

## Investigating the Financial Burden of Inappropriate Use of Supplements in Children under Two Years of Age Receiving the HealthCare Services at Government Health Centers in Qom Province, Iran, in 2019

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### Abstract

**Background:** Given the importance of appropriate use of supplements in children and increasing the effectiveness of the financial resources, this study aimed at investigating the inappropriate use of the supplements.

**Materials and Methods:** In this cross-sectional study, the data were collected using a researcher made questionnaire. Participants of the study were randomly selected from the cases whose information was available in the integrated health system (SIB). They comprised of 1220 children under two years of age who lived in Qom province. All samples were interviewed in comprehensive health care centers by trained nutritionists obtaining their demographic information including the place of residence, age, income, occupation and educational level, as well as their status of supplements usage. All statistical data were analyzed through SPSS 23.

**Results:** According to the results, it was estimated that 15.15% of financial resources of Iran's health system transformation plan were allocated to the family physician program and 29.11% of its financial resources were wasted. The total waste was 8,615,324,009 Rials (27.87%).

**Conclusion:** Due to the significant percentage of wastage in resources allocated to providing supplements for children under two years of age, it is necessary to design and implement appropriate educational interventions for mothers of under two-year-old children and more precisely monitor the allocation of the resources in this field.

**Key Words:** Children under two years of age, Financial burden, Supplement drops.

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## 1- INTRODUCTION

Micronutrients are considered as one of the major groups of nutrients the body needs. A deficiency in such nutrients may result in the disruption of the normal functioning of the body and the occurrence of various diseases in people (1). Micronutrient deficiencies especially iron and vitamin A and vitamin D, are common nutritional problems in children under two years of age. Today, food safety is one of the national and international priority programs; and in the meantime, special attention has been given to food security, especially in the sustainable development goals (SDGs). Micronutrient deficiencies form an important global health issue in many countries worldwide, especially in developing countries (2). According to the World Health Organization's (WHO) recommendations and the guidelines issued by Iranian Ministry of health and Medical Education, the use of vitamin supplements containing vitamins A and D, multivitamin drops or iron supplements for children are essential(3). Based on the new health care services provided for children, children under two years of age should take iron supplements and supplements containing vitamins A and D. Evaluating the dosage recommended for infants is, then, one of the main functions of a health system. (4) In this study, more than 98% of subjects receiving the healthcare services at government health centers in Qom province were children under two years of age living in this province, and some children for some reasons (such as oral and dental complications, gastrointestinal complications, family or physician-induced demand, forgiving to give the child's supplements on the part of the family, having supplement intolerances, etc.) have not taken supplements (5), which may lead to wasting the financial resources allocated

to the provision of this service. It is considerable that 4% of financial resources are allocated to rural health insurance and the family physician program for providing the supplements and 11% to the health system transformation plan in the field of health and distributing supplements containing vitamins A and D, multivitamins or iron drops among all infants at the specified time provided in the instructions and providing parents with necessary training on how to use these micronutrients for children (6). However, no comprehensive study has been conducted, so far, to assess the relationship between the use of supplements and possible wastage of these supplements. In this study, in addition to examining the demographic factors related to infants and families, factors such as availability, geographical distribution, required financial resources, allocated financial resources, appropriate or inappropriate use of supplements in infants, financial burden of Inappropriate use of supplements, and the wasted financial resources were evaluated; moreover, this study may offer an opportunity to conduct further studies on the causes for wasting the financial resources allocated to other sectors. According Budget distribution guidelines, in total, 27,894,511,309 Rials (11% of the financial resources of Iran's health system transformation plan) are allocated to programs providing the supplements for Qom city and its suburban parts; and 3,276,503,597 Rials (4 % of the financial resources of Iran's health system transformation plan) are allocated to the health services for villages and cities with populations less than 20,000 (7).

Accordingly, due to limited health care resources, this study attempted to investigate the financial burden of inappropriate use of supplements in children under two years of age, receiving the health care services at

government health centers in Qom province in 2019.

## **2- MATERIALS AND METHODS**

### **2-1. Study design and population**

The study population consisted of children under two years of age living in urban, suburban and rural areas of Qom province. Proportional stratified sampling was used for selecting the participants from among the cases whose data were provided in the Integrated Health System (SIB) and the Statistical Centre of Iran (SCI) as well as Civil Registration Office of Qom province. The sample size was determined per group. The participants were divided into three groups: (1) those living in urban and rural areas with populations of less than 20,000 (n=90, population= 100,000 people), (2) those living suburbs and low-income areas (n=353, population= 390,000 people), and (3) those living in Qom city (n=777, population= 859,000 people). According to data obtained from the SIB, the sample size per group was calculated using the simple random sampling.

