Journal of Nutrition and Food Security
Shahid Sadoughi University of Medical Sciences
School of Public Health
Department of Nutrition
Nutrition & Food Security Research Center

eISSN: 2476-7425 pISSN: 2476-7417 JNFS 2024; 9(1): 59-68 Website: jnfs.ssu.ac.ir

Food and Nutrition Literacy through Formal Education in Iran: A Content Analysis of School Textbooks

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ARTICLE INFO

ORIGINAL ARTICLE

Article history:
Received: 27 Oct 2022
Revised: 23 Nov 2022
Accepted:28 Nov 2022

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ABSTRACT

Background: Formal education in any society should foster all aspects of students' growth. However, studying the curriculum of the country academic period indicates null food and nutrition. Nutrition, as an essential factor in the health of students, can play an effective role in their academic progress. This study aimed to analyze the content of school textbooks concerning food and nutrition literacy (FNLIT) concept and its components in Iran. **Methods:** This study is a content analysis of school textbooks during 2020-2021 academic year. All school textbooks published in 2020 for elementary (grades 1st to 6th), junior high school (grades 7th to 9th), as well as high schools (grades 10th to 12th) were included. Content analysis of the textbooks was conducted based on Krippendorf framework using FNLIT component checklist. The reliability assessment using Holsti method was 85.29% for elementary school textbooks and 84.78% for junior high school and high school textbooks. **Results:** The cognitive domain of FNLIT had the highest frequency (92%) within the text, images, and practice questions of the elementary school textbooks, followed by very few references regarding the skill domain (7%). The value-attitude domain was largely unnoticed (1%). In junior high school textbooks, the total number of FNLIT components was 439, of which the cognitive domain of 308 (70.16%) had the highest frequency, followed by the skill domain with 96 units (21.86%), while only 35 units were identified regarding the value-attitude domain (7.97%). In high school textbooks, 342 units of analysis were identified, 82.16% of which were related to cognition, 14.03% value-attitude domain, and only 3.80% were related to the skill domain. **Conclusion**: Meager attention is given to FNLIT and its components in school textbooks in Iran, especially concerning skill and value-attitude domains.

Keywords: *Content analysis; Literacy; Schools; Textbooks; Iran*

Introduction

Non-communicable diseases (NCDs) have lead to more than 60% of the disease burden and 70% of death by 2020 (Spronk *et al.*, 2014). Unhealthy eating has been recognized as one of the most important risk factors associated with NCDs (Sheikholeslam *et al.*, 2004). Eating is a complex

This paper should be cited as: Dehghani M, Omidvar N, Doustmohammadian A, Tork Z, Arvand A. ***Food and Nutrition Literacy through Formal Education in Iran: A Content Analysis of School Textbooks.*** *Journal of Nutrition and Food Security (JNFS)*, 2024; 9 (1): 59-68.

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[DOI: 10.18502/jnfs.v9i1.14841]

behavior affecting multiple factors, from individual and social to environmental determinants. Lack of awareness and skills related to food selection, preparation, and consumption can increase the risk of diseases. Making healthy food choices in different contexts, settings, and situations, so-called food and nutrition literacy (FNLIT), is considered essential to healthy eating (Vidgen and Gallegos, 2014).

Childhood and adolescence are critical periods in shaping dietary habits that will continue through adulthood (Chung, 2017, Ronto *et al.*, 2016). Studies have shown that food/nutrition literacy is a key factor in shaping eating patterns of children and adolescents (Laska *et al.*, 2012, Zoellner *et al.*, 2011). School curriculums and textbooks are important sources of learning in this age group. Improvement of educational programs and related materials is critical in promoting community health and nutrition (Ronto *et al.*, 2017). However, studies on the content analysis of school textbooks with regard to health literacy and, in particular FNLIT are scarce (D'Onofrio and Singer, 1983, Subba Rao *et al.*, 2012). Rafieeian analyzed contents of science textbooks of elementary schools in Iran to address food groups (Rafiean, 2014). They found that among 471 surveyed units, the main attention was given to cereals and bread group, and other food groups, specifically milk and dairy group, were ignored(Rafiean, 2014)(Rafiean, 2014)(Rafiean, 2014).

