feeding system. With respect to the consumption variable the interest is focused in this case upon the individual total consumption of a food item (within a given period).

Research studies on the relationship between food preferences and actual consumption are only available (as far as our review of the literature has been able to establish) within the domain of institutional feeding⁴). All of the studies have been carried out thus far on members of the American armed forces. Preferences were assessed in each case by means of the 9-point hedonic scale; the (frequency of) selection or the consumption of the food items offered (mainly in the canteens) served as the measure of consumption. In terms of the correlation between food preferences and consumption the following ranges of values respectively (mean) coefficients

4) Data on the 'general' relationship between the preference and consumption of beverages shall be furnished by a study which is currently in the process of data analysis (Elmadfa and Diehl, in preparation). Along with preference ratings for 196 beverages, the beverages consumed by approximately 600 adults over a period of 3 respectively 7 days were assessed (by means of the protocol method).

emerged in these studies for the food items under analysis (see tabel).

It is evident that in a 'limited' system of food choices relatively close relationships exist between preference and consumption. The strength of the relationship partly varies distinctly between different food items and groups, however. Furthermore, despite the significant relations between preference and consumption

ac considerable portion of consumption variance remains which cannot be accounted for by knowing the preferences expressed by subjects.

Due to a lack of empirical evidence it is not possible to decide at the present time to what extent the strength of the relationships between preference judgements and consumption is valid for the types of food consumption other than that found in the group-feeding systems analysed. Under certain circumstances, a larger number of foods and beverages is to be expected here for which strong preferences are partly linked with relatively infrequent or modest consumption. Whereas those foods and beverages which are 'frequently' consumed in the corresponding cultural group are mainly offered in the case of institutional feeding, food lists which are applied to measure preferences not specifically related to the assortment of a group-feeding system (see table 8) also contain a great number of foods which is generally consumed only rarely (such as venison, frog's legs, edible snails, oysters, etc.) In this case, high degrees of preference may go along with infrequent/low consumption for a more or less high percentage of subjects, thereby preventing the emergence of high positive correlation coefficients at the level reported above.

Methodological problems in the study of relations between food preferences and age

The question of the relations between food preferences and age can focus on different aspects. The emphasis may be placed on determining whether older as opposed to younger persons differ at time X with respect to their preferences for certain foods or beverages. This would be a question of 'generation effects' or 'cohort effects'. Secondly, one might be interested in finding out whether the degree of preference for certain foods changes with increasing age of the individual. In this case, interest is focused upon the 'age effects' in food preferences. Thirdly, the question can be raised as to whether different age effects appear for diverse generations or cohorts with respect to certain food preferences.

The common procedure for researching the relationship between age and food preferences consists of analysing cross-sectional data in which age groups are either formed and compared with regard to the preference or consumption variables of interest or in which the kind and strength of the relationships with age are analysed by means of correlation coefficients. With the exception of those cases involving retrospective inquiries, the preference and aversion studies listed in table 2 and 3 are examples of such analyses of cross-sectional data. The situation is similar for the 73

reference	r
Schutz 1957	0.51-0.77
Schutz and Pilgrim 1958	0.69-0.81
Peryam et al. 1960 (cited in Seaton and Peryam 1970)	0.59-0.77
Kamen 1962	0.59-0.71
Pilgrim and Kamen 1963	0.56
Pilgrim 1967	0.69-0.77
	0.67
Seaton and Peryam 1970	0.51-0.86

studies dealing with the relations between age and actual food consumption which table 4 is based upon; longitudinal data were only analysed in five of these studies.

If longitudinal data are not taken into consideration, however, it is not possible to decide whether the preference differences observed for individuals or groups varying in age reflect an age or a cohort effect or a mixture of both effects (see the basic expositions from Baltes et al. 1977, Costa and McCrea 1982, Garcia et al. 1975, Glenn 1981, Meyers et al. 1981-1982).

The problems which ensue from the interpretation of cross-sectional data shall be demonstrated by means of the example appearing in Diehl (1983,1; see table 2, study No. 12, as well) of the relatively high (negative) correlations between the age-values and the degree of preference for pizza ($r_f = -0.43$; $r_m = -0.50$). In this sample, it is evident that the preference for pizza tends to decrease with increasing age of the subjects. It is impossible to decide however, whether the (at the time of the study) older subjects prefer pizza to a lesser degree due to the fact that the preference for pizza decreases as a person gets older ('age effect') or whether older individuals prefer pizza less because they belong to other cohorts (generation groups) than the younger subjects and therefore have lived through certain stages of life during 'other times' and influences ('cohort effect'). Furthermore, the correlation may of course express both age and cohort effects in the preference ratings.

Therefore, if only cross-sectional data are analysed, it is only legitimate to state that the age-values given by subjects (= the number of years which have been passed since the date of birth) correlate with a preference or consumption variable to a certain degree; in other words, only the statement that age differences were found in the preferences at time X is admissible.

A separation of age and cohort effects, a step which cannot be carried out with cross-sectional data, may not often be of special interest for the practical applications of findings on the relationship between age and food preferences or consumption. For instance, when planning meals for a collective of older people, it would be of primary importance to know which foods and beverages are either liked or disliked (as opposed to the preferences of younger ones). The question of the extent to which the preferences for certain food items are an expression of generation or age effects would be less important in comparison.

The separation of age and cohort effects in as precise a manner as possible is of fundamental importance, however, in attempting to explain the feeding habits which can be observed in the course of the life-span. For this type of analysis designs which require a considerably greater amount of expenditure than those generally applied (and which could be applied) in the studies cited in table 2 and 3, and which table 4 is based upon are certainly necessary. Financial limitations as well as the duration of the required observation period are factors standing in the way of a satisfactory analysis of age and cohort effects in the study of the stability and change of food preferences and habits.

In order to illustrate the expenditure essentially required even for a relatively short (10-year) period of observation, a plan for a longitudinal study in order to analyse the stability and change in food preferences and habits during adolescence and early adulthood is shown in figure 5 (see appendix, page 130). Among other things, this design allows the investiga-

tion of the extent to which age-related changes in food preferences and habits are dependent on the birth or grade cohort. In addition, it enables one to analyse whether eventual changes may possibly be an artefact of the longitudinal procedure and should therefore be attributed to the repeated measurement of the food variables. For the purpose of broader generalization and examination of possible cohort effects an extension of the design to four or more grade cohorts would be certainly desirable.

