Socioeconomic Inequality in Under-five Children Malnutrition in Iran: Evidence from the Multiple Indicator Demographic and Health Survey, 2010

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Running title: Socioeconomic Inequality in Under-five Children Malnutrition in Iran
Abstract

Objectives: The aim of this study was to assess the socioeconomic inequality in malnutrition in under-five children in Iran in order to help policy makers for reducing the such inequality in malnutrition.

Methods: Data on 8443 under-five children were extracted from the Iran Multiple Indicator Demographic and Health Survey. The Wealth-wealth index was used as proxy for socioeconomic status. Socioeconomic inequality in stunting, underweight, and wasting was calculated using the concentration index. The Concentration-concentration index was calculated for the whole sample, as well as for different subcategories include defined in terms of categories such as areas of residence (urban and rural) and the gender of children.

Results: The overall rate of Stunting was observed to be more prevalent rather than underweight and wasting. The results of the concentration index at the national level, as well as in rural and urban areas and in terms of children’s gender, showed that the inequality in stunting and underweight was statistically significant and the children in the lower quintiles were more malnourished. The wasting index was not sensitive to socioeconomic status, and its concentration index value was not statistically significant.

Conclusions: This study showed that it might be misleading to assess the mean values of malnutrition at the national level without knowledge of the distribution of malnutrition among socioeconomic groups might be misleading. Some significant socioeconomic inequality inequalities in stunting, and underweight were observed at the national level and in between both urban and rural areas. Regarding the influence of nutrition on the health and economic efficiency well-being of preschool-aged children at preschool ages, it is necessary for the government to focus on taking targeted measures to reduce malnutrition and also to focus on poorer groups of the within society who bear a greater burden of malnutrition.

Keywords: Under-five children, Malnutrition, socioeconomic inequality, Iran
Introduction

Adequate nutrition at the early stages of children’s lives is essential to ensure the proper development of organs and their optimal performance, having the development of a strong immune system, and adequate mental growth and development [1]. Economic growth and social development require a well-nourished population with good nutrition so that they would be individuals are capable of learning new skills and contributing to society [2]. Malnutrition in children occurs when their bodies do not receive adequate amounts of calories, proteins, carbohydrates, fat, vitamins, minerals, and other micronutrients necessary for the health of their organs and their proper functioning [3]. Malnutrition has long-term consequences on children’s intellectual abilities, economic productivity, and vulnerability to heart and metabolic diseases. It directly or indirectly accounts for more than one-third of all deaths and 21% of disability-adjusted life years (DALY) in children [1-4].

The prevalence of malnutrition in the world has generally declined; and during from 2000 to 2013, the prevalence of stunting diminished from 33% to 25%, and also the prevalence of underweight decreased from 25% to 15% during from 1990 to 2013. However, according to the World Health Organization, the World Bank, and the United Nations Children’s Fund in 2013, about 161 million children in the world suffered from chronic stunting and 99 million children suffered from underweight [5]. Malnutrition is also a major challenge for the health sector and is the main factor contributing to child mortality in the Eastern Mediterranean Region, as defined by the World Health Organization, to the extent that it causes 50% of the deaths of children under five years of age in this region [6].

As in other countries, the prevalence of malnutrition in Iran has declined and the average indices of stunting and underweight have dropped from 19% to around 7% and from 17% to 6%, respectively [7, 8]. Over the past three decades, improved diets and public health policies such as setting up the establishment of health centers have increased vaccination coverage, and access to safe water and improved sanitation facilities have caused the decrease of the prevalence of child malnutrition in Iran to decline [9-11]. On the other hand, nonetheless, according to recent provincial studies,
chronic malnutrition as still remains a health problem has still remained in Iran. For example, 11% of the under-five children in Kerman and 16% in Sistan and Baluchestan are suffering from stunting [12-15]. Additionally, according to the United Nation International Children Emergency Fund (UNICEF), the presence of multiple causes of malnutrition and several unknown aspects of malnutrition are the reasons for neglecting malnutrition that it has been neglected in Iran, and inequality in the malnutrition burden in the provinces of the country is considered as to be a challenge [11]. In this regard, the World Health Organization reported that Iran was among the countries with great major differences between socioeconomic groups in terms of chronic malnutrition [6].