Considering the role of textbooks in formal education and due to the centralized education system in Iran, their content in terms of nutrition literacy is of great importance. Therefore, this study aimed to evaluate the content of school textbooks and curriculums in Iran with regard to FNLIT components. It is hoped that the results will provide insightful feedback for education planners and school textbook authors to re-evaluate educational content related to food and nutrition skills.

Materials and Methods

Study design and sampling

This descriptive study was based on the content analysis method. All textbooks published during 2020-2021 academic year for elementary (grade 1st to 6th), junior high school (grade 7th to 9th), as well as high schools (grades 10th to 12th) in Iran were included and analyzed. The analysis unit was all pages of 41 books of elementary school (4878 pages), 33 books of junior high school (4499 pages), and 94 books of high school (11931 pages), including texts, pictures, and practice questions, as well as the lesson-plan handbooks for the teachers.

Development and validity of the checklist: A checklist was developed based on previous studies (Ashoori *et al.*, 2020, Doustmohammadian *et al.*, 2017), which included components of FNLIT. The validity of the checklist was confirmed by an expert panel, including five experts from the fields of nutrition and curriculum design. The reliability of the checklist was also assessed based on the agreement rate between two coders, calculated by Holsti equation (Mao, 2017):

$$CR = \frac{2M}{N_1 + N_2}$$

where CR represents the percentage of agreement between two coders, M is the number of two coders' consensus decisions, and N1 and N2 are the number of coders' decisions, respectively. The reliability assessment was 84.88% for elementary school textbooks and 84.78% for junior high school and high school textbooks. Therefore, the reliability of the checklist was satisfactory.

Content analysis procedure: Content analysis was performed through the following steps based on the content analysis framework presented by Krippendorf (Krippendorff, 2004):

- First, texts, images, and practice questions from each school textbook related to the components of FNLIT were extracted and inserted into the chart.
- Second, the frequency of each component was counted.
- Third, according to the data, the number of elements of FNLIT in the textbooks was compared.

The content of textbooks was analyzed using

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FNLIT components (Doustmohammadian *et al.*, 2017), presented in **Table 1**.

Table 1. Components of FNLIT domains.

Domain	Main categories	Sub-categories
Cognitive	Health-based knowledge	Food and nutrition knowledge Lifestyle knowledge Food safety knowledge
	Food science	Food preparation knowledge
Skills	Functional	Access Application a. Healthy eating behaviors and health b. Food choices
	Interactive	Interactive skills Discussion Skills Self-control skills
	Critical	Media literacy Analysis of food labeling Decision-making and planning in specific circumstances
Values	Value issues related to food	Respecting cultural and social issues related to food food and Nutrition trends Nutritional health value

Ethical concideration: The ethical committee of the National Nutrition and Food Technology Research Institute, Shahid Beheshti, University of Medical Sciences approved the study protocol (No: IR.SBMU.NNFTRI.REC.1398.018).

Results

In all the reviewed textbooks, from elementary to junior high school and high school, the cognitive domain was the most frequently addressed (92%) FNLIT component, compared to the skill domain (7%) and value domain (1%) (**Table 2**). The total number of FNLIT components identified in junior high school textbooks was 439, cognitive domain of which had the highest frequency (308 units, 70.16%). It was followed by the skill domain (96 units, 21.86%) and value domain (35 units, 7.97%), respectively (**Table 3**). In high school textbooks, cognitive aspects also had the highest frequency (281 units, 82.16%), while it was followed by value-attitude domain (48 units, 14.03%), and skill domain had the lowest frequency (13 units, 3.80%) (**Table 4**).

Some instrumental applications of food items were also identified. They included cases where foods were used to better understand the subject matter. For example, the use of butter or milk to teach the concept of liter and/or volume in elementary school, cakes or pizza to lead a division in junior high school math, or images of potatoes, chicken, and rice to define the genes and number of chromosomes in organisms in the 8th-grade science textbook. The frequency of instrumental application of food in textbooks was relatively high in almost all grades. The total frequency of instrumental application of FNLIT components in three cognitive, skill, and value domains in elementary school textbooks was 1001, 327 in high school, and 234 in junior high school (**Figure 1**).

