Iran Red Crescent Med J. 2018 December; 20(S1):e23585. doi: 10.5812/ircmj.23585.

Published online 2016 January 13. **Research Article**

Prioritizing Food Security Indicators in Iran: Application of an Integrated Delphi/AHP Approach

Mohammad Hassan Abolhassani [1], Fariba Kolahdooz [2], Reza Majdzadeh [3], Mohammadreza Eshraghian [3], Roksana Mirkazemi [4] and Abolghasem Djazayery [1, *]

[1] Department of Community Nutrition, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences, Tehran, Iran
[2] Department of Medicine, Aboriginal and Global Health Research, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Canada
[3] Institute of Public Health Research, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran
[4] Occupational Health Research Center (OHRC), Iran University of Medical Sciences, Tehran, Iran

[*] *Corresponding author*: School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences, P. O. Box: 141556446, Tehran, Iran. Tel: +98-2166402095, Fax: +98-2188974462, Email: rmhooman@gmail.com

Received 2014 September 15; **Revised** 2014 September 27; **Accepted** 2014 October 14.

Abstract

Background: Monitoring of food insecurity is a critical issue for planners and policymakers in the public and private sectors in developing countries. Due to the multifactorial and multidimensional nature of food security and a lack of clarity concerning the causes, specific signs, and consequences of food insecurity, developing a reliable food security index is the major challenge related to monitoring food security.

Objectives: The objective of this study was to identify the most appropriate indicators of food security at the provincial level in Iran through the application of an integrated approach including Delphi (classic Delphi) and analytic hierarchy process (AHP) from March to September 2013.

Materials and Methods: The sample included 43 senior-level managers and experts at the national and provincial levels from different fields of related sciences; they were selected purposively as Delphi and AHP panel members based on the experts' opinions and snowballing. In the first round of Delphi, out of 103 identified indicators, 38 were selected by the experts; the indicators were ranked in the second round. In the AHP study, 25 experts assigned weights in a pairwise comparison of the 20 indicators that had the highest priority based on the Delphi results. Using AHP matrix calculations, this list of indicators was ranked based on priority.

Results: Out of 38 indicators identified in Delphi, 8 were related to the availability dimension, 14 were related to the access dimension, and 16 were related to the utilization dimension. Out of 20 indicators that were ranked in the AHP study, 6 indicators were related to availability, 7 were related to utilization, and 7 were related to access dimensions. However, the indicators related to availability had an overall higher rank compared to indicators related to access or utilization.

Conclusions: This study identified and ranked 20 indicators as the most appropriate indicators of food security measurements at the provisional level in Iran.

Keywords: Food Security, Nutrition Indices, Food Vulnerability, Analytic Hierarchy Process (AHP), Delphi Technique

1. Background

Alarming reports of 870 million individuals suffering from chronic undernourishment, the majority of them in developing countries (1), make monitoring of food insecurity a critical issue for legislators, planners, and managers in governmental, public, and private sectors in developing countries.

One of the major challenges faced when monitoring the degree of food insecurity is developing reliable food security indices (2, 3). The multifactorial and multidimensional nature of food security (4) and the lack of clarity about its causes, signs, and consequences (5) are among the major challenges in developing reliable indices for measuring food insecurity and vulnerability in different countries.

An index of food security should identify the food insecure, assess the severity of their food deficit, and characterize the nature of insecurity (seasonal versus chronic). Furthermore, it should provide a basis for monitoring progress and for assessing the impact of environmental change or any interventions (2, 3).

Indicators used in measuring food insecurity cover a wide spectrum of consumption, poverty, and nutritional benchmarks (1). Some indicators of food insecurity are related to the cause of food insecurity, like the percentage of

individuals receiving less than 70% of their daily energy requirement or the unemployment rate, while some are the results of chronic or acute food insecurity, such as anthropometric measures. Furthermore, the world health organization considers four food security dimensions food availability, economic and physical access to food, food utilization, and food stability (vulnerability and shocks) over time (5).