However, the common characteristic of all recent studies conducted in Iran on malnutrition of the among under-five children is that they have all studied the prevalence of malnutrition in a particular period or its trend over time [12-14]. Since the malnutrition is a complicated phenomenon, on for which the socioeconomic factors such as the educational level of the parents as well as household income are effective relevant, [16-18], and it shows large disparities among socioeconomic groups [19-21]. Therefore, it seems necessary to have a clear picture of the nutritional status of the children among various socioeconomic groups in Iran in order to identify the patterns of inequality and to determine the target vulnerable groups that should be targeted for interventions, with the goal of to offer some developing suggestions to for policy makers for about how to reducing reduce the this inequality.

Materials and Methods

Data:

The study data was extracted from a national survey of households titled the Iran Multiple-Indicator Demographic and Health Survey (IrMIDHS). This survey was conducted by the National Institute Health Research and Ministry of Health in 2010. The IrMIDHS aimed at to producing produce valid and national wide data on health and population indices in order to assess the impact of social indicators on the health of children and women and to help policymakers to develop effective strategies to improve health outcomes and reduce inequalities [8]. In the this cross-sectional survey, the multi-stage stratified cluster sampling was used. Due to significant differences in the population size across different provinces of Iran and different the districts of within provinces, each province’s share in the total sample size as well as each region’s share in the provinces was first specified. In the following Subsequently, the random samples of clusters in each
district were weighted based on the rural and urban populations within each region. Each cluster consisted of 10 households.

In order to have a clear picture of the social indicators within each province, the minimum number of clusters in each province was increased to 40, and ultimately 3096 clusters (30,960 households), including 909 rural clusters and 2187 urban ones, were selected as the sample size of the IrMIDHS. The questionnaires of IrMIDHS included a household questionnaire (107 questions), a questionnaire for women aged 15-54 (145 questions) and a questionnaire about under-five children (88 questions), that were completed by conducting face-to-face interviews with the members of the household. Finally, a total of 29,609 household questionnaires (response rate: 95%) and 9,298 under-five children questionnaires (response rate: 99%) were completed.

To assess the socioeconomic inequalities in child malnutrition, we included 8443 children in this study, whose data on height, weight, age, and sex as well as their socio-economic status had been collected accurately and completely.

The Persian versions of the IrMIDHS questionnaires are available at http://nihr.tums.ac.ir.

**Measurements of socioeconomic status**

No information about the households' income or expenditure was collected in the IrMIDHS. In general, in the absence of the income or expenditure data, proxies such as the asset-based wealth index can be used to assess households' socioeconomic status. Hence, we used the wealth index created through the principal component analysis statistical method, which has already been used very well successfully in previous studies to measure socioeconomic inequalities and is especially suggested for low- and middle-income countries.

Two major categories of variables, including household assets (such as TV sets, refrigerators, freezers, radios, cell phones, wristwatches, computers, laptops, microwaves, washing machines, vacuum cleaners, washing machines, and cars) and household features (such as heating and cooling systems, types of fuel in the kitchen, access to the internet, sources of drinking water, bathrooms, number of rooms, toilets, and home ownership) were used to construct the wealth index. Finally, the wealth index was divided into quintiles (poorest, poor, middle, rich, and richest) to use in the subsequent analysis.

**Measurements of malnutrition**
It is common to use anthropometric indicators to assess the nutritional status of under-five children [25]. The anthropometric indicators height-for-age, weight-for-age, and weight-for-height are calculated using the data collected in surveys on the height, weight, and age of the children. To assess the nutritional status of the children, the anthropometric indicators, calculated as the Z-score, are expressed through which were used to compare the weight and height of the children compared with the weight and height of the same children in the reference population in terms of age and gender.

