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Perspectives in Nutrition

It is hoped that Perspectives in Nutrition will review the literature selectively, interpret it moderately and present a spectrum of ideas that will serve as a continual stimulation to nutritional research applied to medical problems.

The Application of Social Science Research Methods to the Study of Food Habits and Food Consumption in an Industrializing Area[1,2]

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IN COMPARISON with clinical and biochemical surveys, a satisfactory quantitative food consumption survey in developing countries is neither quick, easy, nor inexpensive. Highly trained persons are needed who speak the local language, are trustworthy and able to deal with housewives and others to elicit accurate and valid information; local personnel are preferred. The survey usually will need to be repeated two or three times during the year, in order to investigate seasonal variations in food supply and food consumption. To cover day to day variations, each family should be surveyed over a sufficiently long period, preferably 1 week. Careful planning of the sample is important since usually it is possible to survey only a small proportion of the population; the assistance of a statistician is generally desirable. Where funds are limited and specialized interviewers not available, it cannot be expected that local workers conduct a quantitative food consumption survey themselves.

There is a need, therefore, for simple methods which will provide information on food consumption but which will be less expensive and require less highly trained personnel than the classical food consumption surveys. Such methods are especially needed in areas undergoing rapid social change due to industrialization and urbanization, since they would allow repeated surveys to note the changing habits of the population.

For many years, social scientists have used questionnaires to gather social and economic data. Often questions about foods have been asked, but the responses (the food reports) are not usually analyzed and published. Such questionnaires, of course, do not supply quantitative data, but rather "frequencies," e.g., the frequency with which foods, or food preparations, are consumed by a family during a day or a week.

It has been shown that such "frequency-studies" can supply useful information. A study of pregnant women in Jerusalem (1) showed that the amounts of foods con-

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sumed by these women correlated very well with the frequency with which these foods were eaten. This survey was a recall-type survey; the frequency reports also correlated with the hemoglobin levels of the women. A similar method has been used in England to study diet and heart disease (2). Food-frequency scores from the menu records correlated highly with the weights of the foods consumed, for example, milk, meat, "cakes," and "sweet biscuits."

In a somewhat different survey, part of a cross-cultural study in a rural area of New York State (3), the food reports (recall-type survey) from different population groups formed a Guttman scale, whose levels were the "seven basic" food groups (4, 5) in the following order:

1. Bread, flour, and cereals
2. Meat, poultry, fish, and eggs
3. Potatoes, other fruits, and vegetables
4. Butter and fortified margarine
5. Milk and milk products
6. Citrus fruits and tomatoes
7. Green and yellow vegetables

The lowest level of the scale included the first three groups; therefore, the scale consisted of five steps.

To test the feasibility of the questionnaire method of obtaining data on food consumption, we made use of data which were gathered in 1958 by Young and Young as part of a sociological field study. Their study was concerned with the relation of urbanization and industrialization to structural changes in small, mainly peasant, communities (6).

The area chosen was a 10-mile radius circle surrounding Ciudad Sahagun (Hidalgo, Mexico), a 5-year-old "planned" industrial city, operated by a government-owned company and containing a number of factories. The factories were moved in by the government as part of an effort to industrialize this area and, thereby, to raise the standard of living of the population. The area included 24 villages, and 4 of these were chosen for a detailed household survey.

The sample represented one-half of the families in each of the four villages, or about 150 families in each of two larger villages, and about 50 and 25 families in the two smaller villages. Thus, data on food were available for 377 families. Since the sample was so large, representing approximately 50% of the families, relatively small differences may be significant.

The Youngs used two lengthy questionnaires, one for the male head of the family and one for the housewife. The questions covered a wide range of information on items such as education, occupation, occupational history, type of house, etc. This paper is concerned with that part of the questionnaires which related to food habits and food consumption. The hypothesis tested is that in the process of industrialization or urbanization, food habits or food patterns change progressively, becoming increasingly more complex or varied, and that such changes are related to other similar changes (e.g., simple to complex) in the social and economic milieu.

METHODOLOGY

All information from the questionnaires was transferred to standard cards for use with data-processing equipment. When all the responses had been punched into the cards, further reference to the questionnaires was unnecessary. The data used and the methods of analysis are described below.