Measuring many of indicators requires technologies, cost, logistics, and expertise that are not readily available in developing countries (6). The measurement cost and sensitivity of indicators to identify food and nutrition insecurity and vulnerability are important criteria. Food vulnerability refers to the condition that places vulnerable people at risk of becoming food insecure (1). In Iran, the presence of food insecurity and vulnerability in various provinces and regions has been documented and attributed to different causes in contrast with the adequate food supply at the national level (7, 8).

2. Objectives

This study was conducted to identify the most appropriate indicators of food insecurity at the provincial level in Iran through the application of an integrated approach involving Delphi and the analytic hierarchy process (AHP). This was a part of larger study to develop a composite index for measuring food insecurity at the provincial level in Iran.

3. Materials and Methods

The study was conducted in multiple stages from March to September 2013 using the two techniques of Delphi and AHP to select and prioritize the most appropriate indicators of food insecurity and vulnerability in Iran. A list of all indicators of food insecurity was collected through a review of the literature. In this review, more than 50 documents and papers, including the national reports on food security in different countries; statistics and reports of relevant Iranian ministries and organizations, such as the ministry of Jihade Keshavarzi, the ministry of health and medical education, and Iran statistics centre, found by searching databases like SID, Magiran, and Iran Medex; and reports of international organizations like the food and agriculture organization (FAO), the world health organization (WHO), and the world food program (WFP), as well as other relevant international organizations' reports like the Food Insecurity and vulnerability information and mapping systems (FIVIMS) reports, found by visiting the official websites and searching databases like Google, Google Scholar, PubMed, and Scopus. Key terms like "food security," "food vulnerability," "food insecurity," and "nutrition assessment" were used, and the search yielded a list of 243 indicators of food insecurity. As the purpose of this stage was to provide a comprehensive list of indicators without judgment about them, and the review process was not a systematic review, no inclusion or exclusion criteria were used for the indicators or literature in this stage. One reviewer listed all of the identified indicators (243 indicators).

In the next stage, out of the 243 indicators, 103 were selected by a group of experts. The selection criteria for indicators included availability of the data in Iran, reliability of data (released from official sources in the country like the ministry of health and medical education, the ministry of Jihade Keshavarzi, and the Iran statistics center), measurability and feasibility of data collection in Iran, and relevance to the Iranian situation.

To identify the most appropriate indicators out of the 103 selected indicators, the two well-accepted and well-known techniques of Delphi and AHP were applied. Classic Delphi was used to identify the most appropriate indicators and AHP was used to set the priority among them.

The Delphi technique is a well-accepted method for achieving consensus or agreement concerning opinions of experts within a certain topic concerning real-world knowledge; the approach was mainly developed by Dalkey and Helmer in the 1950s (9). Since this method is based on eliciting experts' opinions, appropriate selection of Delphi subjects is a critical issue (10). The assumptions of classic Delphi, including concealment of participants' information, two rounds of iterations, controlled feedback and the statistics of results for each round was met in this study.

To select the subjects for the study, an expert committee from different fields of nutrition, agriculture, economic, management, and health was formed. This expert group was responsible for defining the selection criteria of Delphi subjects, following the study, and analyzing the results. The expert group identified 43 senior-level experts as Delphi subjects from different fields of public nutrition, epidemiology, economics and agricultural development, biostatistics, medicine, and medical sciences via purposive expert sampling with maximum variation in the field of expertise method and the snowballing technique.

The selection criteria were as follows:

- Education level and expertise in the relevant field;

- Field experience;

- Commitment and ability to devote enough time to participate in the study;

- Having publications in this field; and

- E-communication skills.

The objective of the study, a brief description of the Delphi method, and the 103 previously identified indicators and their definitions were sent out to all of the panel members by email prior to the first round of the Delphi analysis. In addition, the participants were offered further clarification of the methods via telephone or in person if the letter seemed unclear. Participants chose, combined, or removed some of the indices, and added any other relevant indicators that might be missing on the original list. In the first round, out of 43 Delphi subjects, 28 responded (65.11%). The results of the first round of Delphi were analyzed by the expert group, and indicators were re-categorized based on the responses. The outcome of this stage was a list of 38 final indicators. These indicators formed the basis for the Delphi questionnaire in the second round.

