SUMMARY AND CONCLUSION
Malnutrition is still highly prevalent in developing countries. School children may also be at high nutritional risk. However, less information is available regarding the nutritional status of primary school children from India and Iran. Hence, it was envisaged that the data in the present study could serve as baseline data for future studies, as well as be used for public health policy/programmes for the health and nutrition of school aged children. The aim of this study was to assess the nutritional status of Iranian and Indian government primary school children, 6-9 years of age and estimate the prevalence of nutritional stunting. The study was approved by the Department of Higher Education, Ministry of Human Resource Development, and Government of India and by the Department of Research, Ministry of Education and Training, Government of Iran. It was also approved by the Department’s Research Committee. Informed consent was taken from the Principal of each school and the mother of each child before conducting the study.

Heights and weights of 4570 children aged 6-9 years, including 2234 Iranian (1016 boys, 1218 girls) and 2336 Indian (1240 boys, 1096 girls) attending primary schools residing in Mumbai and Ahwaz, Iran were measured and the body mass index (BMI) calculated. The World Health Organization’s (WHO) anthropometric indices of weight-for-age (WA) and height-for-age (HA) and weight-for-height were used to assess the children’s nutritional status. Information was obtained regarding socioeconomic status, whether the child is anemic, has worm infestation, whether the child was taken for health checkup and dietary patterns. Information on dietary pattern included whether the child consumed vegetarian or non-vegetarian foods, consumed food supplements, breakfast consumption patterns and whether the child carried packed lunch/snacks to schools. In addition a food frequency questionnaire was used to record information on the frequency of consumption of various foods that were grouped in to 11 food categories. Dietary diversity score was calculated by summing the number of food items and the frequency of consumption for each food group separately. In addition, total scores were calculated. Data was analysed by using the SPSS windows software version 17.0. Analysis was carried out separately for each country i.e. both for the Iranian children and Indian children. Also comparisons were made between the two countries. Means and standard deviations were computed for all variables. Analysis of variance (ANOVA), post-hoc Bonferroni test and two-tailed Student’s t-test were
used to compare different parameters which were studied. Chi-square test was used to determine independence of attributes within and between groups.

The salient observations of the study are summarized herein:

**Profile of sample:** All the children belonged to low-middle income households with a little less than half, living in chowls in India or small houses in Iran. Family size tended to be larger among the Indian children than among the Iranian children. Educational status of both mothers and fathers of the Indian children was better compared to the Iranian counterparts. In India 2.9% of the mothers were illiterate compared to 4.2% of Iranian mothers. Illiteracy among fathers was less compared to mothers in both countries, with 0.5% of the Indian fathers and 1.6% of Iranian fathers being illiterate. Father’s education was significantly and positively associated with family income. A higher percentage of Iranian families were reported to have health problems such as diabetes mellitus, cardiovascular diseases etc compared to Indian families. In both countries, there was a tendency for children not being taken for regular health checkup. Majority of the Indian mothers reported that their children were not anemic whereas in Iran a substantial proportion of mothers were not aware whether their children were anemic or not.

**Nutritional status of children:** In both countries a small percentage of children were underweight (< 3rd percentile), although the percentage of underweight Indian (3.5%) children was two times more than in Iran (1.5%). A higher percentage of Iranian school children were overweight /obese than Indian children. Boys were more stunted than girls in Iran as well as in India. Children with normal height status (-2SD to +2SD) were observed more in India than Iran in both sexes. The number of severely and moderately wasted children was more among Indian school children of both sexes than Iranian children. Indian boys were lighter than the Iranian boys. Similarly, Indian girls’ BMI on average was 1kg/m² less than that of the Iranian girls. Moderately stunted children (-3SD to -2SD) were observed more in Iran than India in both sexes. Percentage of Iranian boys with normal weight for height z scores was significantly higher than those Indian boys. In case of females, percentage of Indian girls with z scores between -2 and +
2 SD was higher than the percentage of Iranian girls. Obesity (z score > +2 SD) was higher among Iranian girls as compared to Indian girls and boys and Iranian boys.