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Computer programmes used

- (1) ANOVA: Factor analysis of variance (independent groups). Description: P. Beutel, H. Kueffner and W. Schuboe. SPSS Statistik-Programm-System für die Sozialwissenschaften (pp 112-115). G. Fischer Verlag, Stuttgart, Federal Republic of Germany 1980.
- (2) ITAMIS: Test and questionnaire analysis. Description: H.U. Kohr. Itamis - Ein benutzerorientiertes Fortran-Programm-System zur Test- und Fragebogenanalyse. Sozialwissenschaftliches Institut der Bundeswehr, Berichte Heft 6, München, Federal Republic of Germany.
- (3) MISFAK: Principal axes factor analysis (Missing data processing, max. 400 variables); Varimax rotation (programme-author: H.U. Kohr). Description: Programme library, Department of Psychology, University of Giessen, Giessen, Federal Republic of Germany.

APPENDIX

Table 1: The rating scales for assessing food preference in childhood, adolescents, and adulthood. A survey of the response modes from 10 preference studies.

3 2 1 -	 like (good)  o.k.  dislike (bad) ? do not know	3-POINT FACIAL HEDONIC SCALE age group: 3-6 years <i>(e.g. Birch 1980, Burt and Hertaler 1978)</i>	A
3 2 1	like indifferent dislike	3-POINT HEDONIC SCALE age group: 5-12 years <i>(Breckenridge 1959)</i>	B
5 4 3 2 1 -	I like it very much and always eat it I like it fairly well and will eat it I neither like nor dislike it and will sometimes eat it I do not like it, but will eat it I do not like it, and will not eat it I do not remember having eaten it	5-POINT HEDONIC SCALE age group: 9-12 years <i>(Lund and Burk 1969)</i>	C
9 8 7 6 5 4 3 2 1 -	like extremely like very much like moderately like slightly neither like nor dislike dislike slightly dislike moderately dislike very much dislike extremely never tried	9-POINT HEDONIC SCALE age group: adolescents/adults <i>(e.g. Meiselman and Waterman 1978, Piggott 1979, Nielsen et al. 1980)</i>	D
7 6 5 4 3 2 1 -	like extremely like very much like neither like nor dislike dislike dislike very much dislike extremely/refuse to eat do not know	7-POINT HEDONIC SCALE age group: adolescents/adults <i>(Diehl 1983,1,2, for a similar scale see Bognar and Balintfy 1982)</i>	E

Table 2: Survey of foods and beverages resp. food groups for which relationships between preference and age have been found; evaluation of 13 preference studies. For studies No. 12 and No. 13 the coefficients for the correlation 'age-preference' are given; included are the items for which $100 \cdot r^2 \geq 5\%$ ($|r| \geq 0.23$).

	Study/sample characteristics	Increasing preference with increasing age (+ age + preference)	Decreasing preference with increasing age (+ age + preference)
1	Lamme & Lamme (1980) USA, mf, Ch, (<6)-(6-8)-(≥9) Y, favorite foods	pizza, corn, cola/soda, other beverages (coffee, tea, milk shake), sandwiches (roast beef, bacon; lettuce, tomato), pie	hot dogs (etc.), breakfast cereals, carrots, beans, milk, juices, peanut butter and jelly sandwiches
2	Worsley & Leitch (1981) AUS, f, St, (12)-(16)-(St) Y, favorite/disliked foods	fruit, seafood, chocolate/cake/ (ice) cream, (green) vegetables, stews/soups, spaghetti	chicken, lasagna, pizza, chips, offal/tripe, swedes
3	Biener (1969) CH, m, Ap, (16-17)-(18-19) Y, Pr	full-cream cheese (vs. medium and low fat cheese)	chocolate
4	Hill (1980) USA, mf, St, changes in Pr reported retrospectively	vegetables	sweet foods and beverages
5	Eppright (1950), USA, mf, Gp, (17-19)-(46-58) Y, 39 Pr	vegetables (especially cabbage, turnip greens, sweet potatoes, lettuce, egg-plant, onions, sauerkraut), apricots, figs, prunes, roast chicken, lamb chops, eggs, relishes, herbs	lentils, apples, avocado, bananas, dates, grapefruit, grapes, oranges, peaches, ground beef, cheese, milk, cereals, white bread, spaghetti, candy bars, ice cream, cookies, pies, peanuts, pecans
6	Abbott et al. (1952) USA, m, Gp, (17-20)-(45-58) Y, 160 Pr	vegetables, oysters, spices (cinnamon, cloves, ginger)	confections
7	Pilgrim (1961, 1967) USA, m, Mp, Pr	soups, vegetables	beverages, cereals, desserts, fruits; sweet foods
8	Harper (1963) GB, mf, Gp, 2 studies: (1) 23 vegetable Pr, (2) (18-24)-(25-44)-(45-65) Y, 5 vegetable Pr	1) parsnips, broad beans, kale, asparagus, artichokes 2) cabbage, leeks, spinach, asparagus	
9	Pfaff et al. (1979) D, mf, Gp, (<30)-(>30) Y, 21 Pr	beef steak, escalope of pork, butter, margarine	
10	Wood (1980) USA, mf, Gp, (18-24)-(25-34)-(35-49)-(50+) Y, favorite desserts		cake

