

Carbohydrate (CHO), protein and fat intake of healthy Pakistani school children in a 24 hour period

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Abstract

Objective: To determine the frequency pattern of CHO, protein and fat intake in 24 hours by Pakistani school children of different socioeconomic and cultural backgrounds) 6 to 16 years of age.

Methods: The cross-sectional study was a multistage stratified sampling, done in a part of nationwide survey funded by the Higher Education Commission, Pakistan (HEC, Ref no: 20-441/R&D/2008). Sample collection of the study was done from 2006-2009, and growth centile charts have already been published (JPMA 2012; 62:367-77). This is the final paper of the completed project and includes data on only the nutritional status. Final statistical analysis of the nutrition aspect was done from 2012 to 2013 and comprised assessment of quality and quantity of CHO, protein and fats consumed by healthy schoolchildren in a 24 hrs recall (breakfast, brunch, lunch, tea time, dinner and bed time). Food records of 11, 237 school children were subjected to United States Department of Agriculture food exchange list. SPSS 18 was used for statistical analysis.

Results: The age range of the study subjects was 6-16 years, and they represented different areas of Pakistan. The consumption of CHO was high (range: 60-74%) compared to protein (10-12%) and fat (18-32%).

Conclusion: Schoolchildren in Pakistan were found to be taking a deficient amount of protein and fat in their daily diet, while CHO intake was higher than normal.

Keywords: Nutrition, Pakistani school children. (JPMA 64: 1255; 2014)

Introduction

The nutritional status of children is of vital importance for their growth and development. Various studies have measured the nutritional intake of the children within Asia^{1,2} and in the United States.³ The ultimate objective of these studies was to obtain a baseline diet intake of the children and then modify or improve their diet accordingly, and make recommendations and guidelines, if required. Diet of the child, when optimum according to the age, helps in the growth and development of the child and is reflected by the anthropometric measurements as depicted on the centile charts when the height and weight of the child is plotted.⁴ In our previous publication related to the larger study, we developed the centile charts of Pakistani population.⁵ In the same project we also looked at the nutritional status of children. This nutritional aspect is now being described in the present paper. To our knowledge, such a detailed descriptive analysis of a cohort of 11, 237 children from an Asian country has not been done before. This study completes our final objective of the project which started in 2009 and set out to determine the frequency of carbohydrate (CHO), protein and fat intake in 24 hours by Pakistani school children of different socioeconomic and

cultural backgrounds, including those from Balochistan, Khyber Pakhtoonkhwa (KP), Sindh, Punjab and the commercial capital Karachi from 6 to 16 years of age.

Subjects and Methods

The cross-sectional study was a part of nationwide survey funded by the Higher Education Commission (HEC), Pakistan. Sample collection of the study was done from 2006-2009, and growth centile charts have already been published.⁶⁻⁹ This is the final paper of the completed project and includes data on only the nutritional status. The original study lasted from 2006 to 2009. Multistage stratified sampling was employed. The current paper relates to the final objective of the overall study and deals with the nutrition status of the children from across Pakistan. It was mentioned in the last paper published that "data on the nutritional status (quality and quantity of carbohydrates, proteins and fats) will be described in a separate paper".⁵

Final statistical analysis of the nutrition aspect was done in 2012 and 2013. At the outset of the project, the sample size calculated for Pakistan was 36,000 (18,000 girls and 18,000 boys). Due to the turmoil in the country and lack of funds, we had to make do with a sample size of only 12,901. However, the final sample size was further reduced to 11,237 as food items were not completed in the proforma by the researchers involved despite having received relevant training. Also, some children did not

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remember the exact details of what they had eaten in the preceding 24 hours and the parents were not available to verify and complete the missing dietary information.

A qualitative recall of the food consumption in the preceding 24 hours was recorded (24hr dietary recall data). Initially a pilot study was done on 30 children and any deficiency in the questionnaire was corrected. The pilot study confirmed that the information regarding the dietary intake given by the child coincided with the mother's information, and, hence, in the final study dietary recall was taken from the children. If the child could not provide the information then the mother was asked to provide the complete dietary recall of the child and if the mother was not available to answer the information required to complete the diet proforma, then the child was excluded from the study.

The food taken was estimated by standard pre-measured spoons, plates and bowls for the amount in grams. For example, if the child took a complete chappati, the size of the pre-measured plate size for chappati was shown as small (S), medium (M) or large (L) and the amount of dough size made (prior to making the chappati) was also shown to the participant. After identification of the size, the calculated gms of CHO were added to his 24 hours intake. If oil had been used, it was shown again by the spoon used and its amount added in ml and calculated in gms of fat. Similarly, the amount of protein taken by the child was measured and added as gms in the dietary intake. In this way the 24 hours intake was calculated for each child.

