Food Habits and Nutrient Density of Diets of Pakistani Children Living in Different Urban and Rural Settings

Rubina Hakeem¹, Jane Thomas², and Salma H. Badruddin³

¹Department of Food and Nutrition, Raana Liaqat Ali Khan Government College of Home Economics, Stadium Road, Karachi 74800, Pakistan, ²Department of Nutrition and Dietetics, Kings College, London, UK, and ³Department of Medicine/Community Health Sciences, Aga Khan University, Stadium Road, Karachi 74800, Pakistan

ABSTRACT

Food habits and nutrient density of diets of six groups of rural and urban school children aged 10-12 years were compared. Data were collected from three-day food records. In the UK, data were collected during October–November 1994 and in Pakistan during April-May 1995. Based on the apparent level of urbanism, the six groups were arbitrarily assigned urbanization rank 1-6. Patterns of their food and intake of nutrients were different from each other in various aspects and were not always associated with the apparent level of urbanism of the group. With urbanization, the intake of fat and sugar increased steadily. The intake of carbohydrate, fibre, riboflavin, and vitamin E decreased with urbanization. The intake of vitamin C, vitamin B₁₂, and folates was higher among group 4, 5, and 6 than other groups. Due to various factors, in terms of micronutrient density, diets of various urban groups could have more differences than similarities. While these differences point toward the need for comprehensive nutrition education and community nutrition surveys, they also indicate the possibility of having healthy diets in urban settings.

Key words: Diet; Child nutrition; Food habits; Pakistan

INTRODUCTION

Urbanization, an inevitable outcome of economic development, refers to the transition from a rural society to one in which a growing proportion of the population live in cities. The positive relationship between higher levels of economic welfare and urbanization is a strong one, consistently confirmed by various studies. Dietary patterns are often affected by urbanization status and are associated with rural-urban differences in health and nutritional status (1-4). However, the trends are not always uniform. While there are reports of intake of higher energy, fat, and micronutrients by rural populations (5,6), the typical trend is that of increase in lipid and calorie intake and decreased intake of micronutrients with urbanization (6-10). The rural-urban differences in the intake of micronutrients could be more varied in various parts of the world.

These discrepancies are understandable if we view urbanization as a linear phenomenon. Administrative demarcations do not segregate the population in two homogeneous groups. Within each official category, the differences in affluence and/or lifestyle may make certain groups more urbanized than others. Furthermore, other factors, such as affluence and cultural background, may also intervene to check or promote the adoption of certain components of urbanized lifestyle. Thus, dietary intake of various urban and rural groups may vary, and vulnerability for malnutrition may not be linearly associated with urbanization. To identify specific dietary inadequacies within any group, understanding of differences in various urban and rural groups is important.
This study was undertaken to assess the differences in food habits of various urban and rural groups aimed at exploring any relationships between apparent level of urbanization of the sociodemographic group to which children belonged and nutrient density of their diets.

MATERIALS AND METHODS

Study subjects

To study the association between urbanization and food habits, frequency of food consumption and nutrient density of the diets of six groups of school children, aged 10-12 years, representing various urbanization categories, were compared. This particular age group was selected for two reasons: first, because of the importance of this stage in terms of dietary transitions—from dependence on parents to individualization of food choices, and second, because of their expected ability to record their dietary intake.

To assess various genetically similar groups of South Asian children having differing lifestyles, five groups of South Asian children having familial origins in a similar geographical area (Punjab) were recruited from Pakistan and the UK. The first group consisted of children from an officially-designated rural area of Punjab. The second and third groups were recruited from a large metropolis of Punjab. The less-affluent group, due to lack of fiscal resources, was estimated to have a less-urbanized lifestyle than the more affluent one. The fourth and fifth groups of children recruited from Slough, UK, indicate a further higher level of urbanization because of being born and brought up in a more developed country. Since more than 90% of the British Indian children were non-vegetarian Sikhs and since the families of both British Pakistani and British Indian children originated from the Pakistani and Indian provinces of Punjab, the differences in religion were not expected to confound the results. However, the British Indian children were considered to be more urbanized than the British Pakistani children because of a longer period of stay of their parents in the UK. The mean length of stay of mothers of the former group was 17 years and that of the later group was 20 years, and the difference was statistically significant at p<0.05 level.