### **2-2. Methods**

In the next step, using the drug information system of the Food and Drug Organization, Ministry of Health & Medical Education, the dose of supplement drops was obtained and also using the system announcing the dose and conditions of drugs confirmed by Iran's Health Insurance Organization, the dose of supplement drops existing in Iran's pharmaceutical market was obtained; afterwards, the weighted average price of each supplement was to be determined, since due to a sharp rise in inflation in 2019 and the restrictions of drug manufacturing and distribution for drug companies, the price of goods and services, including drugs, had increased by several times during this year. Determination method of the weighted

average price of each supplement ( $\sum_{i=1}^3 w_i x_i / w_i$ ) was used based on the number and price of each drop based on which the weighted average price of iron supplementation was 34.880 Rials and supplements containing vitamins A and D or multivitamin were 35.536 Rials.

### **2-3. Measuring tools: Validity and reliability**

The study tool was questionnaire. This questionnaire consisted of two parts; the first part dealt with generic questions on the demographic characteristics of the participants including their personal and family-related characteristics; and the second part dealt with the questions on access to supplements containing vitamins A and D, supplementation with iron or multivitamins when receiving health care services and appropriate or inappropriate use of these supplements and factors affecting it. 10% of the questionnaires were reviewed by the researcher in order to confirm their validity and reliability. The validity of the questionnaire was examined by the panel of experts based on their opinions and knowledge of the field. Cronbach's alpha was used to assess its reliability. Cronbach's alpha was 0.76 for a sample size of 30.

### **2-4. Ethical consideration**

This study was approved by the ethical committee of Iran University of Medical Sciences (IR.IUMS.REC.1398.738).

### **2-5. Data Analyses**

The obtained data were entered into statistical software. After selecting the subjects and obtaining their individual characteristics as well as the geographical information about their place of residence, a standardized questionnaire included information on the age of the mother and the infant, parental education level, the level of household income, healthcare services

provided by government health centers, the usage status of supplements containing vitamins A and D, the usage status of supplementation with iron or multivitamins, dose of each supplement assessed by a trained person in the field of nutrition, etc. All statistical analysis were performed using SPSS 23. The Pearson Chi-square test and independent-samples t- test were used to test the research hypotheses. The independent-samples t-test was used to examine the association between the age of the mother and the infant and the adequate intakes of iron supplementation and supplements containing vitamins A and D or multivitamins.

### 3- RESULTS

The study participants comprised of 1, 220 children under two years old living in Qom province. Out of 1, 220 participants, 576 were boys (47.2%), and 644 girls (52.8%). Regarding the place of residence, 777 subjects (63.7%) lived in Qom city, 353 subjects (28.9%) lived in the suburbs and low-income areas and 90 subjects (7.4%) lived in in urban and rural areas with populations of less than 20,000. Regarding parental education level, 856 mothers (70.16%) and 1,175 fathers (96.31%) had a high school diploma or less. The results of this study demonstrated that 64.3% of children had access to iron supplementation distributed by Government Health Centers. Access to supplements containing vitamins A and D or multivitamins compared to iron supplementation was slightly better provided, since 77.7% of children had access to these supplements. Moreover, our results revealed that 61.3% of these children did not receive iron supplementation or did not fully use it. Regarding supplements containing vitamins A and D or

multivitamin, 40.2%.of children did not receive them or did not fully use them. Regarding the mother's occupational status, 94.4% of mothers were housewives.

In this study, children ranged from 0 to 24 months in age; the highest frequency (23.2%) was in age group of 21-24 months. The mothers' age ranged from 13 to 54 years, the highest frequency of which was in the age group of 26-30 years (30.5%). Regarding the level of household income, 39.9% of the families had incomes below 15 million Rials, 52% of them had incomes between 15-30 million Rials, 7.6% had incomes between 30-45 million Rials, and 0.5% had incomes greater than 45 million Rials per month. (**Table 1**)

The results of independent-samples t-test showed that there was a significant association between age of the infant and the adequate intakes of iron supplementation ( $p=0.026$ ) and supplements containing vitamin A and D or multivitamin ( $p = 0.001$ ), but no significant correlation was found between maternal age and adequate intake of iron and vitamins A-D or multivitamin supplementation (**Table 2**).