The measurement of each item taken by the child in 24 hours was in accordance with the United States Department of Agriculture (USDA) food exchange list.¹⁰ For food items (local, Pakistani) that were not available on the list, the local food composition list was used to calculate the required calories.¹¹ Overall, in both local and USDA food exchange list, protein was taken as 4gms per calorie, CHO as 4gms per calorie and fat as 9gms per calorie.¹²

Hence, the total grams of CHO, protein and fat taken by each child in 24 hours were calculated. Thereafter, the percentage of CHO, fat and protein of the total grams was calculated.

Each item taken by the child at breakfast, lunch and dinner was calculated for CHO, protein and fat in grams. The total gram was added and percentage of CHO, protein and fat taken at breakfast, lunch and dinner was calculated. A comparison of the percentage of CHO, protein and fat taken by the children in Balochistan, Khyber Pakhtoonkhwa (KP), Punjab and Sindh as well as Karachi, the main urban centre, was calculated.

Nutritional data from the pre-coded questionnaire was

entered into Microsoft Excell sheet followed by analysis by SPSS 18. The USDA food exchange list was used for calculation of each item the child had consumed.¹⁰ Descriptive statistics, mean, standard deviation, frequency and percentage were calculated. Analysis of variance (ANOVA) was applied for comparison between variables. Post Hoc test was then applied.

Results

Of the 12,901 subjects in the study, 1664(12.9%) children had to be excluded as the dietary information was not complete. The final sample size for the purpose of nutritional aspect of the overall study stood at 11, 237(87.1%).

List of the variety of food taken by the children in 24 hours included Aalo Ka Kabab (potato patties), almond, pomegranate, apple, apple juice, apricot, Baisan Ka Halwa (gram flour cooked with butter and sugar), banana, beef (low fat), biscuit (baked), bread, bun, butter scotch, butter (table spoon [tbsp.]), cake (plain), candy hard, Cerelac, Chapatti (M), (L), (S), cheese (low fat), cherries, chicken, chips, chocolate (Rs5), choley, corn, cream, cream cheese, custard, Dal (lentils), dates, egg whole, fish, French fries, fried fish, ghee (tbsp), ghee (tea spoon [tsp]), grapefruit,

Table-1: Percentage of CHO (carbohydrate), protein and fat taken by the schoolchildren in 24 hours, from Balochistan, Pakhtoonwala, Punjab and Sindh (and Karachi). Karachi has been described separately, being the largest city of Pakistan with the maximum population.

Area	No of school children	CHO (%)	Protein (%)	Fat (%)
Balochistan	1000	69	10	21
Pakhtoonkhwa	2,168	57	11	32*
Punjab	1,792	61	12	27
Sindh	3,577	67	11	22
Karachi	2,700	63	11	26
Grand sum & %	11,237	65	11	24

*P <0.0179.

Table-2: Percentage of CHO (carbohydrate), protein and fat taken by Pakistani children, in 24 hours at breakfast, brunch (10 to 11 am), lunch (average 1 pm), Tea Time (4 to 5pm), Dinner (7 to 8pm) and bedtime (half-an-hour before sleep; around 9 to 10pm).

Time	CHO (%)	Protein (%)	Fat (%)
Breakfast	60	8	32
Brunch	68	13	19
Lunch	74	15	11
Tea Time	61	8	32*
Dinner	72	15	14
Bed Time	43	2	55
Grand sum & %	66	11	23

*p<0.6082

CHO: Carbohydrate.

Table-3: Significant variation in the percentage carbohydrate, protein and fat intake by healthy school children in a 24 hour dietary recall, showing significant difference between the areas (Balochistan, Karachi, Khyber Pakhtunkhwa, Punjab and Sindh).

	Balochistan	Karachi	Area of Pakistan NWFP	Punjab	Sindh	P value
CHO	17.51±54.8 *	16.7±24.63φ	15.91±20.63 *φ	27.45±344.71γ€†φ	19.02±133.8γ*€	<0.001
Protein	116.26±382.84γ†	94.901±124.12γ*€	78.96±76.60 *€†φ	134.06±850.16γ†	128.69±850.16γ†	<0.001
Fat	34.150±74.69γ*	37.19±68.42γ*	44.72±77.86 €†φ	56.88±1025γ€†φ	32.43±171γ*†	<0.001

* Different from Punjab

φ Different from Sindh

† Different from Karachi

γ Different from NWFP

€ Different from Balochistan

Dietary recall, from different areas of Pakistan.