If the Z-score value for each anthropometric indicator for a child is less than twice as much as the standard deviation of more than 2 standard deviations (SDs) below the corresponding value for the reference population, the child was considered to be malnourished. In this study, the child growth standard introduced by WHO, the World Health Organization in 2006 was used to calculate the Z-score [26].

According to the measurements of the above-mentioned indicators, the following three forms of malnutrition can be defined as follows: stunting (if the Z-score value for height-for-age is less than twice as much as the standard deviation more than 2 SDs below the corresponding value of the reference population), wasting (if the Z-score value for weight-for-height is more than 2 SDs below the corresponding value of the reference population) and underweight (if the Z-score value for weight-for-age is more than 2 SDs below the corresponding value of the reference population). The outlier values of the height-for-age Z-scores (lower than \(-5\) and higher than \(+3\) SDs), the weight-for-age Z-scores (lower than \(-5\) and higher than \(+5\)) and weight-for-height Z-scores (lower than \(-5\) and higher than \(+4\) SDs) were excluded from the analyses, according to World Health Organization's guidelines [27].

Malnutrition inequality analysis

The inequality analysis inequalities in stunting, underweight, and wasting were done analyzed using through the concentration curve and concentration index.

Concentration curve

The concentration curve shows how the outcome of a health or disease outcome is distributed among different socioeconomic groups. On its horizontal axis, the cumulative percentage of the samples can be seen arranged based on socioeconomic status of the from
poor to the rich, while on the vertical axis, the cumulative percentage of health or disease outcome is shown. If the disease occurs unequally among poorer socioeconomic groups, the concentration curve will be above the equality line. On the contrary, if the variable disease or health variable is concentrated among the rich, the concentration curve will be below the equality line; and finally, the concentration curve will coincide with the equality line if the variable health or disease variable is equally distributed among socio-economic groups. In the present study, also we used the dominance test provided presented by O’Donnell et al. [28] to examine the significance of the concentration curve of the stunting, underweight, and wasting indexes with regard to the equality line (45°-degrees) at the 5% level.

Concentration index

The concentration index is obtained from the enclosed space between the concentration curve and the equality line. If the concentration curve is above the equality line, the index will be negative, and showing that the disease-condition is concentrated among the poor. But However, if the concentration curve is below the equality line, the index will be positive, indicating that the focus of the disease will be condition is among the rich. The concentration index can be written expressed in different ways, but one of the most widely used methods proposed by Kakwani [29], is as follows:

\[
C = \frac{2}{n \cdot \mu} \left[ \sum_{i=1}^{n} y_i R_i \right] - 1
\]  

Where In this equation, \( y_i \) shows the health outcome of interest (e.g., malnutrition) of the \( i_{th} \) individual, \( \mu \) indicates its mean, and \( R_i \) represents the fractional rank of the \( i_{th} \) individual in the distribution of socio-economic status. The concentration index is ranges from \(-1\) to \(+1\), where \(-1\) shows indicates the full concentration of the disease on in the poorest quintile and \(+1\) indicates the full concentration of the disease on in the richest quintile. If the disease or health conditions are equally distributed between the quintiles, the concentration index will be equal to zero.

In this study, the concentration indices for stunting, underweight, and wasting at the national level and according to a certain various classifications including dwelling-place of residence (rural or urban) and the gender of the children, gender were estimated separately. The Bootstrap resampling Technique with 500 bootstrap samples was
used to calculate the concentration index and standard error. All analyses were done using Stata 14.1 (StataCorp, College Station, TX, USA).

Ethics
The all analyses done in this study were all-based on the data contained in the survey, and to preserve moral considerations for ethical reasons, the information on the identity of individuals and households was removed. Furthermore, the consent form was signed by the heads of the households and the mothers at the time of collecting that the initial data were collected by the IrMIDHS team.