While analyzing the content of elementary and high school textbooks, metadata (instrumental) findings were also studied. Although these components were not directly related to cognition and the main significance of nutrition in textbooks, they were used as tools for a better comprehension of lesson subjects. The frequency of instrumental application of food was high in textbooks of both elementary and junior high schools. For example, in elementary school textbooks, doogh (yogurt drink) or milk were used to teach the concept of liquid volume (liter) and capacity, and in high school textbooks, cake and pizza were used to teach fractions. In Farsi Language textbook of the seventh grade, the sentence "my friend ate an apple" was used for teaching sentence structure in Persian grammar. In addition, in experimental sciences textbook of the eighth grade, there were images of potatoes, chicken, and rice as tools for teaching genetics and the number of chromosomes in various organisms. **Figure 1** represents the overall percentage of instrumental application of FNLIT in three areas, including cognition, skill, and nutritional value. The elementary, junior high school, and high school textbooks contained 1001, 327, and 234 examples, respectively.

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[DOI: 10.18502/jnfs.v9i1.14841]

Table 2. Frequencies and percentages of FNLIT components in texts school textbooks.

Textbooks/Grade		Cognitive domain		Skill domain			Value domain	Total	%
		Health-based knowledge	Food knowledge and its preparation	Functional	Interactive	Critical	Food-related value issues		
Elementay	Grade 1st	5 (2.2)[a]	10(4.4)	0(0)	0(0)	0(0)	0(0)	15	6.6
	Grade 2nd	15(6.6)	20(8.8)	0(0)	0(0)	0(0)	1(0.4)	36	9.15
	Grade 3rd	5(2.2)	15(6.6)	0(0)	0(0)	0(0)	0(0)	20	8.8
	Grade 4th	5(2.2)	18(7.9)	5(2.2)	0(0)	0(0)	0(0)	28	5.5
	Grade 5th	7(3.0)	23(10.1)	0(0)	0(0)	0(0)	0(0)	30	13.2
	Grade 6th	46(20.3)	37(16.3)	12(5.3)	0(0)	2(0.8)	0(0)	97	42.9
	Total	83(36.7)	94(47.7)	14(7.1)	0(0)	0(0)	2(1)	197	100
Junior high schoolr-secondary	Grade 7th	66 (46.1)	27(18.8)	25(17.4)	7(4.8)	4(2.7)	14(9.7)	143	59.0
	Grade 8th	19(32.7)	21(36.2)	8(13.7)	0(0)	3(5.1)	7(12.0)	58	23.9
	Grade 9th	14(34.1)	9(21.9)	4(9.7)	1(2.4)	4(9.7)	9(21.9)	41	16.9
	Total	99(40.9)	57(23.5)	37(15.2)	8(3.3)	11(4.5)	30(12.3)	242	100
High school	Grade 10th								
	Litrature/humanities	13(61.9)	4(19.0)	0(0)	0(0)	1(4.7)	3(14.2)	21	28.0
	Experimental sciences	14(51.8)	7(25.9)	0(0)	0(0)	1(3.7)	5(18.5)	27	36.0
	Math/physi	14(51.8)	7(25.9)	0(0)	0(0)	0(0)	6(22.2)	27	36.0
	Grade 11th								
	Litrature/humanities	5(55.5)	2(22.2)	1(11.1)	0(0)	0(0)	1(11.1)	9	12.1
	Experimental sciences	19(57.5)	9(27.2)	1(3.0)	0(0)	0(0)	4(12.1)	33	44.5
	Math/physi	17(53.1)	11(34.3)	0(0)	0(0)	0(0)	4(12.5)	32	16.6
	Grade 12th				0(0)	0(0)			
	Litrature/humanities	7(58.3)	3(25.0)	1(8.3)	0(0)	0(0)	1(8.3)	12	20.6
	Experimental sciences	17(70.8)	5(20.8)	0(0)	0(0)	0(0)	2(8.3)	24	36.3
	Math/physi	13(59.0)	6(27.2)	1(4.5)	0(0)	0(0)	2(9.0)	22	37.9
	Health book	43(89.5)	1(2.0)	0(0)	1(2.0)	0(0)	3(6.2)	48	45.2
	Total	162(63.5)	55(21.5)	4(1.5)	1(0.3)	2(0.7)	31(12.1)	255	100

[a]: N (%)

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Table 3. Frequencies and percentages of FNLIT components in images of school textbooks.