Assessment of acculturation of dietary habits and extent of exposure to western culture according to a test previously used by Kassam-Khamis (11) also showed that British Indian children were relatively more exposed to western culture and were consuming western food more often than British Pakistani children. Relative ranking of Indians and Pakistanis living in Slough, UK, in terms of urbanism, was considered acceptable (12).

A sixth group of children consisted of British Caucasian children, living in the UK, served as control and represented the highest level of urbanized lifestyle.

Data were collected in the UK during October-November 1994 and from Pakistan during April-May 1995.

Assignment of urbanization rank was arbitrary and indicates 'apparent' or expected level of 'urbanism.' The factors that were associated with urbanization were used for categorizing the subjects in urbanization groups. Extent of industrialization of the study area and length of stay of families of the subjects in urban locality were the criteria used for assigning urbanization ranks. Based on the above-mentioned characteristics, children were assigned arbitrary urbanization ranks. Three groups of children who were recruited from Punjab were: rural Pakistani (RrP), middle-income urban Pakistani (MUP), and high-income urban Pakistani (HUP). These groups were assigned urbanization rank (UR) 1, 2, and 3 respectively. The three groups recruited from Slough, UK, were: British Pakistani (BrP), British Indian (BrI), and British Caucasian (BrC). These groups were assigned urbanization rank 4, 5, and 6 respectively.

Recruitment of schools was purposive. Representation of particular demographic status was the basic selection criterion. In the UK, Slough, a city adjacent to London, was selected for the study because of a high concentration of South Asians. Of seven middle schools in Slough, three schools that were willing to participate concurrently were recruited. In Pakistan, the subjects were recruited from Lahore and one rural school from Kala-Shah-Kaku were recruited to represent middle-income and high-income urban and rural groups respectively. Initially, the principals of several schools fulfilling the criterion of selection were contacted, and the ones willing to participate concurrently were recruited. Information on rural or urban status of the area and on general financial status of students of particular schools was obtained from the association of private schools (Punjab). All 10-12-year old students studying in Class 6 and 7 within each school were invited to take part in the study. Seventy-six to 94%
Food habits and nutrient density of diets of Pakistani children

of eligible children from various schools participated in the study.

Collection and treatment of data

Crawford et al. compared three-day food records, five-day food frequency method, and 24-hour recall with unobtrusive observation by trained nutritionists at school lunch time and concluded that the three-day food record was the best overall choice for assessing food intake. The three-day food records had a lower proportion of missing and phantom foods and the lowest level of quantification errors compared to other methods (13).

In this study, for the purpose of getting more precise information on food intake which could be used for assessing nutrient intake and for describing eating patterns, three-day food records were obtained. A food frequency checklist, developed by the University of Exeter for British children (14), was also included in the questionnaire to give more general information on patterns of food intake. Since the results from the two sources provided similar results in terms of assessing inter-group differences, the records kept by children were considered valid.

The diary

One diary was given to each eligible child. The diary had sections on food record and activity record (results being published elsewhere). At the beginning of each section, brief instructions on how to keep records were given. The records were to be kept for two week days (Thursday and Friday in the UK and Wednesday and Thursday in Pakistan) and one weekend day (either Saturday or Sunday in the UK and Friday in Pakistan). (In Pakistan, children have only one weekly holiday on Friday in both urban and rural study areas). In the UK, half of the children kept records for Sunday and half for Saturday. The instruction page of the diary indicated whether the record was to be kept for Saturday or Sunday.

Food records

On each occasion food or drink was eaten, the time, description of food eaten, amount eaten, where eaten, and with whom eaten were noted in the food records. The amount was written in household measures or in gram and millilitre if known.