Data

Food variables. Each food on the list (see APPENDIX) was assigned a column, and each family's responses were punched on its card, according to the following code used for the food listed:

0 = none
1 = breakfast only
2 = noon only
3 = evening only
4 = breakfast and noon
5 = breakfast and evening

6 = noon and evening
7 = all meals

Subsequently, to get data relating to the number of meals, it was simple to use groups 0, 1–3, 4–6, and 7 for no, one, two, and three meals, respectively.

Food frequencies were determined by counting the number of times in a day each food was mentioned and adding up all frequencies of all foods in the food groups. "Fruit" was defined as all foods listed in the category, "Frutas," on the food page of the questionnaire (see APPENDIX). There may be some doubt as to whether "plátano" (bananas) should be grouped with fruits; in many areas of Latin America and elsewhere, plátano is sometimes used as a distinct food, much as the potato is classified separately in some countries. Local concepts about food classes were not exactly known, and therefore, we treated plátano separately.

Similarly vegetables counted were those listed under "verduras," including potatoes, in APPENDIX. It appeared, however, that this group was too heterogeneous in connection with its relative importance and place in the local diet. Consequently, in our final analysis we divided this group: *1*) verduras (leafy vegetables, tomatoes, carrots), *2*) squash, *3*) condiments, and *4*) potatoes; because of the relative unimportance of the *subgroups 2* and *4* (not often eaten, at least during the survey period), these were discarded. "Condiments" refers to the hot peppers, tomato paste, onions, and garlic typically used in Mexico to enhance the flavor of the diet.

As an indicator of variety in the meals, the number of foods mentioned as having been consumed in each of the three meals was counted for each family.

Social variables. These had been analyzed previously by the Youngs and the results were available to use in coded form.

Woman's education and man's education referred to the number of years in school.

"Occupation" was that of the male head of the house.

"Occupational history" classified each male household head by present and past occupations. The term "obrero" means wage earner without reference to special skills or wage differentials (8). The most numerous types of occupation found in the area were career farmers, transitional farmers (i.e., those who had been obreros before), transitional obreros (i.e., those who had been farmers before), and career obreros. In the survey area these types of occupation were found to identify a transition from rural to urban, or to relate to urbanization and modernization (7). The shopkeeper, the only other group large enough to be studied, seems to take an intermediate place in the local urbanization process between the career farmer and career obrero. This typology also appeared to correlate well with a man's level of education, his preference for nonfarm work and city life, his participation in local organizations, and his aspirations for his sons in terms of occupation, residence, and education.

Housing differences in "cash and kind" incomes were difficult to measure in these apparently homogeneous villages. The type of house was, therefore, used as a general index of level of living (or a nonmonetary standard of living). "Housetype" classifies houses by their floors, wall construction and windows. As is true generally of typologies, the contrast between the two extremes is clearer than it is between the intermediates; it is certainly difficult to judge whether a house with adobe walls, improved floors, and no windows is higher on the scale than one with improved walls, earth floor, and no windows. The main reason for using this variable was that it does discriminate between family types when compared with other variables.

Methods of Analysis

The Guttman scale.[3] The food replies were

[3] The essential feature of the Guttman scale is that it provides a measure of the cumulative, unidimensional pattern of development of a characteristic of a given population. *Step 1* of the scale may be regarded as the initial phase of development. No other single step of the scale can exist unless all preceding steps coexist. Thus, an item cannot fall into *step 4* unless the pattern of development already includes *steps 1, 2,* and *3*. The mathematical model corresponding to the Guttman technique is represented by a scalogram. Scalable items have both of the following characteristics: *1*) their presence indicates a greater degree of complexity than their absence and *2*) once developed they tend to be retained, if not indefinitely, at least over long periods of time. The scaling method assumes that seriation can be accounted for by change in one direction. Hence, if a body of data proves to be

treated as dichotomies. The items were arranged according to frequencies of positive responses of all families. Menzel's coefficient of scalability (9) was used. Detailed procedure may be found in references 4 and 10. The application of the Guttman technique to "objects" rather than to "attitudes" is discussed in reference 3.