In the second round of Delphi, the experts were asked to rank each indicator on a scale of 0 to 100. To facilitate the ranking process, a Likert score of 5 points was established (0 - 20 was defined as very low priority and 80 - 100 was defined as the highest priority). It was explained to experts that some of the indicators have a negative effect on food security and some have positive effect on food security, which would be considered in the later stages of the study; at this stage, however, they were asked to rank each indicator according to the level of influence on food insecurity. In addition, the experts were asked to add any indicators that they thought should be added to this list. This questionnaire, along with the definitions and explanation concerning each indicator and the results of the first round of Delphi were sent to experts. Out of 28 experts who participated in the first round, 25 (89.3%) responded to the questionnaire in the second round.

The results of the second round of Delphi were analyzed using SPSS version 19. The indicators were prioritized based on the median score for each indicator. In this study, the median and interquartile range was considered a better measure compared to the mean and standard deviation. A median score above 70 was used as the criterion for inclusion of the indicator in the indicator priority lists. The reliability of the questionnaire in the second round of Delphi was measured by calculating the Cronbach's alpha, which showed a high level of reliability ($\alpha = 0.97$).

The next stage involved using the AHP technique to prioritize the selected indicators based on their influence on food insecurity. The AHP technique, which is used to carry out multi-criteria quantitative evaluation, was developed by Saaty and Peniwati to facilitate group decision making based on mathematics and psychology (11). Since then, this technique has been extensively used and refined. In this method, pairwise comparison of criteria is used by experts to determine their significance (weight) (12, 13). In AHP, selection of the appropriate participants (considering positions and expertise) to represent stakeholders is a critical issue (12).

In this stage, the 25 experts that participated in the second round of Delphi were asked to give weight in a pairwise comparison of the 20 indicators that had the highest priority based on the Delphi results. Twelve experts (48.0%) participated in this phase of the study. AHP was conducted based on a three-step approach. First, a hierarchical list of 20 indicators, which were identified as the highest priority indicators by experts in the second round of Delphi, was prepared; then, experts were asked to weight the indicators based on comparisons of paired indicators and by using a table of nine scores.

In this comparison, it was assumed that if attribute A is absolutely more important than attribute B and is rated as 9, then B must be absolutely less important than A and is valued as 1/9. The results of all pairwise comparisons were summarized as several 20×20 comparison Matrixes.

There are different techniques for calculating the relative weight of elements. The most commonly used is the eigenvector method, but as this method is very time consuming in a large dimensional matrix, Saaty and Peniwati offered four other estimation techniques (11). In this study, the geometric mean technique was used.

3.1. Ethical Considerations

All data were kept confidential. No name or identifier was used during the Delphi or AHP procedures. All participants gave verbal consent to participate in the study; the purpose of the study was explained, and the participants were asked to observe confidentiality of data to which they had access during the study. This study was approved by the institutional review boards at the Tehran University of Medical Sciences.

4. Results

Mean age of participants was 50.5 ± 12.8 years. Areas of expertise of the team members, their educational level, and their level of contribution are presented in Table 1. The Delphi results yielded a total of 38 indicators that were ranked hierarchically based on the median of their ranking score on a scale of 0 - 100.