11	Wayler et al. (1982) USA, m, Gp, (<40)-(40-49)-(50+) Y, 13 foods, taste/texture acceptability	hard rolls	
12	Diehl (1983,1) D, mf, Gp, 17-80 Y (corr), 178 Pr	f/m: sellery (.31/.19), butter (.29/.22), honey (.22/.29), oat flakes (.27/.23), bloater (.21/.26), curdled milk (.25/.25), pickled herring (.19/.25), blue cheese (.24/.23); f: tongue (.33), evaporated milk (.28), herring salad (.26), boiled potatoes (.24); m: fried herring (.29), hard cheese (.29), corned beef (.26)	f/m: pizza (-.43/- .50), coke (-.32/- .37), french fries (-.27/- .30), sodas, carbonated (-.16/- .30), veal, beef or pork, grilled (-.23/- .29), cucumber (-.25/- .20), paprika, raw (-.25/- .19), toast (-.18/- .23), paprika, cooked (-.15/- .23); f: noodles (-.35), strawberries (-.25), ham, cooked (-.25), fried potatoes (-.25), cherries (-.23), ham, raw (-.23), red/white cabbage, raw (-.23); m: meat salad, with mayonnaise (-.29), meat salad, without mayonnaise (-.26), veal, beef or pork, unbreaded (-.23), black tea (-.23)
13	Diehl (1983,2) D, mf, Gp, 17-64 Y (corr), 331 food Pr, 64 spice Pr	f/m: jellied pork (.36/.27), green herring, fried (.23/.27), raw potato dumplings (.26/.21), lentils (.19/.26), seasoning, 'Maggi' (.21/.24), matjes/salted herring, home prepared (.23/.21), f: eel, cooked (.41), trout, steamed (.39), codfish/haddock, steamed (.36), turtle soup (.36), oat flakes soup (.34), halibut, steamed (.34), capers (.34), flounder, steamed (.32), ox tongue, salted (.31), caraway (.31), egg bouillon (.30), beef, cooked (.30), halibut, fried (.29), carp, steamed (.29), sellery (.29), fish filet, steamed (.28), dill (.28), brain (.27), veal sausage (.26), horse-radish (.26), fennel lettuce (.25), roast beef (.25), dough-covered sausage (.25), chicken broth (.24), lung stew (.24), matjes herring (.24), tongue stew (.24), Bismarck herring (.23), trout, fried or grilled (.23); m: lentil stew (.35), bloater (.32), mugwort (.31), potato-vegetable dish (.30), lentil soup (.30), beef liver (.30), borage (.29), potato soup (.26), green beans (.25), vegetable stew without meat (.24), calf's liver (.23), pork liver (.23)	f/m: oregano (-.20/- .23); m: fried potatoes with cheese (-.30), Italian salad (-.29), pizza with tomatoes + cheese (-.29), potato chips (-.27) popcorn, sweet (-.27), carrots, raw (-.26), barbecue sauce (-.26), curry ketchup (-.26), Greek salad (-.25), hamburger (-.25), French fries (-.24), pizza with salami/ham (-.23), pork cutlet with paprika topping (-.23)

Explanation of abbreviations:

- * AUS, CH, D, GB, USA: Country in which the study was carried out.
- * Ap, CH, f, GP, m, Mp, St: Apprentices, children, females, gen. population, males, military personnel, students.
- * 17-80 Y (corr); (16-17)-(18-19) Y: Calculation of the correlation 'age-preference', age range 17-80 years; comparison of the preferences of the age groups 16-17 and 18-19 years.
- * 178 Pr: Assessment of 178 food preferences.

Table 3: Survey of findings from 10 studies on relationship between age and the number of individual food aversions and dislikes.

study/sample characteristics	decreasing number of aversions/dislikes with increasing age	increasing number of aversions/dislikes with increasing age
1 Garb and Stunkard 1974 USA m,f,Ch,St,Gp, (6-12)-(13-20)-(21-30)-(31-45)-(46-60)-(>60) years	number of food aversions	
2 Babayan et al. 1966 RL+ ET m,f,St,(11)-(16)-(20) years	number of food aversions	
3 Piggott 1979 UK, m,f,Ch, St,Gp, (>15)-(15-30)-(>30-45) years	number of food aversions	
4 Lindgren 1962 USA, m,f, St, (<21)-(>21) years	number of food aversions	
5 Logue et al. 1981 USA, m,f,St		
6 Wallen 1945 USA, m,Mp, median age: 19-27 years	number of food aversions	
7 Abbott et al. 1952 USA, m,Gp, (17-20)-(45-58) years	↑age, ↑width of food acceptance	
8 Eppright 1950 USA, m,f, Gp, (17-19)-(46-58) years	number of food dislikes (f)	number of food dislikes (m)
9 Diehl 1983,1 FRG, m,f, Gp, (17-30)-(31-39)-(40-80) years	number of food dislikes (see figure 3)	
10 Diehl 1983,4 FRG, m, f,Gp, (17-26)-(27-35)-(36-64) years	number of food dislikes (see figure 4)	

Explanation of abbreviations:

* FRG, ET, UK, RL, USA: country in which the study was carried out.

* Ch, f, Gp, m, Mp, St: sample consisted of children, females, general population, males, military personnel, students.

* (17-19)-(46-58): comparison of the numbers of dislikes of the age groups 17-19 and 46-58 years.

Table 4: Survey of the foods and beverages respectively food groups or nutrients whose consumption was related to subjects' age in at least 5 studies. Results from 73 studies with adults. The number of studies in which a positive or negative relationship between age and consumption was observed is pictured next to the food variables.

nutrient/food (group)	decreasing intake/ consumption with increasing age	increasing intake/ consumption with increasing age
energy	22x	1x
protein	13x	0x
fat	8x	2x
carbohydrate	5x	1x
iron	6x	1x
calcium	8x	4x
niacin	8x	0x
vitamin A	6x	1x
thiamin	10x	0x
riboflavin	8x	2x
ascorbic acid	10x	3x
quality of diet	5x	1x
bread	1x	5x
butter	0x	4x
eggs	2x	4x
fish	6x	2x
meat	4x	3x
vegetables	5x	3x
potatoes	5x	2x
fruits	2x	4x
sugar/sweets	7x	4x
alcohol	12x	5x
soft drinks	8x	0x
coffee	0x	5x
milk (products)	14x	3x

Table 5: Items of scale (8) for assessing the preference for 'green salad/vegetable salads (mostly uncooked)'. Example for the calculation of the scale value; (corrected) item-total correlation coefficients of the items.

preference scale (8): green salad/ vegetable salads											
	1	2	3	4	5	6	7	8	A		
bean salad	0	---	0	---	0	---	0	---	0	0	0.65
greek salad	0	---	0	---	0	---	0	---	0	0	0.61
white cabbage salad	0	---	0	---	0	---	0	---	0	0	0.59
lettuce	0	---	0	---	0	---	0	---	0	0	0.56
red radish salad	0	---	0	---	0	---	0	---	0	0	0.55
endive salad	0	---	0	---	0	---	0	---	0	0	0.53
lamb's lettuce	0	---	0	---	0	---	0	---	0	0	0.53
Italian salad	0	---	0	---	0	---	0	---	0	0	0.52
radish (salad)	0	---	0	---	0	---	0	---	0	0	0.51
onion salad	0	---	0	---	0	---	0	---	0	0	0.49
tomato salad	0	---	0	---	0	---	0	---	0	0	0.48
red cabbage salad	0	---	0	---	0	---	0	---	0	0	0.44
beet root	0	---	0	---	0	---	0	---	0	0	0.41
cucumber salad	0	---	0	---	0	---	0	---	0	0	0.38
sauerkraut salad	0	---	0	---	0	---	0	---	0	0	0.37
carrots, raw	0	---	0	---	0	---	0	---	0	0	0.32

Explanation:

1. refuse to eat
2. dislike very much
3. dislike
4. neither like nor dislike

5. like
6. like very much
7. like extremely
8. do not know
- A. item-total correlation

scale value of person X:

$$\frac{\text{sum of item responses of X}}{\text{number of items}} = \frac{4+5+6+4+7+7+6+3+3+6+5+3+6+5+4}{16} = 4.94 =$$

mean item response of person X = indicator of degree of preference for food class 'green salad/vegetable salad'

High scale value: indicator of high degree of preference.