Children were instructed to measure the size and/or volume of the glass, cup, bowl, plate, and spoon they normally used. A 30-mL plastic measuring cup graduated in 1 mL calibration was given to each child, and the procedure for measuring the volume was demonstrated in each class separately.

Actual cartons and packets of juice and crisps, and biscuits of varying sizes and types were shown to clarify the importance of detailed records and to show how they could estimate the amount they had eaten from looking at the label.

For use in Pakistan, diaries were translated into Urdu.

Analysis of dietary data

The researchers visited the schools twice during the record-keeping period: once on the second day of record-keeping and the second time after completion of the record. At the first visit, records were checked, and any questions from the children were answered. On the second visit, the records were checked again, and any missing information was retrieved. After further scrutiny by the researchers, only records considered reasonably accurate were used for analysis of nutrients.

Food-consumption information from the food records was coded and entered directly on SPSS version 6 (SPSS Inc. Illinois, USA). The nutritional analysis package, COMP-EAT (Nutrition Systems, London), with added data on South Asian dishes from Kassam-Khamis (11) was used for calculating the intake of nutrients. The mean daily intake of nutrients by each subject was transferred to SPSS (version 6) for further analysis. Nutrient density (per 1,000 calorie) was calculated and compared with those suggested by the Food and Agriculture Organization (FAO) for international use (15).

RESULTS

Characteristics of respondents and their families

In all, 308 boys and girls aged 10-12 years completed food records for this study. Participation by group, sex, and mean age of the children are presented in Table 1. The mean age of children ranged from 130 to 144 months. Information on their nutritional status was available (16), and the height and weight status was found to improve with urbanization rank.

The characteristics of families of children are presented in Table 1, 2, and 3. The mean family size was slightly higher at rural level (6.38). A relatively much higher proportion of all the urban groups of parents was educated (fathers: 64-100%, mothers: 55-89%) compared to the rural parents (fathers: 48%, mothers: 11%).
All Pakistani and British Pakistani parents were Muslims, whereas most (96%) British Caucasian parents were Christians. Seventy-nine percent of the British Indian parents were Sikhs, and 21% were Hindus. Although the majority of both British Pakistani and British Indian parents was born in Pakistan and India respectively, a slightly higher proportion of British Indian parents was born in the UK compared to the British Pakistani parents. None of the Pakistani fathers and only 1% of the Indian fathers were born in the UK, whereas 3% of the Pakistani mothers and 8% of the Indian mothers were born in the UK.

Meal pattern and food habits

Typical meal pattern of various groups is presented in Table 4. The three main meals—breakfast, mid-day meal, and evening meal—were consumed by most children of each group. Frequency of consuming snacks at mid-morning, at afternoon, or at bedtime was lower among the less-urbanized groups. The mean number of meals

<table>
<thead>
<tr>
<th>Group</th>
<th>RrP (UR1)</th>
<th>MUP (UR2)</th>
<th>HUP (UR3)</th>
<th>BrP (UR4)</th>
<th>BrI (UR5)</th>
<th>BrC (UR6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>14</td>
<td>137</td>
<td>137</td>
<td>136</td>
<td>137</td>
<td>137</td>
</tr>
<tr>
<td>Mean</td>
<td>144</td>
<td>137</td>
<td>138</td>
<td>137</td>
<td>136</td>
<td>137</td>
</tr>
<tr>
<td>SD</td>
<td>(15)</td>
<td>(14)</td>
<td>(8)</td>
<td>(7)</td>
<td>(7)</td>
<td>(8)</td>
</tr>
<tr>
<td>Boys</td>
<td>16</td>
<td>24</td>
<td>18</td>
<td>26</td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>Mean</td>
<td>131</td>
<td>130</td>
<td>141</td>
<td>137</td>
<td>135</td>
<td>136</td>
</tr>
<tr>
<td>SD</td>
<td>(13)</td>
<td>(9)</td>
<td>(9)</td>
<td>(7)</td>
<td>(7)</td>
<td>(7)</td>
</tr>
</tbody>
</table>

Table 1. Mean age in months of boys and girls who participated in the study

Table 2. Family size and mean age of parents

Table 3. Percentage of educated parents (at least 10 years of formal education)
(r=0.360, p=0.000), and somewhat weak for fruit
(r=0.286, p=0.000), milk (r=0.224, p=0.000), and meat
urbanization rank and vegetable intake became weaker
and less significant (r=0.199, p=0.042).