Table 2 shows the results of the Delphi study. From the experts' point of view, the most appropriate indicator of food insecurity and vulnerability was the "percentage of individuals receiving less than 70% of daily energy requirement," with a median of 90. The lowest importance was given to "per capita consumption of tobacco," with a median of 20. "Percentage of food expenditures to total

Table 1. Characteristics of Participating Experts in the Delphi Study and Their Level of Contribution[a]

	Number of Experts to Participating in the Second Stage of Delphi (Percent)	Number of Experts Participating in the First Stage of Delphi (Percent)
Experts' field of expertise		
Nutrition sciences	17 (89.47)	19 (82.60)
Epidemiology	4 (80)	5 (100)
Economy/agriculture	4 (100)	4 (26.66)
Educational level		
PhD and above	20 (0.80)	21 (0.75)
MPH, MSc	5 (0.20)	7 (0.25)
Total	25 (89.28)	28 (65.11)

[a] Data are expressed as No. (%).

household expenditures", "per capita diet energy supply (DES)," and "per capita provision of micro-nutrient (vitamins and minerals) requirement" all ranked second, with a median of 80. "Average consumption of macro-nutrients" and "employment and unemployment rates," with a median of 75, ranked above "prevalence of stunting, wasting, and underweight in children under 5 years," " annual inflation of foodstuff and beverage price," "human development index (HDI)," "percentage of individuals receiving less than 70% of the daily protein requirement," "per capita provision of protein, bread, and cereal," and "per capita production of protein, bread, and cereal," with a median of 70.

"Per capita consumption of tobacco" (median score 20), "number of active beds in healthcare services per 100,000 people" (median score 25), "population density" (median score 30), and "percentage of individuals with daily exercise of at least 10 minutes" (median score 30) were considered the least influential indicators of food insecurity and vulnerability.

Of the indicators identified in Delphi, 8 were related to the availability dimension, 14 were related to the access dimension, and 16 indicators were related to the utilization dimension.

The AHP study result of prioritizing the indicators is shown in Table 3. The AHP results showed that the "prevalence of stunting, wasting, and underweight" had the highest priority, with a mean score of 0.10, and "percentage of individuals receiving less than 70% of the daily energy requirement" ranked second, with a mean score of 0.09. "Percentage of underweight among adults" and "per capita supply of micronutrient" had the third rank, with a mean score of 0.08. "Percentage of food expenditures to total household expenditures" had a mean score of 0.06 and ranked fourth. "Percentage of individuals under coverage of social welfare" and "percentage of individuals with access to a sanitary toilet" had the lowest priority based on the experts' view, with a mean rank of 0.01.

Out of 20 indicators that were ranked in the AHP study, 6 were related to availability, 7 to utilization, and 7 to access dimensions. However, the indicators related to availability had an overall higher rank compared to those related to access or utilization.

5. Discussion

Selecting proper indicators that are easily, less expensively and reliably measurable and sensitive enough to identify all the food insecurity at the household, provincial, and state levels is a main issue in each country, especially concerning the latter two levels in developing countries. To the best of the authors' knowledge, this is the first study aiming to identify the most appropriate food insecurity and vulnerability indicators at the provincial level in Iran. Two well-known collective decision-making techniques, Delphi and AHP, were used to collect the experts' views on the priority indicators of food insecurity and vulnerability in this country.

The Delphi results showed that experts considered a wide range of indicators from different domains, such as food provision, food selection, economic purchasing power, and healthcare provision in the list of priority indicators of food insecurity and vulnerability in Iran. The Delphi study identified the "percentage of individuals receiving less than 70% of daily energy requirement" as the first-ranked indicator in food insecurity and vulnerability; in contrast, the AHP results identified "prevalence of stunting, wasting, and underweight" as the first-ranked indicator, which shows a shift from nutrient intake to an anthropometric measure. However, anthropometric indices are usually considered as late manifestations of food crises

Table 2. Median Scores and Interquartile Range of 38 Indicators of Food Insecurity and Vulnerability Resulting From the Delphi Study