According to the results of the tests performed, a significant associations was observed between place of residence and adequate intake of iron supplementation. ( $P = 0.000$ ), so that the children living in urban and rural areas with populations less than 20,000, the suburbs and Qom received the adequate intake of iron supplementation. Similarly, there was a significant association between place of residence and adequate intake of supplements containing vitamins A and D or multivitamin ( $p=0.020$ ). (**Table 3**)

**Table-1:** Demographic information obtained in the studied samples

Variables		Frequency	Percentage frequency	Cumulative Percent
Sex	Male	576	47.20%	47.20%
	Female	644	52.80%	100.00%
Place of residence	Urban areas	777	63.70%	63.70%
	Suborn / the low-income suburban parts	353	28.90%	92.60%
	Rural areas	90	7.40%	100.00%
Mother's education level	Primary education	142	11.60%	15.90%
	Less than high school diploma	178	14.60%	30.50%
	high school diploma	484	39.70%	70.20%
	post graduate degree	364	29.80%	100.00%
Father's education level	illiterate	45	3.70%	3.70%
	Primary education	150	12.30%	16.00%
	Less than high school diploma	190	15.60%	31.60%
	high school diploma	405	33.20%	64.80%
	post graduate degree	430	35.20%	100.00%
Receiving supplements containing Iron	Yes	785	64.30%	64.30%
	No	435	35.70%	100.00%
Receiving supplements containing vitamins A and D or multivitamins	Yes	948	77.70%	77.70%
	No	272	22.30%	100.00%
Adequate intake of supplements containing Iron	Yes	472	38.70%	38.70%
	No	748	61.30%	100.00%
Adequate intake of supplements containing vitamins A and D or multivitamins	Yes	730	59.80%	59.80%
	No	490	40.20%	100.00%
level of household income	Less than 15 million Rials	487	39.90%	39.90%
	15 million Rials <income<30 million Rials	634	52.00%	91.90%
	30 million Rials <income<45 million Rials	93	7.60%	99.50%
	More than 45 million Rials	6	0.50%	100.00%
Mother's occupation	Housewives	1152	94.40%	94.40%
	Outdoor worker	68	5.60%	100.00%

**Table-2:** Relationship between child and maternal age and child supplementation

The Independent Samples t-Test	d.f	T	P value
The age of the child (month)/ the adequate intake of iron supplementation	783	-2.196	P<0.05
The age of the mother (year)/ the adequate intake of iron supplementation	783	0.214	P>0.05
The age of the child (month)/ the adequate intake of supplements containing vitamin A and D	946	-3.378	P<0.05
The age of the mother (year)/ the adequate intake of supplements containing vitamin A and D	946	0.262	P>0.05

**Table-3:** association of place of residence with adequate intakes of iron vitamin A and D supplementation

Testing hypotheses	Yes	No	Total	P value	
place of residence/ the adequate intake of iron supplementation	Urban areas	261 (61. %)	161 (38.2%)	422 (100%)	P<0.05
	Suborn				
	the low-income suburban parts	154 (53.1%)	146 (46.9%)	290 (100%)	
	Rural areas	57 78.1%	16 21.9%	73 100%	
	Qom province	472 (60.1%)	313 (39.9%)	785 (100%)	
place of residence/ the adequate intake of supplements containing vitamin A and D	Urban areas	414 (77.5%)	120 (22.5%)	534 (100%)	P<0.05
	the low-income suburban parts	224 (73.5%)	88 (26.5)	332 (100%)	
	Rural areas	72 (87.8%)	10 12.2%	82 (100%)	
	Qom province	730 (77%)	218 (23%)	948 (100%)	

Moreover, no statistically significant association was observed between maternal education level and the adequate intake of supplements containing vitamins A and D or multivitamins (p=0.217). Likewise, there was no significant relationship between maternal education level and the adequate intake of iron supplementation (p =0.131). A significant association was, however, observed between the father's education level and the adequate intake of supplements

containing vitamins A and D or multivitamin (p=0.041), while there was no significant relationship between the father's education level and the adequate intake of iron supplementation (p= 0.104). No statistically significant association was found between household income level and the adequate intakes of iron supplementation (p=0.240) and the supplements containing vitamins A and D or multivitamins (p=0.325). Additionally, there was no

significant association between maternal occupation and the adequate intakes of iron supplementation ( $p=0.497$ ) and supplements

containing vitamins A and D or multivitamins ( $p=0.329$ ). (**Table 4**)