### Table 4. Typical week-days’ meal pattern of each group

<table>
<thead>
<tr>
<th>Meal</th>
<th>RrP (UR1)</th>
<th>MUP (UR2)</th>
<th>HUP (UR3)</th>
<th>BrP (UR4)</th>
<th>BrI (UR5)</th>
<th>BrC (UR6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>‘Paratha’</td>
<td>Sliced bread</td>
<td>Sliced bread</td>
<td>Cereal</td>
<td>Cereal</td>
<td>Cereal</td>
</tr>
<tr>
<td></td>
<td>Tea</td>
<td>Milk</td>
<td>Milk whole</td>
<td>Milk whole</td>
<td>Milk skimmed</td>
<td></td>
</tr>
<tr>
<td>Mid-morning</td>
<td>Asian snacks</td>
<td>Asian snacks</td>
<td>Asian snacks</td>
<td>Potato chips</td>
<td>Crisps</td>
<td>Potato chips</td>
</tr>
<tr>
<td>Mid-day meal</td>
<td>Chapati</td>
<td>Lentil curry</td>
<td>Lentil curry</td>
<td>Baked beans</td>
<td>Baked beans</td>
<td>Meat burger</td>
</tr>
<tr>
<td></td>
<td>Lentil curry</td>
<td>Crisps</td>
<td>Fruit drink</td>
<td>Fruit drink</td>
<td>Fruit drink</td>
<td></td>
</tr>
<tr>
<td>Afternoon</td>
<td>Tea</td>
<td>Tea</td>
<td>Tea</td>
<td>Sweets</td>
<td>Fruits</td>
<td>Chocolates</td>
</tr>
<tr>
<td>Evening meal</td>
<td>Chapati</td>
<td>Meat and/or vegetables</td>
<td>Meat and/or vegetables</td>
<td>Chapati</td>
<td>Chapati</td>
<td>Potato chips</td>
</tr>
<tr>
<td></td>
<td>Meat and vegetables</td>
<td>Curry</td>
<td>Curry</td>
<td>Meat and/or vegetables</td>
<td>Meat and/or vegetables</td>
<td>Vegetables</td>
</tr>
<tr>
<td></td>
<td>Curry</td>
<td>Curry</td>
<td>Curry</td>
<td>Curry</td>
<td>Curry</td>
<td>Meat sausages</td>
</tr>
<tr>
<td>Night</td>
<td>Fruits</td>
<td>Milk</td>
<td>Ice cream</td>
<td>Fruits</td>
<td>Fruits</td>
<td>Crisps</td>
</tr>
</tbody>
</table>

BrC=British Caucasian, BrI=British Indian, BrP=British Pakistani, HUP=High-income urban Pakistani, MUP=Middle-income urban Pakistani, RrP=Rural Pakistani, UR=Urbanization rank

Fig. 1. Variations in food habits with urbanization

(r=0.158, p=0.000). However, the urbanization-related increase in the intake of vegetables was highly significant due to the intake of fried potatoes (chips and crisps). After excluding these two foods, the association between

Calorie intake and nutrient density of diets

Results regarding energy intake and nutrient densities of diets are presented in Table 5-6. Caloric intake was lower than estimated requirements (FAO) among most
children of each group. The mean calorie intake of rural boys and girls was markedly lower than that of other groups. Although all the urban groups had a much higher calorie intake compared to the rural group, energy intake carbohydrates and fibre, on an average, was lowest in the British Caucasian and highest in the rural group. In terms of micronutrient density, the urban groups differed from the rural groups to a varying extent for different