Number	Indicator	Dimension of Food Insecurity	Median Score	Inter-Quartile Range
1	Percentage of individuals receiving less than 70% of daily energy requirement	Availability	90	80 - 100
2	Percentage of food expenditures to total household expenditures	Access	80	60 - 85
3	Per capita diet energy supply (DES)	Availability	80	50 - 80
4	Per capita supply of micronutrient (vitamins and minerals) requirement	Availability	80	50 - 80
5	Average consumption of macro-nutrients (proteins such as meat-grease, bread, and cereals)	Availability	75	70 - 100
6	Employment and unemployment rates	Access	75	70 - 80
7	Prevalence of stunting, wasting, and underweight in children under 5	Utilization/absorption	70	70 – 85
8	Annual inflation rate of foodstuff and beverage price	Access	70	50 - 80
9	Human development index (HDI)	Access	70	40 - 65
10	Percentage of individuals receiving less than 70% of the daily protein requirement	Availability	70	30 - 70
11	Per capita supply of protein, bread, and cereal	Availability	70	60 - 90
12	Per capita production of protein, bread, and cereal	Availability	70	45 - 80
13	Education Index	Access	70	40 - 80
14	Percentage of individuals with access to safe drinking water	Utilization/absorption	65	30 - 65
15	Prevalence of anemia in pregnancy	Utilization/absorption	65	30 - 70
16	Access to primary health care (PHC)	Utilization/absorption	60	50 - 75
17	Percentage of underweight among adults (body mass index (BMI) < 18.5)	Utilization/absorption	60	50 - 80
18	Prevalence of low birth weight (LBW; under 2,500 g)	Utilization/absorption	60	30 - 60
19	Literacy rate		60	20 - 50
20	Average of 5-year rainfall		60	40 - 80
21	Gross domestic product (GDP) index	Access	60	70 - 85
22	Percentage of families under catastrophic health expenditure	Access	60	60 - 85
23	Under 5 mortality rate	Utilization/absorption	60	40 - 80
24	Percentage of population under coverage of social welfare	Access	60	45 - 85
25	Percentage of families with child labor among their children	Access	60	25 - 80
26	Population growth rate	Access	50	20 – 50
27	Percentage children breast fed	Utilization/absorption	50	40 – 80
28	Percentage of individuals with access to a sanitary toilet	Utilization/absorption	50	40 – 80
29	Life expectancy	Utilization/absorption	50	70 - 90
30	Percentage of child vaccination coverage	Utilization/absorption	40	65 - 90
31	Maternal mortality rate	Utilization/absorption	40	40 - 80
32	Total fertility rate	Utilization/absorption	40	40 - 80
33	Prevalence of goiter	Utilization/ absorption	40	10 - 55
34	Ratio of urban population to rural population	Access	40	15 - 50
35	Percentage of people with daily exercise of at least 10 minutes	Utilization/absorption	30	30 - 60
36	Population density (population per square kilometer)	Access	30	40 - 80
37	Number of active beds in healthcare services per 100,000 people	Access	25	30 - 70
38	Per capita consumption of tobacco	Utilization/absorption	20	50 - 80

Table 3. Mean Scores of 20 Top Ranked Indicators of Food Insecurity and Vulnerability in the AHP Study

Number	Indicator	Dimension of Food Insecurity	Mean
1	Prevalence of stunting, wasting, and underweight in children under 5	Utilization/absorption	0.10
2	Percentage of individuals receiving less than 70% of the daily energy requirement	Availability	0.09
3	Percentage of underweight among adults (BMI < 18.5)	Utilization/absorption	0.08
4	Per capita supply of micronutrient (vitamins and minerals) requirement	Availability	0.08
5	Percentage of individuals receiving less than 70% of the daily protein requirement	Availability	0.07
6	Average consumption of macro-nutrients (proteins such as meat-grease, bread, and cereals)	Availability	0.07
7	Under 5 mortality rate	Utilization/absorption	0.06
8	Percentage of food expenditures to total household expenditures	Access	0.06
9	LBW	Utilization/absorption	0.05
10	Prevalence of anemia in pregnancy	Utilization/absorption	0.05
11	Annual inflation rate of foodstuff and beverage price	Access	0.05
12	HDI	Access	0.04
13	Per capita supply of macronutrient	Availability	0.04
14	Average of 5-year rainfall	Availability	0.03
15	Employment and unemployment rates	Access	0.03
16	Percentage of individuals with access to safe drinking water	Utilization/absorption	0.02
17	Percentage of families under catastrophic health expenditure	Access	0.02
18	Literacy rate	Access	0.02
19	Percentage of population under coverage of social welfare	Access	0.01
20	Percentage of individuals with access to a sanitary toilet	Utilization/absorption	0.01

and do not identify food insecurity before physiological changes occur (13).