Results
Table 1 shows the descriptive statistics of the under-five-5 children in the present study. The average values of the height-for-age, weight-for-age, and weight-for-height Z-scores for children were respectively 0.6, 0.62, and 0.44, on average respectively. There were somewhat more male children were a little more than the females children (51.10% vs. 48.9%). A significant percentage majority of the children (63.34%) were living in urban areas, while 36.66% were living in rural areas. The average number of people in each family was 4.4, and the distribution of the children in the study was almost the same across the socio-economic quintiles.

Table 2 shows the rates of stunting, underweight, and wasting at the national level, by area of residence, and by the gender of the child. The results indicated that the overall rate of stunting was higher than that of underweight and/or wasting, and its frequency at the national level was almost twice and three times as much higher as those of underweight and wasting, respectively. The rates of stunting and underweight were significantly higher in rural areas than in urban areas, while although there was no significant relationship between wasting and dwelling place of residence. Although the rates of stunting, underweight, and wasting were slightly higher in males than in females, but no significant difference relationships were found between any of the three malnutrition indices and the gender of the children (Table 2).

Table 3 shows the frequency of stunting, underweight, and wasting among under-five-5 children across socioeconomic quintiles at a national level. The rate of stunting, compared to underweight and wasting, was generally higher in all socioeconomic groups. The number of the children who suffered from malnutrition in the lowest socioeconomic quintile was higher than in other quintiles, and a decline in the frequency of stunting, underweight, and wasting could be seen
as the socioeconomic quintiles were improving, The Table 3 also shows the odds ratios of getting stunting, underweight, and wasting in children of other quintiles compared to the richest quintile. The odds ratio for stunting in children of the four other quintiles had showed a significant relationship compared to the baseline group, and the children in the lowest quintile had more chance, the highest odds ratio. Regarding the underweight index, the odds ratio at the 5% level was significant only for the first two poorest groups compared to the richest quintile, and no significant odds ratio for the wasting index was found in a comparison between other different quintiles and the reference quintile (using the chi-square test).

Figure 1 shows the concentration curve of the stunting, underweight, and wasting indices of the under-five children. The concentration curves for the three malnutrition indices were above the equality line. This implies that the types of malnutrition indices were mainly focused, concentrated among children in poorer groups and that this group of children suffered more from malnutrition. To measure the significance of the concentration curve for each index (stunting, underweight, and wasting) with regard to the equality line, we used the stochastic dominance test. Using the dominance test at the significance level of 5%, the concentration curves for stunting and underweight indices statistically dominated the equality line; in other words, this result suggests that the concentration curves for the stunting and underweight indices were above the equality line with a significant difference to a statistically significant extent, but the concentration curve for the wasting index was not statistically significantly above the equality line, and it was dwelling almost tangent to it.

As can be seen in Table 4, the concentration indices for stunting, underweight, and wasting at the national level were respectively -0.177, -0.092, and -0.032, respectively. The results of the concentration index at the national level showed that the inequality in stunting and underweight was statistically significant and the children in lower deciles quintiles suffered more from malnutrition. The negative value of the concentration indices for stunting and underweight in urban and rural areas also implies the existence of inequality, to the detriment of these conditions concentrated among the lower quintiles. Our results also showed that there was a significant difference between urban and rural areas in terms of inequality, and the lower quintile in urban areas bore a greater burden of stunting than in rural areas (Table 4). The stunting and underweight inequality pattern in terms of children’s gender was so that the likewise indicated a tendency for children in the lower deciles quintiles to suffer more from malnutrition. The wasting index at the national level in terms of dwelling-place of residence and gender of the children showed that there was a significant difference between boys and girls, with boys having a higher incidence of wasting than girls.

Please check the accuracy of this revision; it does not appear to be the case that deciles were used in the analysis.

Please check in light of the above comment about deciles vs. quintiles.
Discussion

Previous studies concerning child malnutrition in Iran have mainly focused on absolute levels of malnutrition and relative trends. Using IrMIDHS data, this study first investigated the prevalence of malnutrition at the national level and in urban and rural areas in Iran, and then measured the socioeconomic inequality in malnutrition among under-five children.