**Table-4:** Association between adequate intakes of supplements and Demographic variables

		Value	df	P value
Testing hypotheses (Vitamin A D)	Mother's education level	5.769 <sup>a</sup>	4	.217
	Father's education level	9.954 <sup>a</sup>	4	.041
	level of household income	4.206 <sup>a</sup>	3	.325
	Mother's occupation	.034 <sup>a</sup>	1	.329
Testing hypotheses (Iron)	Mother's education level	7.089 <sup>a</sup>	4	.131
	Father's education level	7.676 <sup>a</sup>	4	.104
	level of household income	4.206 <sup>a</sup>	3	.240
	Mother's occupation	.034 <sup>a</sup>	1	.497

Based on the data obtained from demographic information as well as the calculation of the costs of the wastage of supplements provided to 0-24-month-old children using the weighted average, the following results were obtained as shown in **Table 5:**

- 161 of the subjects living in Qom city (38.2% of all), did not fully take iron supplementation, which wasted 38.15% of the financial resources, equal to 67,388,160 Rials.
- 136 of the subjects living in the low-income suburban parts of Qom city, (46.9% of all) did not fully take iron supplementation, which wasted 46.90% of the financial resources, equal to 56,924,160 Rials.
- 16 of the subjects, living in rural areas (21.9% of all) did not take iron supplementation fully, which wasted 21.92

% of the financial resources, equal to 6, 696, 960 Rials.

- 120 of the subjects living in Qom city (22.5% of all) did not fully take supplements containing vitamins A and D or multivitamins, which wasted 22.47% of the financial resources, equal to 102,343,680 Rials.
- 88 of the subjects living in the low-income suburban parts of Qom city (26.51% of all) did not fully take supplements containing vitamins A and D or multivitamins, which wasted 26.51% of the financial resources, equal to 75,052,032 Rials.
- 10 subjects living in rural areas (12.2% of all) did not fully take supplements containing vitamins A and D or multivitamins, which wasted 12.20% of the financial resources, equal to 8,528,640 Rials. (**Table5**)

**Table-5:** Percentage wastage of supplements in the study population

	Place of residence	Urban areas	Low-income suburban parts	Rural areas	Total
Adequate intake of Iron supplementation	Yes	261	154	57	472
	No	161	136	16	313
Adequate intake of supplements containing vitamins A and D	Yes	414	244	72	730
	No	120	88	10	218
Annual costs of iron supplementation use in children (Rials)	The costs of complete consumption	109,244,160 Rials	64,458,240 Rials	23,857,920 Rials	197,560,320 Rials
	The wasted costs	67,388,160 Rials	56,924,160 Rials	6,696,960 Rials	124,981,980 Rials
	The wasted costs (percentage)	38.15%	46.90%	21.92%	38.75%
Annual costs of the use of supplements containing vitamins A and D in children (Rials)	The cost of complete consumption	353,085,696 Rials	208,098,816 Rials	61,406,208 Rials	622,590,720 Rials
	The wasted costs	102,343,680 Rials	75,052,032 Rials	8,528,640 Rials	177,395,712 Rials
	The wasted costs (percentage)	22.47%	26.51%	12.20%	22.17%
Total costs and wastage percentage of the financial resources among the study population	Place of residence	Urban areas	Suborn the low-income suburban parts	Rural areas	Total
Total costs of the supplements providing program for the study subjects per year	The cost of complete consumption	632,061,696 Rials	404,533,248 Rials	100,489,728 Rials	1,137,084,672 Rials
	The wasted costs	169,731,840 Rials	131,976,192 Rials	15,225,600 Rials	316,933,632 Rials
Wastage percentage of the financial resources		29.11%		15.15%	27.87%