Table 6: Mean age and sample size (N) of the age groups formed in study No. 1 and No. 2.

study 1	age groups						total	
	17-30	N	31-39	N	40-80	N	age	N
female	23.9	75	34.7	57	52.9	52	35.4	184
male	25.5	42	34.9	50	52.9	43	37.7	135
total	24.5	117	34.8	107	52.9	95	36.4	319

study 2	age groups						total	
	17-26	N	27-35	N	36-64	N	age	N
female	21.8	41	29.8	33	50.0	39	35.5	113
male	23.0	33	31.0	31	45.2	32	33.0	96
total	22.4	74	30.4	64	47.3	71	33.3	209

Table 7: Intercorrelations (product-moment coefficients) between the values of the 13 scales of food preference in study No. 2.

	1	2	3	4	5	6	7	8	9	10	11	12	13	
**	0.35	0.37	0.59	0.08	0.24	0.26	0.12	-0.02	0.19	0.09	0.29	0.32	1	
0.35	**	0.47	0.10	0.35	0.04	0.10	0.09	0.29	0.17	-0.04	0.09	0.04	2	
0.37	0.47	**	0.29	0.41	0.02	0.20	0.04	0.13	0.15	-0.02	0.32	0.17	3	
0.59	0.10	0.29	**	0.11	0.37	0.35	0.27	-0.02	0.26	0.18	0.39	0.53	4	
0.08	0.35	0.41	0.11	**	0.09	0.16	0.21	0.33	0.25	-0.02	0.17	0.10	5	
0.24	0.04	0.02	0.37	0.09	**	0.38	0.42	0.33	0.41	0.32	0.24	0.30	6	
0.26	0.10	0.20	0.35	0.16	0.38	**	0.49	0.32	0.39	0.20	0.31	0.24	7	
0.12	0.09	0.04	0.27	0.21	0.42	0.49	**	0.41	0.31	0.15	0.20	0.16	8	
-0.02	0.29	0.13	-0.02	0.33	0.33	0.32	0.41	**	0.37	0.21	0.11	0.01	9	
0.19	0.17	0.15	0.26	0.25	0.41	0.39	0.31	0.37	**	0.13	0.24	0.19	10	
0.09	-0.04	-0.02	0.18	-0.02	0.32	0.20	0.15	0.21	0.13	**	0.15	0.38	11	
0.29	0.09	0.32	0.39	0.17	0.24	0.31	0.20	0.11	0.24	0.15	**	0.32	12	
0.32	-0.04	0.17	0.53	0.10	0.30	0.24	0.16	0.01	0.19	0.38	0.32	**	13	

preference scale:

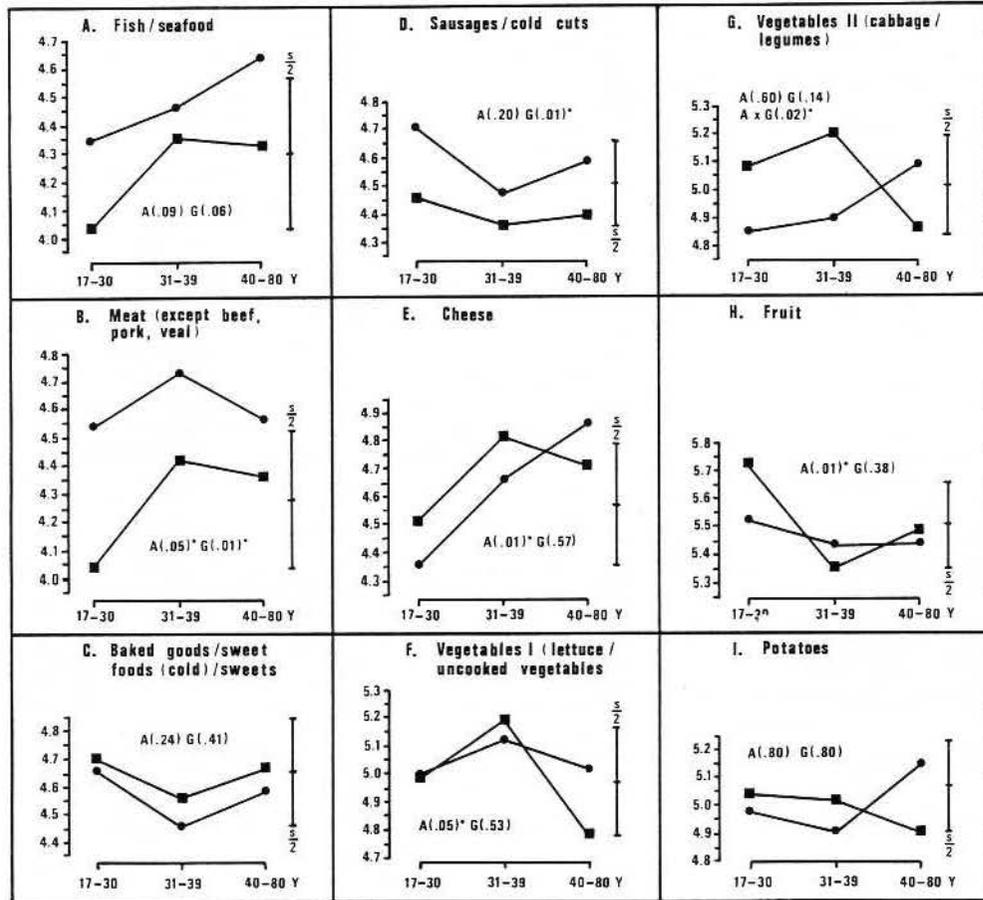
1. familiar meats
2. less familiar meats
3. innards/hearty dishes
4. fast food
5. fish/seafood
6. noodle dishes/pizzas

7. familiar vegetable dishes (cooked)
8. green salad/vegetable salads
9. less familiar vegetable dishes
10. mushrooms/asparagus/ham/egg dishes
11. sweet dishes
12. egg dishes (without ingredients)
13. snacks (mostly salty)

Table 8: Individual items of the 13 scales of food preference constructed in study No. 2. Corrected item-total correlation coefficients and Cronbach alpha coefficients as a measure of the internal consistency of the scales. Item numbers (italics) according to Diehl (1983,2, table 4); w = with.