Textbooks/Grade		Cognitive domain		Skill domain			Value domain	Total	%
		Health-based knowledge	Food knowledge and its preparation	Functional	Interactive	Critical	Food-related value issues		
Elementay	Grade 1st	9(3.7)[a]	28(11.6)	0(0)	0(0)	0(0)	0(0)	37	15.3
	Grade 2nd	25(10.3)	25(10.3)	0(0)	0(0)	0(0)	0(0)	50	20.7
	Grade 3th	32(13.2)	18(7.4)	0(0)	0(0)	0(0)	0(0)	50	20.7
	Grade 4th	12(4.9)	1294.9)	0(0)	0(0)	0(0)	0(0)	24	9.9
	Grade 5th	0(0)	13(5.3)	0(0)	0(0)	0(0)	0(0)	13	5.3
	Grade 6th	24(9.9)	24(9.9)	15(6.2)	0(0)	4(1.6)	0(0)	67	27.8
	Sum (%)	102(42.3)	120(49.7)	15(6.2)	0(0)	4(1.6)	0(0)	241	100
Junior high school	Grade 7th	65(69.1)	7(7.4)	17(18.0)	0(0)	3(3.1)	2(2.1)	94	61.8
	Grade 8th	9(25.7)	17(48.5)	3(8.5)	1(2.8)	2(5.7)	3(8.5)	35	23.0
	Grade 9th	16(69.5)	39(13.0)	2(8.6)	0(0)	29(8.6)	0(0)	23	15.1
	Total	90(59.2)	27(17.7)	22(14.4)	1(0.6)	7(4.6)	5(3.2)	152	100
High school	Grade 10th								
	Litrature/humanities	0(0)	1(100)	0(0)	0(0)	0(0)	0(0)	1	14.2
	Experimental sciences	1(33.3)	2(66.6)	0(0)	0(0)	0(0)	0(0)	3	42.8
	Math/physi	2(66.6)	1(33.3)	0(0)	0(0)	0(0)	0(0)	3	42.8
	Grade 11th								
	Litrature/humanities	3(100)	0(0)	0(0)	0(0)	0(0)	0(0)	3	5.4
	Experimental sciences	10(40.0)	11(44.0)	0(0)	0(0)	0(0)	4(16.0)	25	45.4
	Math/physi	11(40.7)	12(44.4)	0(0)	0(0)	0(0)	4(14.8)	27	49.0
	Grade 12th								
	Litrature/humanities	1(33.3)	0(0)	0(0)	0(0)	0(0)	2(66.6)	3	9.3
	Experimental sciences	4(28.5)	6(42.8)	0(0)	0(0)	0(0)	4(28.5)	14	43.7
	Math/physi	5(33.3)	7(46.6)	0(0)	0(0)	0(0)	3(20.0)	15	46.8
	Health book	35(97.2)	0(0)	0(0)	0(0)	0(0)	1(2.7)	36	52.9
	Total	72(55.3)	40(30.7)	0(0)	0(0)	0(0)	18(13.8)	130	100

[a]: N (%)

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Table 4. Sum of frequencies and percentages of FNLIT components in practice questions of school textbooks.