Factors influencing Nutritional Status: There was significant association between family income and nutritional status in both countries. A higher percentage of underweight children belonged to lowest income category (>Rs15000 or >RI 4000000) compared to higher income category. Lower height for age children were in lower income categories. Although all wasted children belonged to <Rs 25000 per month income category. Children from higher income families had higher weight for age z-scores.

Type of house and nutritional status was significantly associated. Family size and nutritional status was significantly associated. Children from larger families had lower weight for age and smaller stature in India. Among Iranian children, larger families and single parent families were associated with low height for age. Maternal and paternal educational level were associated with nutritional status of children. Lower maternal education level was associated with lower z-scores for weight for age, smaller stature; although some mothers who had received higher education had lower body weight and smaller stature. Children of fathers who were better educated had higher weight for age z-scores. In Iran, one third of the stunted children had illiterate fathers.

Morbidity and nutritional status of children were not significantly associated. With reference to being taken for a health checkup, the data indicated that children who were malnourished (underweight or over weight) tended not to be taken for a health checkup.

Diet pattern and nutritional status of children: Approximately one tenth of the Indian children consumed non vegetarian foods whereas all the Iranian children were non vegetarian. Overall, Iranian children consumed more number of meals per day compared to the Indian children, with no difference between the two sexes. The number of meals consumed was significantly and positively associated with family income in both countries. Larger family size was associated with less number of meals in both countries. Better parental education was associated with more number of meals especially in Iran.
Number of meals per day was significantly and positively associated with weight for age z-scores height for age z-scores in both countries. Children with higher BMI in India had more than 5 meals per day.

Almost all children in both countries consumed breakfast. However, the frequency of consumption per week varied, with about one fifth of Iranian children and one fourth of Indian children consuming breakfast twice or thrice in a week. Frequency of consumption was influenced by family income, with differences between the two countries. Further, mother’s and father’s education level influenced frequency of breakfast consumption.

A significant association was observed between how frequently the child ate breakfast and nutritional status. Lower frequency of consumption was associated with lower weight for age z-scores. Most children with normal height for age consumed breakfast daily, whereas less frequent consumption was associated with stunting. Similarly wasting was associated with lower frequency of consuming breakfast whereas children who were over weight or obese consumed breakfast more frequently.

Almost one third of the children from Iran and almost half the Indian children consumed foods ready to eat once in a week. Frequency of consumption of these foods was positively associated with family income, mother’s and father’s education level. Children who ate such foods more frequently, tended to have higher weight for height z-scores.

**Dietary diversity and nutritional status:** Total mean dietary diversity scores for Iranian children were significantly higher than the scores of the Indian children. Significant differences were also observed between the two countries for mean scores for individual food groups. Comparison between boys and girls showed no significant gender differences except for cereals, pulses, sweets and specially dairy products in Iran. When mean scores compared by age groups, in India the scores for cereals, dairy foods, nuts and mixed dishes decreased with increasing age but was highest for the 9-9.11 year age group. A reverse trend was observed for Iran. Differences were also observed for other foods in relation to age. The number of meals consumed significantly influenced mean scores. In India, mean scores for cereals, vegetables, dairy products, pulses, sweets and fats were higher when the number of meals consumed was more. Also mean scores
for cereals, vegetables, fruits, dairy products, nuts, non-vegetarian foods, beverages, sweets and fats were higher for children coming from families with higher incomes in India. In Iran, income not influence mean scores for vegetables, sweets and beverages. Maternal education positively influenced mean scores for several food groups in both countries, although in Iran the highest scores were observed at both extremes in level of education i.e. among children of mothers who were illiterate and those with post-graduate degrees. Similar trends were observed in relation to father’s education.

Children who were reported to be anemic by Iranian mothers had significantly lower scores for cereals, fruits, dairy products and non-vegetarian foods while in India significant differences were seen for pulses, dairy products, nuts, mixed dishes, beverages, sweets and fats.