<p>1 Familiar meats</p> <p>.67 plain escalope of pork, roasted/deep-fried 38</p> <p>.67 grilled chicken 47</p> <p>.63 breaded pork cutlet 36</p> <p>.63 roast chicken 46</p> <p>.62 escalope of veal, plain 15</p> <p>.61 roast pork 33</p> <p>.61 escalope with paprika gravy 40</p> <p>.61 fried chicken 42</p> <p>.60 breaded escalope of pork, roasted/deep-fried 37</p> <p>.58 roast veal 9</p> <p>.57 escalope w cream gravy 23</p> <p>.57 Vienna schnitzel 32</p> <p>.54 roast chicken meat, breaded 48</p> <p>.52 pork filet 34</p> <p>.52 pork cutlet, plain 35</p> <p>.49 rolled slice of veal 14</p> <p>.48 breaded escalope w mushroom gravy 8</p> <p>.48 breast of veal 10</p> <p>.48 roast turkey 50</p> <p>.47 roast turkey meat, breaded 51</p> <p>.45 goulash 4</p> <p>.44 veal fricassee 11</p> <p>.44 roast slices of beef 25</p> <p>.92 Cronbach α</p>	<p>.48 rump steak 30</p> <p>.44 roast w onions 41</p> <p>.43 roast beef 29</p> <p>.42 roast goose 44</p> <p>.41 beef steak 26</p> <p>.39 pepper steak 21</p> <p>.33 sauerbraten 31</p> <p>.96 Cronbach α</p>	<p>.54 hamburger 302</p> <p>.51 cheeseburger 293</p> <p>.49 dough-covered sausage 310</p> <p>.48 breaded ham + fried egg 201</p> <p>.47 cured sparerib of pork 16</p> <p>.47 roast ground beef 83</p> <p>.47 cold cuts salad 190</p> <p>.46 cevapcici 81</p> <p>.46 ham + eggs 194</p> <p>.46 shashlik 307</p> <p>.45 Hungarian goulash soup 270</p> <p>.41 veal sausage 309</p> <p>.39 meat salad w mayonnaise 180</p> <p>.38 meat balls 299</p> <p>.37 instant oxtail soup 266</p> <p>.37 crusted toast 308</p> <p>.36 meat loaf (liver, ham + pork) 90</p> <p>.36 potato salad 185</p> <p>.35 ribs 28</p> <p>.94 Cronbach α</p>	<p>.59 fish filet, crust-ed on top 122</p> <p>.58 herring salad, 'red' 182</p> <p>.58 fish rissoles 297</p> <p>.54 deep-fried fish filet w French fries 301</p> <p>.53 fresh clams, cooked 119</p> <p>.53 deep-fried fish filet w potato salad 300</p> <p>.51 crabmeat salad 186</p> <p>.97 Cronbach α</p>	<p>8 Green salad /- vegetable salads (mostly uncooked)</p> <p>.65 bean salad 178</p> <p>.61 Greek salad 166</p> <p>.59 white cabbage salad 176</p> <p>.56 lettuce 169</p> <p>.55 red radish salad 171</p> <p>.53 endive salad 163</p> <p>.53 lamb's lettuce 164</p> <p>.52 Italian salad 168</p> <p>.51 radish (salad) 172</p> <p>.49 onion salad 177</p> <p>.48 tomato salad 175</p> <p>.44 red cabbage salad 173</p> <p>.41 beet root 151</p> <p>.38 cucumber salad 167</p> <p>.37 sauerkraut (salad) 174</p> <p>.32 carrots, raw 170</p> <p>.86 Cronbach α</p>	<p>ham, bacon, mushrooms) 198</p> <p>.50 stuffed omelette (e.g. ham, bacon, mushrooms) 196</p> <p>.41 black salsify 154</p> <p>.88 Cronbach α</p>
<p>2 Less familiar meats</p> <p>.84 roast venison 57</p> <p>.83 venison goulash 59</p> <p>.83 deer goulash 63</p> <p>.81 roast wild boar 66</p> <p>.81 wild boar filet/steak 67</p> <p>.79 roast partridge 60</p> <p>.79 deer filet/steak 62</p> <p>.79 wild boar goulash 68</p> <p>.78 venison filet/steak 58</p> <p>.75 lamb stew 19</p> <p>.74 roast deer 61</p> <p>.73 roast lamb 17</p> <p>.72 mutton cutlet 8</p> <p>.72 lamb cutlet 18</p> <p>.72 roast pheasant 54</p> <p>.71 mutton stew 7</p> <p>.71 roast hare 65</p> <p>.70 hare goulash 56</p> <p>.69 venison pie 65</p> <p>.66 oxtail stew 20</p> <p>.65 roast mutton 5</p> <p>.57 roast pigeon 52</p> <p>.54 roast turkey 53</p> <p>.52 roast duck 43</p> <p>.52 frog's legs 89</p> <p>.50 edible snails 96</p>	<p>3 Innards / hearty dishes</p> <p>.74 heart stew 71</p> <p>.74 calf's kidneys 74</p> <p>.70 lung stew 75</p> <p>.66 poultry liver 70</p> <p>.66 tongue stew 80</p> <p>.65 calf's liver 73</p> <p>.63 beef tongue, salted 77</p> <p>.63 pork kidneys 79</p> <p>.61 brain 72</p> <p>.58 fried potatoes w blood sausage 203</p> <p>.57 knuckle of pork 39</p> <p>.57 pork liver 78</p> <p>.56 pickled pork knuckles 3</p> <p>.54 beef liver 76</p> <p>.53 knuckle of veal 13</p> <p>.53 cold plate of various meats + sausages 94</p> <p>.49 jellied pork 95</p> <p>.46 giblets 45</p> <p>.46 liver dumpling soup 261</p> <p>.92 Cronbach α</p>	<p>5 Fish / seafood</p> <p>.80 codfish/haddock, grilled 112</p> <p>.76 halibut, fried 108</p> <p>.76 carp, baked 115</p> <p>.76 mackerels 116</p> <p>.76 matjes herring filet 117</p> <p>.75 smoked fish 121</p> <p>.74 trout, fried/grilled 107</p> <p>.74 flounder, steamed 124</p> <p>.73 eel, cooked 98</p> <p>.73 flounder, fried 123</p> <p>.72 halibut, steamed 109</p> <p>.72 carp, steamed 114</p> <p>.71 codfish/haddock, steamed 113</p> <p>.71 matjes/salted herring, home prepared 118</p> <p>.71 herring salad, 'white' 183</p> <p>.70 green herring, fried 110</p> <p>.69 eel, smoked 97</p> <p>.69 trout, steamed 106</p> <p>.68 fish filet, steamed 104</p> <p>.68 smoked eel 120</p> <p>.66 bloater 102</p> <p>.66 fish soup 250</p> <p>.65 Bismarck herring 100</p> <p>.65 cuttlefish, steamed 127</p> <p>.64 sole 125</p> <p>.63 lobster 