Two-variable comparisons. All the 377 families investigated were sorted into groups, according to the responses to one variable. Then these groups were considered in relation to the responses to another variable. Results were recorded in percentages. The variables used were education, occupational history, housing, frequencies of foods and of food combinations.

Rank correlation. Correlations were calculated according to Kendall's rank correlation coefficient (tau) (11). For this purpose we used the "Ranko" program at the Cornell University Computing Center. To test the significance of the results, the *Z*-score was calculated (11).

RESULTS

The Food Scale was found to form a Guttman scale of six items having a coefficient of scalability of 0.77. A scale is usually considered to be acceptable when the coefficient of scalability is at least 0.65 (9).

Table I shows the different steps of the scale, and the percentages of the sample which gave a positive response at each step. If one substitutes "plátano" for "frutas," including plátano (see APPENDIX), one gets a scale with a coefficient of scalability of 0.74.

Neither the vegetable group, called verduras in APPENDIX, nor any single or combined items of this group fitted in the scale pattern. This problem will be discussed later.

The fact that the food data could be arranged in a Guttman scale suggests that there is some underlying cause for this, which might be discovered by comparing the scale with some other variables. Our argument is that since a Guttman scale represents a unidimensional and cumulative change, in this instance from simple to more complex diets, other similar (e.g., simple to complex) factors should show similar trends and the scale steps would then reflect increasing urbanization. If the food reports, as presented in the scale, reflect concepts about diet held by different social groups, these social groups would be expected to differ in other respects too.

TABLE I

Guttman Scale Derived from Food Reports

Step Number	Item	Percent of Sample
1	Tortilla (corn flat bread, staple cereal)	100
2	Frijol (black beans, eaten cooked and mashed)	95
3	Meat, fish, chicken or eggs (nondairy animal food)	77
4	Wheat bread (prepared product, secondary cereal)	61
5	Dairy food (milk, cheese, or coffee with milk)	37
6	Plátano (plantain)	20

Number of families = 377.
Coefficient of scalability = 0.77.

The Food Scale and Diet Complexity

Diet complexity may be indicated by meal variety and food-group frequencies. Table II shows the rank correlations between the food scale and these two variables. In this analysis Kendall's tau is significant as extreme as ± 0.14 at the 0.0005 probability level; at least ± 0.10 at the 0.01 probability level; and at least ± 0.07 at the 0.05 probability level.

It will be noted that meal variety correlates significantly with the food scale. In particular, the main meal (at noon) and to a lesser extent, breakfast, are positively related. In contrast, the negative correlation between the evening meals and the food scale may indicate that this meal is a different type of meal in these villages.

scalable, this property must be ascribed to change in time or space and one or other of the possibilities must therefore be eliminated.

TABLE II

Rank Correlations Between Food Scale and Indicators of Dietary Complexity[a]

Indicator	Correlation with Food Scale (Kendall's tau)
Noon variety	0.48
Breakfast variety	0.15
Evening variety	−0.09
Fruit frequency	0.51
Meat, fish, chicken, eggs, frequency	0.47
Vegetable frequency	0.02

[a] Dietary complexity as indicated by meal variety and food-group frequencies.

Some families reported no evening meal; others described the menu as "Lo que sobra de la comida," leftovers from noon. Perhaps at higher scale levels enough is eaten at the other two meals to satisfy the day's hunger.

Food-group frequencies further validate a complexity interpretation which, however, may not extend across all foods. Fruit frequency correlated more highly with the food scale than did the other food-group frequencies; the correlation of the scale with the frequency of meat, fish, chicken, and eggs was nearly as high. The failure of vegetable frequency to correlate is not surprising, in view of the inability of this food group to fit into the scale.

The food scale seems to reflect increasing complexity of food habits. At lower levels the food pattern includes relatively few foods. At higher levels, there are more food groups mentioned, more servings of foods within several groups, and more items in the menus of two meals.

The Food Scale and Social Position

If the food scale represents a continuum of complexity of dietary patterns in general, and if it reflects, inter alia, a social consensus of what a given family in a given social position in its village should be eating, then other indices of social position would be expected to correspond to the food scale; occupation might be one of these.