### Table 5: Mean calorie intake at various urbanization ranks

<table>
<thead>
<tr>
<th>Gender</th>
<th>RrP (UR1) (n=40)</th>
<th>MUP (UR2) (n=81)</th>
<th>HUP (UR3) (n=59)</th>
<th>BrP (UR4) (n=83)</th>
<th>BrI (UR5) (n=65)</th>
<th>BrC (UR6) (n=29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>1,380</td>
<td>1,680</td>
<td>1,576</td>
<td>1,552</td>
<td>1,679</td>
<td>1,581</td>
</tr>
<tr>
<td>Boys</td>
<td>1,595</td>
<td>1,892</td>
<td>1,788</td>
<td>1,703</td>
<td>1,644</td>
<td>1,775</td>
</tr>
</tbody>
</table>

RrP = Rural Pakistani, MUP = Middle-income urban Pakistani, HUP = High-income urban Pakistani, BrP = British Pakistani, BrC = British Caucasian, BrI = British Indian, UR = Urbanization rank

Fig. 2. Frequency of food intake per day by six groups of children having different urbanization status

Adequacy of fat intake is presented in Fig. 3. The percentage of children having an excess of fats in their diets was higher in the urban Pakistani groups and was the highest in the British Caucasian group. The proportion of children having higher than recommended proportion of saturated fats in their diets increased steadily with urbanization rank.

Results regarding nutrient densities of diets are presented in Table 6 in terms of the mean percentage of requirements met by each group. Requirements for each child were determined on the basis of his/her calorie intake. The protein density of diets was, on an average, adequate (>100%) for each group, and no linear trend with urbanization was observed. The intake of nutrients. Dietary adequacy for iron, calcium, pyridoxine, vitamin B₁₂, vitamin C, and vitamin A was higher among the urban groups, whereas the intake of riboflavin and vitamin E decreased with the apparent level of urbanism. The intake of thiamine decreased from group 1 to 4, but was then relatively higher for group 5 and 6. Thus, the pattern of nutritional deficiencies varied with urbanization stage.

Lack of iron, zinc, folates, and vitamin A in diets was a problem present in all groups. Certain nutrients were generally lacking only in certain groups. At urbanization rank 1 (RrP), low intake of pyridoxine, vitamin B₁₂, and vitamin C was noticeable. At urbanization rank 2 and urbanization rank 3, along with pyridoxine and vitamin C, low intake of thiamine, total carbohydrate, and fibre was also common, and at urbanization rank 4-6, diets were typically deficient in vitamin E. Thus, in terms of micronutrient density, diets
Food habits and nutrient density of diets of Pakistani children

Pakistani children had a relatively low intake of wheat compared to the rural children, and, thus, a major source of thiamine was in lower proportion in their diets, and the intake of thiamine decreased. Although the British South Asians were not taking more wheat, they were getting thiamine from several enriched breakfast cereals. Thus, their intake of thiamine was more than that of the urban Pakistani children. The rural and urban Pakistani children had a low intake of vitamin C and folates due to lower consumption of fresh fruits and raw vegetables. Thus, what the authors conclude from these observations is that, in terms of micronutrient density, diets of various urban groups could have more differences than similarities. While these differences point toward a need for comprehensive nutrition education and community nutrition surveys, they also indicate the possibility of having healthy diets in urban settings.