111</p> <p>.62 fish filet, fried 103</p> <p>.62 fishmac 298</p> <p>.61 herring, fried/grilled 101</p> <p>.60 oysters 99</p> <p>.60 cuttlefish, fried 126</p>	<p>6 Noodle dishes / pizzas</p> <p>.71 lasagna 224</p> <p>.71 noodle souffl�e 226</p> <p>.70 cannelloni 223</p> <p>.66 baked noodles (e.g. w ham, eggs) 227</p> <p>.63 spaghetti w ground-beef-tomato sauce 231</p> <p>.62 noodles 225</p> <p>.62 pizza w tomatoes + cheese 241</p> <p>.58 spaghetti w mushroom sauce 230</p> <p>.58 pizza w salami/ham 240</p> <p>.56 noodle salad 187</p> <p>.55 spaghetti w ham-creme sauce 232</p> <p>.52 ravioli 228</p> <p>.50 spaetzles 229</p> <p>.49 pizza w onions + garlic 242</p> <p>.46 spaghetti w bacon + eggs 233</p> <p>.90 Cronbach α</p>	<p>9 Less familiar vegetable dishes (uncooked)</p> <p>.73 broccoli 132</p> <p>.72 courgettes 161</p> <p>.71 chicory, crusted 135</p> <p>.68 corn, cooked 145</p> <p>.68 corn on the cob, baked/roasted 146</p> <p>.68 fennel lettuce 165</p> <p>.66 chicory, cooked/fried 134</p> <p>.65 eggplants 129</p> <p>.64 fennel, boiled 137</p> <p>.64 corn on the cob, cooked 147</p> <p>.63 leek, crusted 143</p> <p>.60 spring roll 138</p> <p>.60 soybean salad 189</p> <p>.58 artichokes 128</p> <p>.55 chicory salad, raw 102</p> <p>.54 Italian vegetable soup 259</p> <p>.48 leek, cooked 142</p> <p>.93 Cronbach α</p>	<p>11 Sweet dishes</p> <p>.77 baked rice pudding w apples, cherries, etc. 282</p> <p>.73 seminola slices, baked 275</p> <p>.70 cut-up + sugared pancake w raisins 277</p> <p>.67 rice pudding 279</p> <p>.65 seminola pudding, sweet 274</p> <p>.64 apple strudel 271</p> <p>.64 chocolate-fruit fondue 285</p> <p>.63 sweet yeast dumplings w vanilla sauce 272</p> <p>.63 Salzburger nockerln 283</p> <p>.62 omelette w jam, sugar, etc. 273</p> <p>.61 plum dumplings 286</p> <p>.59 porridge 281</p> <p>.56 hot apple pie 276</p> <p>.49 muesli 280</p> <p>.45 corn flakes 316</p> <p>.42 potato fritters w sweet topping 278</p> <p>.92 Cronbach α</p>
<p>4 Fast food</p> <p>.78 grilled sausage w potato salad 291</p> <p>.76 grilled sausage w curry sauce + French fries 296</p> <p>.75 beef sausage w potato salad 305</p> <p>.74 grilled sausage w roll 290</p> <p>.74 beef sausage w French fries 306</p> <p>.70 grilled sausage w curry sauce + roll 294</p> <p>.69 thick frankfurter w roll 287</p> <p>.69 thick frankfurter w French fries 289</p> <p>.68 thick frankfurter w potato salad 288</p> <p>.66 grilled sausage w curry sauce + potato salad 295</p> <p>.65 grilled sausage w French fries 292</p> <p>.64 beef sausage w roll 304</p> <p>.60 hot dog 303</p> <p>.56 French fries 219</p>	<p>7 Familiar vegetable dishes (cooked)</p> <p>.72 lentil stew 262</p> <p>.68 lentils 144</p> <p>.67 lentil soup 263</p> <p>.66 pea stew 248</p> <p>.65 bean stew 243</p> <p>.63 savoy cabbage 160</p> <p>.61 pea soup 249</p> <p>.57 vegetable stew w meat 253</p> <p>.55 stuffed cabbage 84</p> <p>.55 Brussels sprouts 150</p> <p>.53 cauliflower, crusted 131</p> <p>.53 vegetable stew without meat 254</p> <p>.52 cauliflower 130</p> <p>.50 green beans 139</p> <p>.50 white cabbage, cooked 159</p> <p>.47 borecole 140</p> <p>.44 peas 136</p> <p>.43 potato soup 260</p> <p>.42 kohlrabi 141</p> <p>.41 spinach 157</p> <p>.41 bean soup 244</p> <p>.91 Cronbach α</p>	<p>8 Mushroom / asparagus / ham / egg dishes with ingredients</p> <p>.69 cooked ham w asparagus 92</p> <p>.68 asparagus 156</p> <p>.63 mushrooms 133</p> <p>.62 chanterelles 149</p> <p>.60 raw ham w asparagus 93</p> <p>.60 flat mushrooms 158</p> <p>.59 cream-of-mushrooms soup 246</p> <p>.59 asparagus-cream soup 268</p> <p>.54 fried eggs w ingredients (e.g. ham, bacon, mushrooms) 200</p> <p>.52 scrambled eggs w ingredients (e.g.</p>	<p>10 Mushroom / asparagus / ham / egg dishes with ingredients</p> <p>.69 cooked ham w asparagus 92</p> <p>.68 asparagus 156</p> <p>.63 mushrooms 133</p> <p>.62 chanterelles 149</p> <p>.60 raw ham w asparagus 93</p> <p>.60 flat mushrooms 158</p> <p>.59 cream-of-mushrooms soup 246</p> <p>.59 asparagus-cream soup 268</p> <p>.54 fried eggs w ingredients (e.g. ham, bacon, mushrooms) 200</p> <p>.52 scrambled eggs w ingredients (e.g.</p>	<p>12 Egg dishes (mostly without ingredients)</p> <p>.65 fried eggs, plain 199</p> <p>.55 scrambled eggs, plain 197</p> <p>.50 egg salad 179</p> <p>.45 omelette, plain 195</p> <p>.45 proached eggs 202</p> <p>.36 egg bouillon 251</p> <p>.33 egg, soft-boiled 192</p> <p>.31 egg, hard-boiled 191</p> <p>.75 Cronbach α</p> <p>13 Snacks (mostly salty)</p> <p>.67 peanut flips 317</p> <p>.66 peanuts, salted 318</p> <p>.66 potato chips 321</p> <p>.62 pretzels 322</p> <p>.62 crackers, fish-shaped 323</p> <p>.60 salt sticks 329</p> <p>.56 peanuts, unsalted 319</p> <p>.56 crackers 324</p> <p>.54 potato chips, paprika flavored 325</p> <p>.53 hazelnuts 320</p> <p>.51 walnuts 330</p> <p>.46 popcorn, salted 326</p> <p>.89 Cronbach α</p>	