The prevalence of child malnutrition was calculated using stunting, underweight, and wasting indices. Additionally, the rate of inequality in the malnutrition indices was measured through the concentration index. According to the present study (Table 2), the rates of stunting, underweight, and wasting at the national level were obtained found to be 10.13%, 5.7%, and 3.29% percent, respectively, and the values of the malnutrition indices in rural areas were slightly higher than in urban areas. A comparison between the results of this study with those of previous surveys in Iran, such as Multiple Indicator Cluster Survey (1995) and Anthropometric Nutritional Indicators Survey (1999) reveals that similar to in accordance with the global trend of malnutrition prevalence [5], there was a downward trend in the stunting, underweight, and wasting indices both nationally and in urban and rural areas.

Increased access to health services and the development of healthcare centers, as well as the promotion of public health indicators after implementation of a primary health care (PHC) network across the country on the one hand, and the establishment of the Multidisciplinary Program for the Improvement of Nutrition on the other hand, can may be the main reasons for reducing that the prevalence of malnutrition has decreased in recent years in Iran [30].

A total overall reduction of malnutrition can occur by neglecting the nutritional status of children in poor families and improving the nutrition of the children in rich families. Moreover, the average reports of malnutrition indices at the national level can be misleading and may hide the useful and vital subnational information for that can be used for better and more appropriate policy making [31, 32]. Therefore, creating obtaining a clear picture of malnutrition in children within across socioeconomic groups, especially the stunting index, whose which has a well-proven relationship with the socioeconomic status of children has been well proved in previous studies [18, 20, 33] seems essential for policy makers to produce valuable information.
The concentration indexes at the national level for stunting, underweight, and wasting were obtained. Found to be $-0.177$, $-0.092$, and $-0.032$, respectively. Considering these values and the concentration curve (Figure Fig. 1), it is clear that, in general, poorer children suffer more from malnutrition. This is consistent with findings of previous studies on socioeconomic inequality in malnutrition, which have reported socioeconomic inequality in malnutrition to the detriment of lower socioeconomic groups. The concentration index of childhood malnutrition was reported to be $-0.147$ in Nigeria [34]. In the study conducted by Chen et al. study of childhood malnutrition in China, they found the concentration index, indicating socioeconomic inequality of under-five 5 childhood malnutrition, was $-0.366$ [35].

Using DHS-Demographic and Health Survey and MICS-Multiple Indicator Cluster Survey data in 80 countries, Caryn Bredenkamp et al. showed that generally, the decrease in the prevalence of malnutrition had not been accompanied by reduced socioeconomic inequality, and that in all countries malnutrition was concentrated in lower groups, with no exceptions [36]. Furthermore, Ellen Van de Poel et al. used DHS-Demographic and Health Survey data of 47 developing countries to investigate the inequality in stunting and wasting. Their findings indicated that greater inequality in stunting, compared to wasting, was occurred to the advantage of higher socioeconomic groups [20].

Other studies in India [24], South Africa [31], China [37] and Ghana [31] confirmed socioeconomic inequality in children's malnutrition among children. Investigating the inequality in malnutrition indexes in terms of the dwelling place of residence can contribute to policy making and prioritizing the regions where inequality is more. Like as at the national level, the inequality in terms of when analyzed according to children's dwelling place was distributed to the detriment of poorer groups. While the rate of malnutrition indexes in rural areas was higher, the concentration index value for stunting was greater in urban areas. This finding was in line with the results of other studies that have reported more inequality in stunting among the children in urban areas [24, 31, 33]. It seems that a lack of resources and economic opportunities, as well as the rapid population growth in urban areas, may lead to reduced planning potential and increased marginalization. Additionally, the diversity and wider range of variables relating to poverty, nutritional status, disease, and death are among the reasons for the increased inequality in urban areas [38-40].
Strengths and limitations

This study has in turn some advantages and some limitations. Since the data in the present study was extracted from the IrMIDHS survey at the national level with a large randomized sample size, our findings can be generalized to the entire country.