#### 4- DISCUSSION

Micronutrient deficiencies, especially in regard to iron and vitamin A and vitamin D, form an important global health issue, and consumption of these supplements has been recommended by healthcare systems (2). There are different views about the consumption of these micronutrients, so that some believe that dietary modifications (especially in children) and the modified food pyramid for family can reduce the micronutrient deficiency (11). Some studies and supplemental programs for children in developed countries recommend different methods of enriching infant cereals or the use of MMPs (12) (13) in order to provide household food security and children's health (14). In the same line, some scientific research studies considering the adverse effects of supplements and the need for caution in giving them to a child recommend for providing the nutrients and diets containing a variety of different foods instead of dietary supplements (12). Despite, in the supplements providing program for children aged 0-24 months, according to national programs and recommendations of the World Health Organization, iron, vitamin A and vitamin D supplements should be given to a child daily to reduce the micronutrient deficiencies (6). The present study, thus, investigated the financial burden of inappropriate use of supplements in children under two years of age receiving the healthcare services at government health centers in Qom province during 2018. Among 948 subjects (77%) living in Qom province, 218 cases (23%) did not fully take supplements containing vitamins A and D or multivitamins; and caused a loss of 185,924,352 Rials out of 808,515,072 Rials allocated to the supplements providing program for children. Likewise, amongst 785 subjects (64.3%) living in Qom province, 313 cases (39.87 %) did not fully take iron

supplementation; and caused a loss of 131,009,280 Rials out of 328,569,600 Rials allocated to this program (**Table 5**).

Finally, according to the obtained data, the total financial burden of inappropriate use of supplements in children under two years of age living in Qom province was 8,615,324,009 Rials out of 31,171,014,906 Rials allocated to the program (27.87%) (**Table 5**).

The findings revealed that 23% of children receiving supplements containing vitamins A and D or multivitamin did not take them fully and wasted the financial resources allocated to this service in Qom province. This is consistent with the results of a study conducted by Dr. Kermani at Milad Hospital, suggesting that only 70% of people had fully taken the supplements containing vitamins A and D. In addition, 42% of clients in his study did not have access to supplements containing vitamins A and D, which was higher than the data obtained from our study, but the results are consistent with our findings (17). Moreover we found that 39.87% of children did not fully take the iron supplementations, which wasted 39.87% of financial resources. According to studies conducted in this regard, especially Masoudpour's study in Rafsanjan city this result can be related to the side effects of the use of iron supplementation observed by those receiving this service (18). Previous studies have shown that adequate intake of iron supplementation in people living in Rafsanjan (18), Ardabil (8); Gorgan (19) and Yasuj (20) was found to be about 50%. In the present study, it was approximately 60%, which was consistent with the results obtained from studies conducted in other cities.

Furthermore, our results revealed no significant association between the adequate intakes of vitamins A and vitamin D and iron supplements and maternal education level ( $p = 0.131$ ) and ( $p = 0.217$ ), respectively. These findings

are also consistent with the results of studies in Ardabil (8) and Milad Hospital in Tehran (17). Moreover, in this study, no significant relationship was observed between the adequate intake of iron supplementation and father's education level ( $p = 0.104$ ), but there was a relationship between adequate intake of supplements containing vitamins A and D and father's education level ( $p=0.041$ ). Our results showed that there was a significant association between the age of the child and adequate intakes of iron supplementation ( $p = 0.026$ ) and supplements containing vitamins A and D ( $p = 0.001$ ). In addition, no significant association was observed between the maternal age and the adequate intakes of iron supplementation ( $p = 0.140$ ) as well as supplements containing vitamins A and D ( $p = 0.428$ ). However, the results obtained from the study conducted in Rafsanjan showed a significant relationship between maternal age and adequate intake of iron supplementation ( $p = 0.000$ ) (18). Moreover, the present study showed that there was no significant association between the maternal occupation and the adequate intakes of iron supplementation and supplements containing vitamins A and D ( $p=0.513$ ). (Table 4)

The present study also investigated the financial burden of inappropriate use of supplements in children under two years of age receiving the healthcare services at government health centers in Qom Province during 2018 and the results revealed that only 64.3% of children under 2 years of age living in Qom Province had access to iron drops and 77.7% of them had access to vitamin drops and only 38.69% of children under 2 years received the iron supplementation and 59.84% of them received supplements containing vitamins A and D or multivitamin adequately. Further in this study, the rate of the wasted financial resources in the supplements providing program for

children was about 27/87%, which due to the overhead costs of the mentioned chain, the real value will be much more than this amount. (Table 5)

According to some studies, a maximum of 10% wastage in financial resources allocated to family physician program (related to delivering quality health services) is acceptable in Iran's health system transformation plan (6). The rate of wastage found in the present study is not, however, acceptable; and the parameters related to the health service providers, the recipient of services and distributor of the supplements must then be evaluated.

## 5- CONCLUSION

Considering the significant percentage of wastage in resources allocated to providing supplements for children under two years of age, it is necessary to design and implement educational interventions for mothers of under two-year-old children and more precisely monitor the allocation of resources in this field.

## 6- Acknowledgment

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