Figure 1: Age and sex relations of the preferences for the 9 food groups in study No. 1. Graphic presentation of the mean preferences in the three age groups of males (m) and females (f). Results of the analysis of variance of the main and interaction effects of age and sex.



Explanations:

- * A(0.09): degree of 'significance' of the age effect (p-value).
- * G(0.01): degree of 'significance' of the sex effect (p-value).
- * AxG(0.02): degree of 'significance' of the interaction effect between age and sex (p-value). With the exception of scale G in figure 1 none of the p-values fell below 0.12; for this reason, the p-values for the interaction effects are not cited in detail in figures 1-4.
- * Asterisk (*) indicates: statistically significant at the 5% level ($p \leq 0.05$).
- * P: mean preference; range of the scale values: 1-7.
- * s/2; s/4: graphic presentation of 1/2 resp. 1/4 of the mean standard deviation within the 6 age by sex groups (for easier evaluation of the sizes of the effects).

Figure 2: Age and sex relations of the preferences for the 13 food groups in study No. 2. Graphic presentation of the mean preferences in the three age groups of males (m) and females (f). The results of the analysis of variance of the mean and interaction effects of age and sex. For explanations, see figure 1.

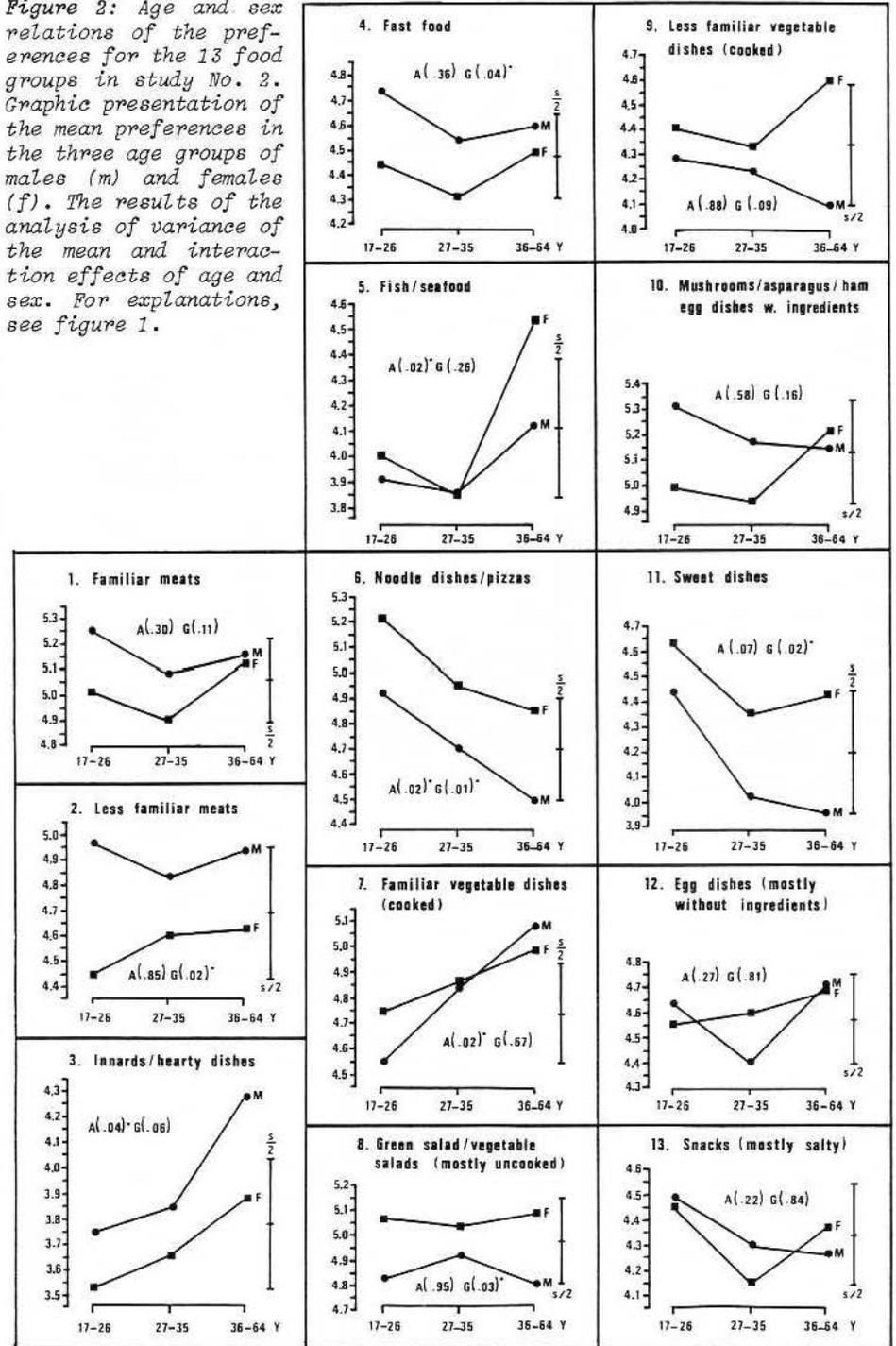
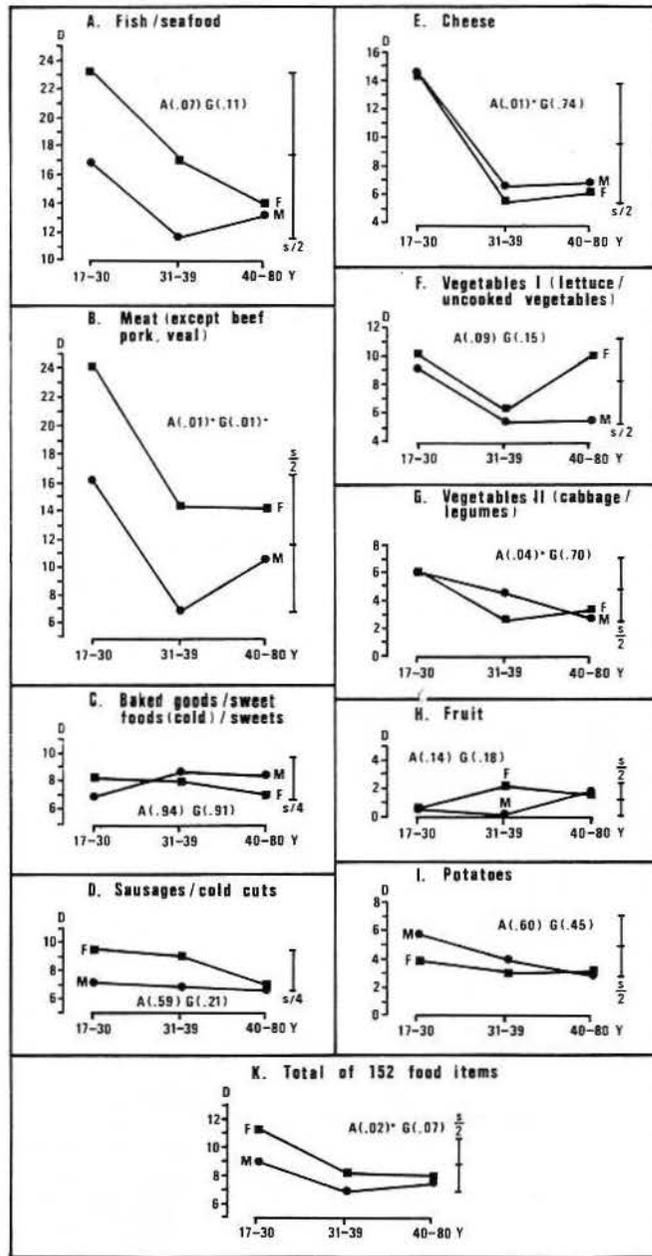