One of the most important limitations of such surveys as the IrMIDHS is the lack of collecting absence of directly collected information about households’ costs, expenditures, and income; and instead, the wealth index was the wealth index based on assets used in this study does not necessarily show similar results that correspond to those obtained using income and household variables, although the wealth index has fewer limitations in developing countries.

The data in this study was extracted from a cross-sectional survey. Therefore, interpretations should be done with caution.

Conclusions

In summary, like other studies, this study showed that the mean values of malnutrition indices at the national level, without knowledge of the distribution of malnutrition among different socioeconomic groups, might be misleading, and that evaluating the distribution of malnutrition among children is as important as assessing the average malnutrition across the entire population. Significant socioeconomic inequality in malnutrition indices (stunting, underweight, and wasting), especially in stunting, was observed at the national level and in urban and rural areas. Regarding the influence of nutrition on the health and economic efficiency-well-being of preschool-aged children, at preschool ages, it is necessary for the government to focus on taking targeted measures to reduce malnutrition, and also focus on the poorer groups of the society who bear a greater burden of malnutrition.

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Conflict of Interest:
The authors have no conflicts of interest to declare for this study.

References


Table 1. Summary statistics for under-5 children based on data from the Iran Multiple Indicator Demographic Health Survey, 2010.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number</th>
<th>Percentage</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height-for-age Z-score</td>
<td></td>
<td></td>
<td>0.6</td>
<td>1.12</td>
</tr>
<tr>
<td>Weight-for-age Z-score</td>
<td></td>
<td></td>
<td>0.62</td>
<td>0.72</td>
</tr>
<tr>
<td>Weight-for-height Z-score</td>
<td></td>
<td></td>
<td>0.44</td>
<td>0.64</td>
</tr>
<tr>
<td>Sex of child</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4,314</td>
<td>51.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4,129</td>
<td>48.90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age of child</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;6 months</td>
<td>782</td>
<td>9.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-12 months</td>
<td>837</td>
<td>9.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;12 months</td>
<td>6,824</td>
<td>80.82</td>
<td></td>
<td></td>
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<tr>
<td>Area of residence</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Rural</td>
<td>3,095</td>
<td>36.66</td>
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<td></td>
</tr>
<tr>
<td>Urban</td>
<td>5,348</td>
<td>63.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breastfeeding duration, years</td>
<td></td>
<td></td>
<td>1.04</td>
<td>0.19</td>
</tr>
<tr>
<td>Number of under-5 children in household</td>
<td></td>
<td></td>
<td>1.26</td>
<td>0.5</td>
</tr>
<tr>
<td>Size of household</td>
<td></td>
<td></td>
<td>4.38</td>
<td>1.6</td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Poorest</td>
<td>1,689</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>1,700</td>
<td>20.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>1,694</td>
<td>20.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rich</td>
<td>1,690</td>
<td>20.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Richest</td>
<td>1,670</td>
<td>19.78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: SD, standard deviation.
Table 2. Estimated rates (%) of stunting, underweight, and wasting in under-5 children at the national level, by area of residence, and by gender, Iran, 2010.

<table>
<thead>
<tr>
<th></th>
<th>Stunting</th>
<th>Underweight</th>
<th>Wasting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rate (%)</td>
<td>P value</td>
<td>Rate (%)</td>
</tr>
<tr>
<td>National</td>
<td>10.13</td>
<td></td>
<td>5.7</td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>8.47</td>
<td>&lt;0.001</td>
<td>4.94</td>
</tr>
<tr>
<td>Rural</td>
<td>12.99</td>
<td></td>
<td>7.01</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10.38</td>
<td>0.422</td>
<td>5.7</td>
</tr>
<tr>
<td>Female</td>
<td>9.86</td>
<td></td>
<td>5.69</td>
</tr>
</tbody>
</table>
Table 3. Frequency, estimated ORs, and 95% CIs of stunting, underweight, and wasting in under-5 children across socioeconomic quintiles, Iran, 2010.