Table III shows the food scale levels of major occupation groups. Most of the farmers are in the low and medium levels of the food scale. Obreros are concentrated in the medium and high levels and shopkeepers in the high levels. The farmer is certainly the least urban of the three groups. The other two groups are more difficult to place. The shopkeepers may not be as "urban" as obreros, but the obreros originally from these villages may not yet have been sufficiently exposed to urban ways to have become fully urbanized. However, the results clearly indicate that the two urban occupations have a greater tendency to fall in the higher food scale levels than does the farmer.

Table IV shows the correlations of the food scale with other social variables, namely the education of the household heads, occupational history, and house typology.

The table indicates that educational backgrounds of the two household heads correlated with the food scale. Since education will influence the degree to which a person is exposed to ideas beyond his immediate environment, these correlations

TABLE III

Food Scale Levels of Major Occupation Groups

Scale Level	Occupation of Male Household Head		
	% Farmer	% Obrero	% Shopkeeper
1	7	3	7
2	25	12	3
3	21	18	0
4	25	28	17
5	14	14	17
6	9	25	59
Number of cases	165	98	30

TABLE IV
Correlations of Social Variables With the Food Scale

	Correlation (Kendall's tau)
Woman's education (years of school)	0.34
Man's education (years of school)	0.29
Occupational history (typology of occupational experience)	0.31
House type (standard of living)	0.25

indicate that the food scale may also be reflecting exposure to various aspects of a broader perspective.

The house-type variable, as an indicator of the standard of living, and maybe also of economic level, correlates less highly although still significantly, with the food scale. This may be partly due to the problem with any typology, of placing in rank order the middle categories, as already mentioned.

Occupational history also correlates with the food scale. Since occupational history is a strong index of urbanization, as shown by the Youngs (7), this correlation indicates forcefully that the food pattern of a family is very much a part of its total way of life.

Thus, it would seem that the more the family head is exposed to an urban way of life, as measured by different indicators, the more complex is the kind of diet his wife (daughter, or mother) reports. This correlation supports what nutritionists have learned in practice, namely, that food habits are part of, and tied to, the entire network of attitudes.

Vegetables—Special Problem

As already mentioned, the group of vegetables ("verduras" in APPENDIX) is a very heterogeneous group of foods having different places and functions in the diets, such as the leafy vegetables, the condiments, squashes, and potatoes. The total group did not prove scalable, neither did any of the four subgroups. Because of the nutritional significance of some members of the group (i.e., as sources of provitamin A, vitamin C, and riboflavin), it seemed important to analyze this problem further. Because of the low frequencies of squashes and potatoes (either because they were not in season at the time of the survey, or for other reasons were not available or consumed) we left these out of our consideration.

Tables v and vi indicate the consumption of verduras (leafy vegetables, tomatoes, carrots) and of condiments at different scale levels.

Table v shows an increasing frequency of verduras at the higher food-scale levels.

TABLE V
Families' Reports of Frequency of Verduras[a] at Different Scale Levels

Frequency of Verduras	% of Families Reporting at Scale Level		
	Low 1 and 2	Medium 3 and 4	High 5 and 6
0	72	61	46
1–3	26	37	50
4–6	2	2	4
Number of families	88	151	138

[a] Leafy vegetables, tomatoes, carrots.

TABLE VI
Families' Reports of Frequency of Condiments[a] at Different Scale Levels

Frequency of Condiments	% of Families Reporting at Scale Level		
	Low 1 and 2	Medium 3 and 4	High 5 and 6
0	16	20	36
1 or 2	52	47	36
3 or 4	23	24	25
5 or more	9	8	4
Number of families	88	151	138

[a] Onions, garlic, tomato paste, peppers.

This is similar to the frequencies of animal products (meat, fish, poultry, and eggs) and of fruit as implied in Table I. This then may be an additional component of the increasing complexity of food choices attributed to the food scale.