**DISCUSSION**

As found in several other studies (2,3,7,8,11), we also observed in our study that urbanization had a relationship with the increased intake of calories, fat, and sugar. However, the trends in nutrient density were different for various micronutrients: intake of all micronutrients studied did not increase with urbanization. The five urban groups differed from the rural group to a varying extent. The differences in nutrient intake reflected the differences in consumption of various foods. For example, due to the low intake of meat, density of diets for both pyridoxine and thiamine was lower in the Pakistani groups. Pyridoxine contributed to the diet of British children by the consumption of cornflakes at breakfast. Thus, the intake of pyridoxine by the Pakistani children was lower than that by all the British groups. On the other hand, since the intake of meat increased with urbanization, the intake of niacin and vitamin B₁₂ increased more steadily. Although the rural and urban Pakistani groups had a low intake of milk—a classic good source of riboflavin—their intake of riboflavin was high due to the high intake of whole wheat. Whole wheat flour has 0.215 mg of riboflavin per 100 g. One medium-sized chapati is made from 60 g of flour. Thus, a child who eats 4 chapatis gets 2.4x0.215=3 mg of riboflavin in a day. And if his calorie intake is 1,500, he is getting 1.5 mg of vitamin B₂/1,000 kcal, much more than the suggested requirement. For thiamine, we observed a U-shaped curve in relation to urbanization. The urban Pakistani children had a relatively low intake of wheat compared to the rural children, and, thus, a major source of thiamine was in lower proportion in their diets, and the intake of thiamine decreased. Although the British South Asians were not taking more wheat, they were getting thiamine from several enriched breakfast cereals. Thus, their intake of thiamine was more than that of the urban Pakistani children. The rural and urban Pakistani children had a low intake of vitamin C and folates due to lower consumption of fresh fruits and raw vegetables. Thus, what the authors conclude from these observations is that, in terms of micronutrient density, diets of various urban groups could have more differences than similarities. While these differences point toward a need for comprehensive nutrition education and community nutrition surveys, they also indicate the possibility of having healthy diets in urban settings.

Intake of micronutrients is considered to be a mediating factor in the progression and complications of chronic diseases (10,11,17-19). For example, lack of vitamin E and C could add to oxidative stress, thereby contributing to initiation or progression of atherosclerosis. A thorough understanding of effects of various patterns of food intake may provide clues to the higher incidence of non-communicable diseases along with undernutrition in urban areas of the developing world.
The above observations also indicate that, with ‘apparent’ increment in urbanization status, uniform transition in patterns of nutrient intake could not be expected. Different urban groups could differ greatly in their patterns of macro- and micronutrient intake, and inevitably it would affect their health. For example, in this study, the rural group had a lower energy intake, and their diets were lacking in several micronutrients. Thus, there may be more stunting and wasting, but since they had an adequate intake of fat, fibre, and carbohydrates, the likelihood of their suffering from chronic disease was relatively less. On the other hand, the affluent urban group from Pakistan had a high intake of fat and sugar as did the British Caucasian group, but the intake of micronutrients was relatively much less for several micronutrients. Thus, there may be more micronutrient deficiencies. Although the rural group had a lower intake of essential nutrients, their intake was balanced. On the other hand, the affluent urban group had a high intake of fat and sugar, and their intake of essential nutrients was relatively much less. Thus, in relation to the rural group, health risks from imbalanced nutrition would be much greater for the affluent urban Pakistanis than for the British Caucasian group. We may, therefore, infer that health risks for various urban groups are not linearly associated with their apparent level of urbanization.
developing world, various forms of faulty nutrition could occur simultaneously. A portion of the population may still have an overall lack of diet and have a low intake of both micro- and macronutrients and could, thus, be expected to be stunted and underweight. A small group, fortunate to have enough awareness and resources to consume an adequate amount of balanced meals, may escape chronic diseases. However, the vast majority consuming a high fat and high-calorie diet with an insufficient intake of micronutrients may be exposed to several chronic diseases.

The impact of these dietary patterns may not be apparent for several decades, but when they do appear, most pathologic events will be irreversible. So, there is an urgent need to understand the situation in urban areas of the developing world and to take actions to prevent the future generation being entrapped with various kinds of health problems in their adult life due to their imbalanced nutrient intake today. The focus should be on a thorough assessment of dietary patterns in specific areas because, due to various geographic and economic factors, both nutritional inadequacies and relevant dietary guidelines could differ.

ACKNOWLEDGEMENTS

Dr. R. Hakeem was the recipient of a Commonwealth Scholarship while doing her PhD, and ISFE Switzerland provided additional financial support.

REFERENCES