In the Delphi study, indicators related to economic purchasing power were given high priority; for example, "percentage of food expenditures to total household expenditures" was ranked second in the Delphi study; however, in the AHP results, the indicators related to economic purchasing power were given lower priority. The abovementioned indicator ranked fifth in the AHP analysis. Still, "percentage of food expenditures to total household expenditures" is an important indicator with a good predicting power, as those households that spend more than 75% of their income to purchase food are more vulnerable to food insecurity, regardless of their present food consumption conditions, because any turbulence in their income or purchasing power like inflation can easily expose them to food insecurity, both qualitatively and quantitatively (14).

The HDI was identified as a priority indicator in Delphi (6th rank) and in AHP (7th rank). In, addition some other development-related indicators, such as literacy rate, GDP, employment ratio, and child labor, were considered priority indicators of food security. The State of Food Insecurity in the World, 2012, clarified that while economic growth is necessary to combat hunger and malnutrition, it is not sufficient by itself. In order for economic growth to enhance the nutrition of the neediest, participation and involvement of the poor in the growth process are required, with the generated additional income used for nutrition and health improvement and governmental support to the poor (1). Therefore, considering overall development, literacy, the educational index, and the employment rate ensure that economic growth can reach the poor and empower them to improve their nutrition and health.

The FAO has identified that agricultural growth is particularly effective in reducing hunger and malnutrition, because most of the extreme poor depend on agriculture for their nutrition (1). The average 5-year rainfall has also been considered a priority indicator for food insecurity in Iran. Indicators related to sanitation and access to healthcare facilities show that Iranian experts have noticed the importance of food bio-availability in addition to access and supply.

The percentage of families under coverage of social welfare was considered as priority indicator in both the Delphi and AHP studies. The FAO emphasized that social protection is necessary for accelerating hunger reduction,

as this can protect the most vulnerable, underprivileged individuals; if "properly structured," it can also accelerate empowerment of the poorest to "manage risks and adopt improved technologies with higher productivity" (1).

In the Delphi study, the number of identified indicators related to utilization was greater than the number of identified indicators related to access; the lowest number of identified indicators was related to availability. In contrast, in the AHP study, the number of indicators related to access was equal to the number of indicators related to availability. In both the Delphi and AHP studies, the indicators related to availability had a higher rank and scores. This finding shows that although the utilization dimensions is more often considered by experts, they perceive the importance of the availability dimension to be higher. In "The State of Food Insecurity in The World" (2013), the world health organization in also emphasized that food availability plays a prominent role in food security, and it is necessary to supply enough food to counter food insecurity; however, this measure is not sufficient on its own (4).

5.1. Limitations

The limitations in this study arise from the nature of Delphi and AHP techniques, which may result in biased participant selection, as experts tend to put more focus on their respective field. The presence of a higher percentage of experts from the nutrition field in this study may have affected the median scores given by the experts in favor of nutrition-related indicators. The purposive and snowballing sampling strategy could have had an adverse impact on the representativeness of experts from all relevant fields, and therefore, this limits the generalizability of the results of the study to the total target population.

5.2. Conclusions

In conclusion, the identified range of indicators selected as priority indicators by experts showed that anthropometric measures and nutritional benchmarks are considered the most appropriate indicators by Iranian experts, but other developmental and health-related indicators have also been noted as priority indicators of food insecurity and vulnerability in Iran.

The variation in the ranking of the indicators between the AHP study and the Delphi study can be attributed to the methodological issues latent in these two techniques, as discussed above. This research was part of a larger study to develop a composite index for food insecurity at the provincial level in Iran.