<table>
<thead>
<tr>
<th></th>
<th>Poorest</th>
<th>Poor</th>
<th>Middle</th>
<th>Rich</th>
<th>Richest</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stunting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency (%)</td>
<td>17.4</td>
<td>10</td>
<td>8.3</td>
<td>8.3</td>
<td>6.4</td>
</tr>
<tr>
<td>OR (95% CI)</td>
<td>3.04 (2.4, 3.8)*</td>
<td>1.6 (1.24, 2.08)*</td>
<td>1.32 (1.01, 1.73)*</td>
<td>1.31 (1, 1.72)*</td>
<td>reference</td>
</tr>
<tr>
<td><strong>Underweight</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Frequency (%)</td>
<td>9.7</td>
<td>5</td>
<td>5.3</td>
<td>4.5</td>
<td>3.8</td>
</tr>
<tr>
<td>OR (95% CI)</td>
<td>2.68 (1.98, 3.67)*</td>
<td>1.4 (1, 1.98)*</td>
<td>1.32 (0.93, 1.86)</td>
<td>1.19 (0.84, 1.7)</td>
<td>reference</td>
</tr>
<tr>
<td><strong>Wasting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency (%)</td>
<td>3.8</td>
<td>3.4</td>
<td>3.1</td>
<td>3</td>
<td>2.9</td>
</tr>
<tr>
<td>OR (95% CI)</td>
<td>1.29 (0.87, 1.92)</td>
<td>1.2 (0.8, 1.79)</td>
<td>1.01 (0.66, 1.53)</td>
<td>1 (0.66, 1.52)</td>
<td>reference</td>
</tr>
</tbody>
</table>

Abbreviations: OR, odds ratio.

* All estimates are significant at P<.05 (using the chi-square test)
Table 4. Concentration indices (CIs) of stunting, underweight, and wasting among under-5 children at the national level, by area of residence, and by gender, Iran, 2010.

<table>
<thead>
<tr>
<th></th>
<th>Stunting CI</th>
<th>Stunting P value</th>
<th>Underweight CI</th>
<th>Underweight P value</th>
<th>Wasting CI</th>
<th>Wasting P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>-0.177</td>
<td>&lt; 0.001</td>
<td>-0.092</td>
<td>&lt; 0.001</td>
<td>-0.031</td>
<td>0.369</td>
</tr>
<tr>
<td>Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>-0.176</td>
<td>&lt; 0.001</td>
<td>-0.073</td>
<td>&lt; 0.001</td>
<td>-0.031</td>
<td>0.434</td>
</tr>
<tr>
<td>Rural</td>
<td>-0.107</td>
<td>&lt; 0.001</td>
<td>-0.094</td>
<td>&lt; 0.001</td>
<td>-0.053</td>
<td>0.129</td>
</tr>
<tr>
<td>Diff 1</td>
<td>0.069</td>
<td>0.016</td>
<td>-0.021</td>
<td>0.154</td>
<td>-0.021</td>
<td>0.405</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>-0.176</td>
<td>&lt; 0.001</td>
<td>-0.090</td>
<td>&lt; 0.001</td>
<td>-0.031</td>
<td>0.361</td>
</tr>
<tr>
<td>Female</td>
<td>-0.178</td>
<td>&lt; 0.001</td>
<td>-0.095</td>
<td>&lt; 0.001</td>
<td>-0.031</td>
<td>0.508</td>
</tr>
<tr>
<td>Diff 2</td>
<td>-0.002</td>
<td>0.945</td>
<td>0.005</td>
<td>0.759</td>
<td>-0.000</td>
<td>0.994</td>
</tr>
</tbody>
</table>

Abbreviations: CI, concentration index; Diff 1, the difference in the CI of under-5 child malnutrition between urban and rural; Diff 2, the difference in the CI of under-5 child malnutrition between males and females.

*Independent 2-tailed t test to compare the values with 0.