Textbook/Grade		Cognitive domain		Skill domain			Value domain	Total	%
		Health-based knowledge	Food knowledge and its preparation	Functional	Interactive	Critical	Food-related value issues		
Elementay	Grade 1st	13(5.6)[a]	13(5.6)	0(0)	0(0)	0(0)	0(0)	26	13.1
	Grade 2nd	25(12.6)	22(11.1)	2(1.0)	0(0)	0(0)	2(1.0)	51	25.8
	Grade 3rd	23(11.6)	11(5.5)	0(0)	0(0)	0(0)	0(0)	34	17.2
	Grade 4th	7(3.5)	3(1.5)	1(0.5)	0(0)	0(0)	0(0)	11	5.5
	Grade 5th	2(1)	17(8.6)	0(0)	0(0)	0(0)	0(0)	19	9.6
	Grade 6th	17(8.6)	28(14.2)	11(5.5)	0(0)	0(0)	0(0)	56	28.4
	Total (%)	87(44.1)	94(47.7)	14(7.1)	0(0)	0(0)	2(1)	197	100
Junior high school	Grade 7th	23(67.6)	5(14.7)	3(8.8)	2(5.8)	1(2.9)	0(0)	34	75.5
	Grade 8th	2(33.3)	2(33.3)	2(33.3)	0(0)	0(0)	0(0)	6	13.3
	Grade 9th	1(20.0)	2(40.0)	2(40.0)	0(0)	0(0)	0(0)	5	11.1
	Total (%)	26(57.7)	9(20.0)	7(15.5)	2(4.4)	1(2.2)	0(0)	45	100
High school	Grade 10th								
	Litrature/humanities	2(66.6)	1(33.3)	0(0)	0(0)	0(0)	0(0)	3	16.6
	Experimental sciences	1(16.6)	2(33.3)	1(16.6)	1(16.6)	0(0)	1(16.6)	6	33.3
	Math/physi	2(22.2)	1(11.1)	2(22.2)	2(22.2)	1(11.1)	1(11.1)	9	50
	Grade 11th								
	Litrature/humanities	3(60.0)	1(20.0)	0(0)	0(0)	0(0)	1(20.0)	5	16.6
	Experimental sciences	2(50.0)	2(50.0)	0(0)	0(0)	0(0)	0(0)	4	16.6
	Math/physi	2(50.0)	2(50.0)	0(0)	0(0)	0(0)	0(0)	4	16.6
	Grade 12th								
	Litrature/humanities	2(50.0)	1(25.0)	0(0)	0(0)	0(0)	1(25.0)	4	36.3
	Experimental sciences	2(5.0)	2(50.0)	0(0)	0(0)	0(0)	0(0)	4	36.3
	Math/physi	2(66.6)	1(33.3)	0(0)	0(0)	0(0)	0(0)	3	27.2
	Health book	6(54.5)	1(9.0)	1(9.0)	0(0)	1(9.0)	2(18.1)	11	50.0
	Total	24(45.2)	14(26.4)	4(7.5)	3(5.6)	2(5.6)	6(11.3)	53	100

[a]: N(%)

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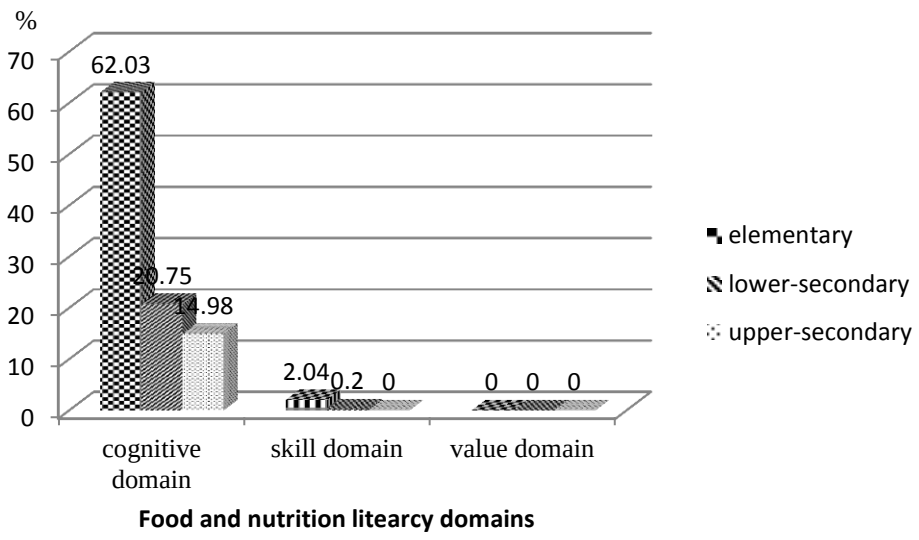

Figure 1. Instrumental application of food in school textbooks in Iran.

Discussion

Content analysis of school textbooks in Iran showed that the share of FNLIT dimensions is relatively small and mostly limited to the cognitive domain. The extent to which each of the FNLIT dimensions and their components is taken into consideration differs across textbooks. Besides, there is no progressive approach to building up the students' knowledge and skills regarding FNLIT. Among the FNLIT domains, there was a higher emphasis on cognitive domain, while the skill domain was very little addressed in elementary and high school textbooks. The value/attitude domain was almost ignored. Although nutrition knowledge is a key component of food literacy/nutrition literacy (Spronk *et al.*, 2014) and has been identified as an essential component for behavior change, knowledge alone is generally not sufficient to produce sustained behavior change in complex behaviors (Worsley, 2002).