CHO: Carbohydrate.

grapes, bean, guava, honey, Horlicks, ice cream, ice lolly, jam/jelly, kheer, khichri, Kit Kat (Rs 5), Lassi (yoghurt and water and milk and salt), mango, margarine, mayonnaise (tbsp), mayonnaise (tsp), melon, milk (low fat), milk (skimmed), milk whole, milo/Ovaltine, Mozzarella, mutton, naan (100gms), preserved fruit juice, full cream powdered milk, oil (tbsp), oil (tsp), paratha (M), (L), (S), pasta (noodles), peas, bean, peach, peanut (S), (L), pear, persimmon, plum 2", porridge, potato, biscuit, pumpkin seed, rice, coloured sugar water, rusk, sagodana (Sago pudding), salad, seeds, shahi tukray (bread pudding), shami kabab (meat patties), sheer khurma (vermicelli and milk+sugar), squash, strawberry, sugar (tbsp), sugar (tsp), orange drink, Tiger biscuit, gourd, vegetable, watermelon, and yogurt.

There was a wide variety of intake, but the majority of the children took chappati, occasionally rice, potatoes or any cheap vegetable available on a daily basis. Milk intake was replaced by tea with milk due to poverty. Some children received only black tea with food, as for example in Balochistan, especially in the winters, at breakfast.

The lowest amount of protein and maximum amount of CHO taken was by the children of Balochistan (Table-1). The maximum amount of protein was taken by the children of Punjab. However, the difference in protein intake was not significant. The fat intake was maximum in KP and the difference was significant ($p<0.0179$).

The maximum amounts of CHO and protein were taken at lunch and dinner (Table-2). Overall, the subjects were taking more CHO, followed by fat and very little protein.

There was wide variation in the overall dietary intake of the children on regional basis (Table-3). Intake of CHO, for instance, was different for Punjab when compared with Sindh, Balochistan and KP ($p<0.001$) but not significantly different for Karachi.

Discussion

The dietary intake of healthy school children 6 to 16 years of age by a 24 hours dietary recall method was done in Balochistan, KP, Sindh, Punjab and Karachi. The percentage intake of CHO, protein and fat were worked out. Statistically significant difference between the areas Balochistan, Karachi, KP, Punjab and Sindh for intake of CHO, protein and fat was seen in the study.

Recommended intake in children is 45% to 65% of their calories from carbohydrates, 25% to 40% from protein and 20% to 35% from fat.¹³ In this study the children were taking 60% to 74% of their calories from CHO, 10% to 12% from protein and 18% to 32% from fat, indicating a high percentage of CHO and low protein intake. Fat was near the normal requirement.

This sample size⁵ was chosen based on children who were completely immunised according to age, had not been admitted in the hospital for any chronic illness and did not have any debilitating disorder and were included from all the socioeconomic classes. Overall the study indicates that the children were being given high, energy-dense (ED) food (mainly CHO) as the parents due to poverty, could not afford protein-rich foods like meat, which was expensive. The majority of children were from the middle socio-economic class, but were receiving a diet more affordable for individuals of low socioeconomic status. For example, the bun kabab available at the local vendor was seen to be a favourite for most children, locally called as the "allo kabab bun" (bread bun with potato filling and fried with small amount of oil/ghee and also containing 2 or 3 slices of onion and herbs such as green coriander and small amount of ground spices like red chillies). The caloric intake of this was mostly CHO, ED food.

This highlights the poverty status of the country. According to the Poverty and Equity databank, poverty head count

ratio is 2008:60.2, with 60% of the population of Pakistan living below the poverty line i.e., earning per day per individual is less than \$2 or Rs 600 per day.¹⁴ Another reason for the imbalance in the CHO, protein and fat could be due to lack of parents' knowledge about the food pyramid.¹²

In strong contrast, a study done in Pakistan on the affluent 652 school children has shown a prevalence of obesity in 5-6%⁵⁻⁹ and overweight children were 20%.⁸ These children were taking excessive junk food and overall intake of CHO and fat was high, while protein intake was low and of poor quality. This was predominantly seen in children of Karachi and Lahore, while children from Quetta were taking less amount of junk food and their protein intake was better.⁸ In the present study, the children were from all the socioeconomic class, and not just the affluent school children. Overall, their intake of quality food was towards the lower side. CHO intake was high; protein low, and fat was less than the normal requirement for age. Hence, in this study prevalence of obesity was 5% in a sample size of 12,837,⁵ while in affluent schools the obesity was 6% in a sample size of 652.⁸