Table VI shows that the proportion of families who report no condiments increases with the scale level. This might be in agreement with experience elsewhere, namely that the poorer families use seasonings to make their monotonous diet more tasty, while the increased variety of tasty foods available to the higher economic levels makes such seasonings less important. These contrasting tendencies may explain the failure of the original vegetable grouping to scale; since one component is increasing while the other is decreasing, there would be no net change at the different scale levels.

The Ranko program calculated Kendall's rank correlation coefficients (tau) for the food scale and several variables, including the two variables, frequency of verduras and frequency of condiments. Some of these are presented in Table VII; see also Tables II and IV.

The verduras correlated well with the food scale, thus confirming the conclusions from Table V. This group seems to be included in the increasing complexity of food patterns at higher scale levels.

The condiments group did not correlate significantly with the food scale. This contradicts the results of Table VI, which had indicated that there would be a negative correlation here. Since condiments are generally flavoring agents, used in relatively small amounts, added during cooking or mixed with food on eating, it is quite possible that many persons do not think of them in the same way as they would think of meat, or a distinct serving of peas or carrots. They might not mention condiments when being asked what foods (alimentos) they ate. We should find out if this is really a distinction in these Mexican villages. Certainly in the United States, many people would not include mustard, catsup, and onion when mentioning that they had eaten a hamburger.

TABLE VII

Rank Correlations Between Food Scale and Some Indicators of Dietary Complexity

	Kendall's tau
Fruit frequency	0.51
Meat, fish, chicken, eggs, frequency	0.47
Vegetable (over-all), frequency	0.02
Verduras[a] frequency	0.25
Condiments[b] frequency	−0.01

[a] Leafy vegetables, tomatoes, carrots.
[b] Onion, garlic, tomato paste, peppers.

SUMMARY AND CONCLUSIONS

Social scientists have long used a questionnaire method to gather social and economic data. To test the usefulness of such a method in obtaining information on food habits, the replies to questionnaires used in a sociological survey in an industrializing rural area in Mexico were analyzed. The data pertained to 377 families, representing 50% of the families in the four villages studied. Selected social science research methods were used in the analysis.

It was found that the food patterns fitted into a Guttman scale, indicating the sequence of changes in food patterns and a trend toward increasing complexity of diets. The scale correlated with other indices of growing urbanization, in particular, education and occupational history. The findings support the hypothesis that, in the process of industrialization or urbanization, food habits or food patterns change progressively, becoming increasingly more complex and varied, and that such changes are related to other similar changes (e.g., simple to complex) in the social and economic milieu.

With an improved questionnaire, and more general background information (e.g., annual cycle of crops, marketing, and other factors which might influence the

availability of foods, and local classification of foods) more conclusive results could have been obtained. In addition, data on health and nutritional status should be available from clinical and biochemical studies.

Where it is not essential to have quantitative information on food consumption, the questionnaire method would seem to have two special advantages over the traditional type of food consumption survey: it does not require highly trained interviewers and a much larger sample can be covered. The method permits a study of the changes in food habits which take place under the impact of such major forces of change as industrialization and urbanization. Such information is important for the nutrition educator, food planner, etc. Further research is needed to verify our results and to test the validity of this method elsewhere. It is hoped, however, that this preliminary study will have heuristic value.

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(See page 64 for APPENDIX)

APPENDIX

Foodlist Used in the Survey

Qué alimentos comieron ustedes ayer para

	Almorzar o Desayunar	Comida	Canar o Merendar	Otras
Café negro				
Café con leche				
Leche				
Chocolate				
Atole				
Pulque				
Agua de limón				
Te				
Refresco				
Agua				
Pan de trigo				
Tortillas				
Avena				
Arroz				
Pasta				
Papas				
Sopa seca (otro)				
Sopa aguada				
Carne				
Pescado				
Pollo				
Pato				
Huevos				
Frijoles				
Queso				
Frutas				
Melones				
Sandia				
Naranja				
Limones				
Mangos				
Ciruelas				
Platanos				
Papaya				
Zapote				
Verduras				
Salsa (tomate, chile)				
Jitomate				
Cebolla				
Chile				
Calabaza				
Espinaca				
Ejotes				
Chícharos				
Lechuga				
Col				
Zanahoria				
Dulces				