Textbooks of Iranian elementary schools (grades 1st to 6th) had paid little attention to some functional skills of FNLIT, including "food preparation" and the application of "food labeling and traffic lights" in the "work and technology", "science" and "social studies" subjects. These findings are in line with the previous content analysis of elementary school textbooks in the country, which reported food preparation as the main subject related to food skills education in school textbooks (Rao *et al.*, 2011, Salehi Omran and Abedini Baltork, 2011).

Furthermore, concerning the content of junior high school and high school textbooks, the cognitive domain of FNLIT was the dominant component being included, while there were not many in terms of skill and attitude domains. These findings are consistent with the results of the studies conducted by Rafiian (Nutbeam and Kickbusch, 2000), D'Onofrio (D'Onofrio and Singer, 1983), Salehi (Salehi Omran and Abedini Baltork, 2011), and Izadi (Izadi *et al.*, 2010). In the current study, similar to Omidvar (Omidvar *et al.*, 2016) , the instrumental application of FNLIT in the text and images of textbooks of Iranian formal education system, especially in the cognitive domain, was remarkable.

According to the existing evidence, to properly develop FNLIT in children, it is necessary to pay attention to all aspects of functional, interactive, and critical dimensions (Nutbeam and Kickbusch, 2000). Based on the evidence, the ultimate goal of FNLIT is to educate and develop students' skills and make them committed and responsible citizens as adults with regard to food and nutrition (Dyg, 2014). One of the major emphasis and orientation of

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the FNLIT components is to make fundamental changes in the three aspects of functional, interactive, and critical literacy level of the students (Goldstein, 2014). Textbooks are practically used as the essential instruments and medium of instruction to convey concepts, meanings, and values to students in all educational systems, specifically in centralized educational structures. In fact, the content of textbooks is regarded as an important curriculum element and a means of meeting its goals. Moreover, in most educational institutes and particularly in elementary and high schools, the materials and subjects included in textbooks are mainly theoretical and often impractical to affect students' food preferences and choices (Doustmohammadian *et al.*, 2019).

In recent years, considering the high prevalence of unhealthy eating behaviors among children and adolescents and their negative consequences on their health (Cristina Lindsay *et al.*, 2017), FNLIT has become a priority in framing and developing educational interventions and programs to improve children's eating (Truman *et al.*, 2017). It is required to include the FNLIT components in the content of textbooks, since formal education can play an important role in shaping students' food-related knowledge and skills. Therefore, it is suggested that authors of textbooks pay attention to this issue in future educational planning.

This is the first study to evaluate all school textbooks in terms of attention to FNLIT components. One of the most significant contributions of this study was creating and developing a checklist to analyze FNLIT, the reliability of which was assessed based on the agreement rate between two coders and calculated by the Holsti equation. The reliability of the checklist was satisfactory; nevertheless, it could be considered in further studies.

The study had some limitations, including the lack of specialized software for performing qualitative content analysis of textbooks. The techniques of data collection could also alter the information in subtle ways. The another was limited to the lack of similar background and previous research in this area.

Conclusion

This study showed that textbooks of primary and secondary education in Iran did not pay proper and objective attention to the dimensions of FNLIT. Among the components of FNLIT, cognitive domain was more included, while skill and value-attitude domains were almost ignored in text, images, and practice questions of school textbooks. The study findings have general applicability and can provide useful insights for policymakers and textbook authors in improving the quality of higher education. Based on the results, there is a need to revise the content of these textbooks to ensure proper and systematic coverage of FNLIT domains.

Acknowledgement

This research was conducted by a grant from research council of National Nutrition and Food Technology Research Institute (NNFTRI), Shahid Beheshti University of Medical Sciences.

Funding

This work was supported by the research council of National Nutrition and Food Technology Research Institute (NNFTRI), Shahid Beheshti University of Medical Sciences under Grant [number IR.SBMU.NNFTRI.REC.1398.018].

Conflict of interests

The author(s) declare no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

Authors' contributions

Omidvar N and Dehghani M designed research; Arvand A and Tork Z conducted research; Doustmohammadian A, Arvand A and Tork Z analyzed data; and Doustmohammadian A and Dehghani M wrote the paper. Omidvar N had primary responsibility for final content. All authors read and approved the final manuscript.

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[DOI: 10.18502/jnfs.v9i1.14841]

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