A serious aftermath of the imbalance in the CHO, protein and fat intake in children results in stunting, which has been supported by previous studies.^{5,15} One study has shown a 14% prevalence of stunting.⁵

Developing world is now therefore showing a mixed pattern of obesity and stunting. In Oran, Algeria, it was 13.4%,^[16] in our country it was 5-6%.⁵ Frequency of obesity is still low^{5,16} compared to the developed world. For example in the USA, a study done showed that in eighth grade (mean age: 14.1 years) school children, 20.8% were obese and 17% were overweight.¹⁷ In Australia, in boys and girls, prevalence rates have settled to around 21%-25% for overweight and obesity together, and 5-6% for obesity alone.¹⁸

In India, an estimated 51% prevalence of stunting and 61 million stunted children are present, which are many more than Pakistan. India is the most affected country in the world.¹⁹ Another study done in India in schoolchildren has also shown a mixed picture of overweight and obesity of 6.19% while underweight and stunting was 53% and 29%. Hence, a mixed pattern of both stunting and obesity is seen in the two countries of the subcontinent.²⁰

Recently a longitudinal study of childhood poverty in four low- and middle-income countries including India has shown that substantial recovery from early stunting occurred among these children.²⁰ However, in our present study, age of the children was 6 to 18 years. Also in this study follow-up of the 14% children with stunting was not done and so a comparison with the Indian study is not possible.²¹

High ED foods were given by the mothers to the children as these products were advertised on TV and were easily available in the market so the mother did not have to cook. Snacks included for biscuits. The favourite snack taken by most children any time during the day, mostly in the lunch break of school, was chocolates, butterscotch toffees, plain cake (small cup) and icecream. The item taken by the child was dependent upon the money given by the parent for the lunch break. So this again indicates a lack of a proper time schedule of quality diet for a child. Studies²² support that such a time table is important otherwise the child is unable to acquire the required calories.

In the evening snack, some children had potato chips either made at home or by some local vendor or local shop, and others had rice or corn or French fries or seasonal fruit. Some had juice or custard or sweet pudding, or something local such as sheer khurma/shahitukray, but these were mostly leftovers and not a regular snack. There were some who had ice lolly and very few who had purchased local chocolates such as Kit Kat. Again, these items were added CHO since the child had not eaten a full balanced meal, and hence was taking the junk food to satisfy his hunger and also because they were trendy and parents did not have the time and money to satisfy the needs.

Overall, it was seen that only about 50% of the children were taking food such as paratha in the morning and usually it was taken with tea, which was with milk and sugar. This pattern may be changing with urbanisation²³ so that children of working mothers have started to get bread or rusk to decrease mothers' load of cooking early in the morning. School children are now having a breakfast which is again not balanced. Some were going to school with a cup of tea and rusk. This in the long run results in malnutrition and stunting.

Overall, percentage of CHO, protein and fat taken by the children was the same as in previous studies by the same authors.⁶ However, quantitatively, the children in this study were taking less than the required amount¹² of CHO, protein and fat. This may also account for the stunting present in the children with increasing age.⁵

School children in this study were from both government and private schools of Pakistan and, hence, high, middle and low socioeconomic all classes were represented.⁵ However, children with chronic illness and/or admission in a hospital were excluded from the study. Among these healthy children, nutritional intake was less than what has been recommended⁵ and 14% were stunted. Previous detailed work¹⁵ has shown stunting in poor countries due to decreased food intake, poor quality diet and early child

hood infections. However, in our cohort of "healthy children", stunting was still seen as 14%. This was due to a poor quality and more reflective of an imbalanced diet. The child was eating whatever was available or locally grown when in a rural area and not what is recommended by the food pyramid.^{10,12}

Variation in the dietary intake and imbalance is due to the fact that 60% of the national population happens to be in the poverty bracket and also owing to the varied cultural, religious and ethnic backgrounds of the children.^{5,14} Similar variation in dietary intake may also be seen in other countries of the world like USA²⁴ where a recent study indicates that the lower income and non-Hispanic blacks were taking a diet which is not balanced. This population was consuming excess energy from fats and added sugars (CHO) irrespective of income and race/ethnicity.

Conclusion

Schoolchildren across Pakistan were taking a deficient amount of protein and fat in their daily diet as documented by a 24-hour recall method. CHO intake was higher than normal.

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