Figure 3: Age and sex relations of the number of individual food dislikes in the 10 food groups in study No. 1. Graphic presentation of the mean number of dislikes in the three age groups of males (m) and females (f). Results of the analysis of variance of the mean and interaction effects of age and sex.



Explanation:
* D: the mean percentage of scale items for which a dislike was expressed.
* for further explanations refer to the footnote to figure 1.

Figure 4: Age and sex relations of the number of individual food dislikes in the 14 food groups in study No. 2. Presentation of the mean number of dislikes in the three age groups of males (m) and females (f). Results of the analysis of variance of the mean and interaction effects of age and sex. For explanations, see figure 3.

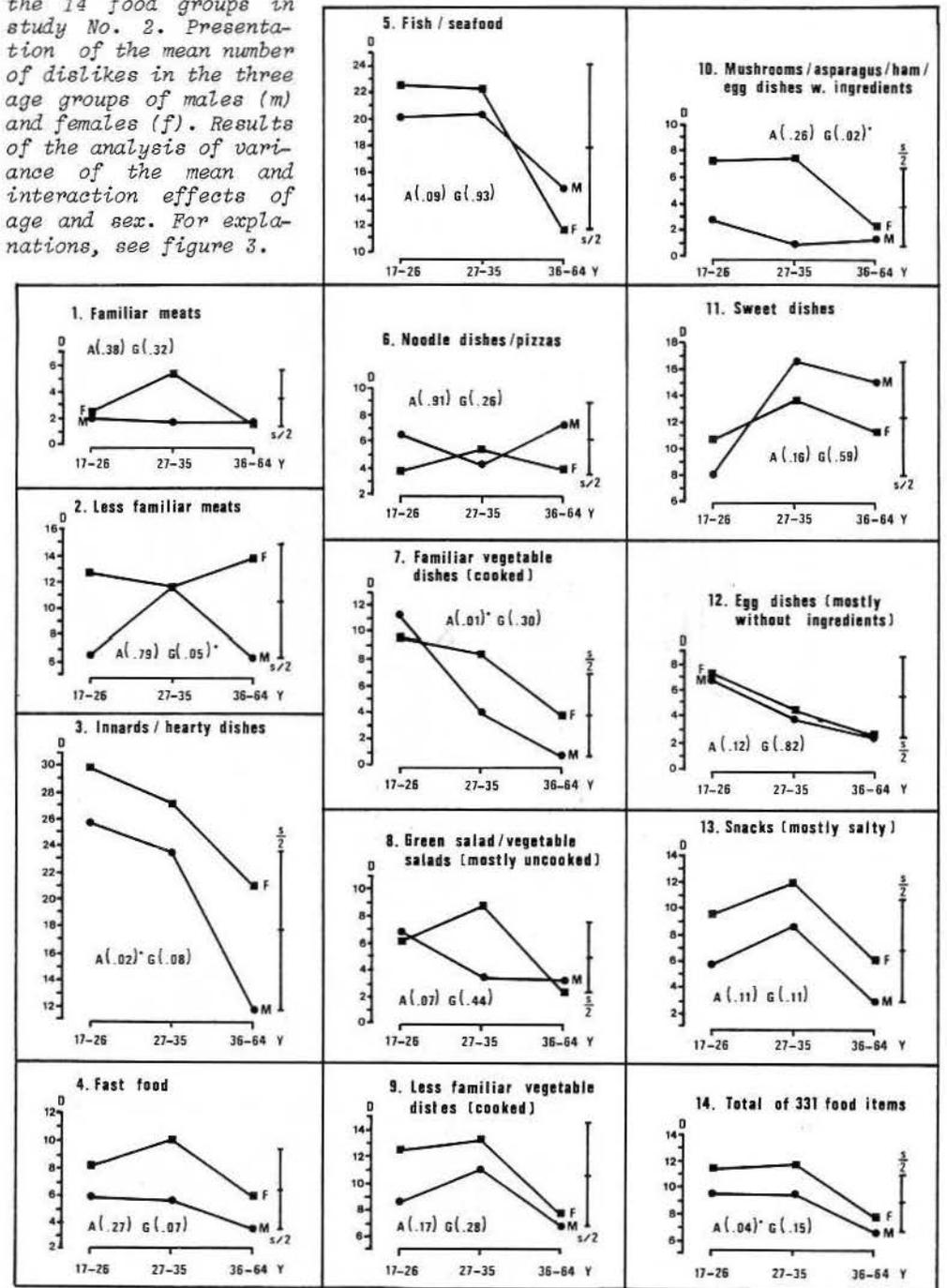


Figure 5: Plan for a longitudinal study in order to analyse the stability and the change in food preferences and habits in adolescence and early adulthood.