Significant associations were observed with the nutritional status of the children in both the countries. Total mean scores were lowest for underweight children and were significantly higher for those who were overweight in both countries. Total food group scores increased with better height status of the children. In both countries, severely and moderately stunted children had lower total mean scores than those who had normal and above average height. Wasting was associated with lower total mean scores. Analysis of data for individual food groups showed that increasing weight was associated with higher scores for almost all food groups in India. In Iran, mean scores for vegetables, beverages, sweets and fats increased with increasing weight. Height for age z-scores were positively associated with mean score for pulses in both countries and dairy products, beverages and fats. Higher BMI was associated with higher scores for cereals, fruits, vegetables, dairy products, mixed dishes, beverages, sweets and fats.

The present study was undertaken to answer the following research questions and the data obtained have enabled the following conclusions to be drawn:

**Research Question 1:** Are there differences in nutritional status i.e. height for age, weight for age and body mass index (BMI) of urban Iranian and Indian primary school children, 6-9 years of age?
Differences in nutritional status were observed between the two countries. Although most children had normal z-scores for all three parameters - weight for age, height for age and weight for height; underweight was two time more among Indian boys than among Iranian boys. Among girls, the Indian sample was better off than the Iranian girls.

**Research Question 2:** What is the prevalence of stunting in the two groups of children and in which country, Iran or India is the prevalence of nutritional stunting children 6-9 years of age higher?

The prevalence of stunting in both countries was found very low. Based on percentiles 7.7% of boys and 7.3% girls from Iran; 2.6% boys and 0.6% girls from India, were stunted. Based on z-scores the percentage of severely stunted children was lower - 0.4% of Iranian girls. None of the Iranian males and Indian children of both sexes were severely stunted. A small percentage of children of both sexes were moderately stunted. Overall the prevalence of nutritional stunting was higher in Iran.

**Research Question 3:** Are any of the factors, i.e. family size, family income, parent’s education and child health checkup associated with nutritional status of school children?

All the factors were found to be significantly associated with child nutritional status. Large family size, low family income and lower level of mother’s and father’s education were associated with poorer nutritional status. Children who were undernourished or overweight tended not to be taken for health check up.

**Research Question 4:** Does dietary diversity differ among children from Iran and India?

Dietary diversity differed between the two countries with the Iranian children having slightly higher total scores than Indian children. Iranian children had lower scores for cereals, pulses and vegetables and higher scores for fruits, dairy products, non vegetarian items, nuts and beverages.
Research Question 5: Are there differences in dietary diversity vis a vis family income, number of meals, parental education, child's anemia status, family size?

Dietary diversity scores were influenced by all the above factors. Larger family size low family income and lower level of parental education were associated with lower scores for several food groups. Children who were reported to be anemic by their mothers had slightly lower scores for fruits, non-vegetarian items, dairy products and cereals in Iran.

Research Question 6: Is there any association between consumption pattern of selected food groups and the heights and weights of the selected school aged children? If so, which food group(s) has/have the most influence?

Association was examined between diversity scores for 11 food groups and z-scores for height for age, weight for age and weight for height. Overweight children tended to have higher scores for several food groups while those who were underweight had lower scores. In both countries, height for age z-scores were positively associated with scores for pulses, dairy products and non-vegetarian food items.

Research Question 7: To what extent does dietary diversity influence nutritional status?

The data suggests that greater dietary diversity for cereals, mixed dishes, beverages, sweets and fat consumption as well as fruits and vegetables is associated with increasing body mass index. However there is a need for further study in this area to determine whether among fruits and vegetables, cereal preparations and mixed dishes; the type and method of preparation and consequently the energy density affect body weight and nutritional status.
In conclusion, the present study showed that majority of the children was well nourished although a small percentage of Iranian children were stunted. Overweight and obesity was noted in approximately 15-20% children from Iran and Indian boys. However, there is a need to determine the extent to which this is due to diet and life style patterns and the contribution of prepubertal changes in body composition, body weight and stature. Although, the children included in the study sample were from the low to middle income categories, the data points to the need for improving the diets of the children in terms of nutritional quality.