Acknowledgments

The authors would like to thank expert panel members for so generously giving of their time and knowledge and for their extensive collaborations throughout the project. Special thanks to Mr. Saeid Manavi and Ms. Afsaneh Omidimorad for their help in AHP analysis.

Footnotes

Authors' Contribution: Mohammad Hassan Abolhasani designed, formulated, and conducted the research; Fariba Kolahdooz, Reza Majdzadeh, and Mohammadreza Eshraghian contributed to the formulation of the research; Roksana Mirkazemi contributed in formulating and writing the manuscript; Abolghasem Djazayery supervised the research.

Conflict of Interests: It was not declared by the authors.

Ethical Approval: This study was approved by the institutional review boards at the Tehran University of Medical Sciences.

Funding/Support: This project was supported by postgraduate funds from the Tehran University of Medical Sciences.

Informed Consent: All participants gave verbal consent to participate in the study.

References

1. McGuire S. WHO, World Food Programme, and International Fund for Agricultural Development. 2012. The State of Food Insecurity in the World 2012. Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition. *Adv Nutr Int Rev J*. 2013;**4**(1):126–7. doi: 10.3945/an.112.003343.
2. Jones AD, Ngure FM, Pelto G, Young SL. What are we assessing when we measure food security? A compendium and review of current metrics. *Adv Nutr*. 2013;**4**(5):481–505. doi: 10.3945/an.113.004119. [PubMed: 24038241].
3. Baumann SM, Webb P, Zeller M. Validity of food consumption indicators in the Lao context: moving toward cross-cultural standardization. *Food Nutr Bull*. 2013;**34**(1):105–19.
4. FAO , IFAD , WFP. *Food and Agriculture Organization of the United Nations.Rome;*. 2013.
5. Pangaribowo EH, Gerber N, Torero MA. Food and Nutrition Security Indicators: A Review. *SSRN Electronic J*. 2013. doi: 10.2139/ssrn.2237992.
6. Kennedy G, Berardo A, Papavero C, Horjus P, Ballard T, Dop M, et al. Proxy measures of household food consumption for food security assessment and surveillance: comparison of the household dietary diversity and food consumption scores. *Public Health Nutr*. 2010;**13**(12):2010–8. doi: 10.1017/S136898001000145X. [PubMed: 20602864].
7. Kolahdooz F, Najafi F, Sadeghi Ghotbabadi F. *Report of a national survey: food security information and mapping system in Iran*. Tehran: Nafis Negar; 2012.

8. Mohammadzadeh A, Dorosty A, Eshraghian M. Household food security status and associated factors among high-school students in Esfahan, Iran. *Public Health Nutr*. 2010;**13**(10):1609-13. doi: 10.1017/S1368980010000467. [PubMed: 20359375].
9. Dalkey N, Helmer O. An Experimental Application of the DELPHI Method to the Use of Experts. *Manag Sci*. 1963;**9**(3):458-67. doi: 10.1287/mnsc.9.3.458.
10. Boulkedid R, Abdoul H, Loustau M, Sibony O, Alberti C. Using and reporting the Delphi method for selecting healthcare quality indicators: a systematic review. *PLoS One*. 2011;**6**(6). eee20476. doi: 10.1371/journal.pone.0020476. [PubMed: 21694759].
11. Saaty TL, Peniwati K. *Group decision making: drawing out and reconciling differences*. RWS publications; 2013.
12. Shi S, Cao J, Feng L, Liang W, Zhang L. Construction of a technique plan repository and evaluation system based on AHP group decision-making for emergency treatment and disposal in chemical pollution accidents. *J Hazard Materials*. 2014;**276**:200–6.
13. Young H, Jaspars S. Nutritional assessments, food security and famine. *Disasters*. 1995;**19**(1):26-36. [PubMed: 7735853].
14. Smith LC, Subandoro A. *Measuring food security using household expenditure surveys. Intl Food Policy Res Inst*. 2007.