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The Knowledge, Attitudes, and Practices toward Food Additives in Personnel of Isfahan University of Medical Sciences in Iran

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ABSTRACT

Background: Use of additives in food industry is of specific importance. Currently, more than 2,500 additives are added to foods to achieve the desired goals or to extend the product's shelf life. However, application of these substances has raised concerns about the consumers' health. Since public information on these substances is inadequate, promoting people's knowledge can play a key role in this regard. Therefore, knowledge, attitude, and practices of the personnel of Isfahan University of Medical Sciences toward food additives were evaluated. **Methods**: This cross-sectional descriptive study included 800 participants selected randomly among the personnel of Isfahan University of Medical Sciences in Iran. The participants' demographic information, knowledge, attitudes, and practices were measured via a self-administered questionnaire. The relationship of participants' educational level, age, and gender with their knowledge, attitudes, and practices were determined. **Results**: The participants' knowledge, attitudes, and practices average scores were calculated as 30.6±1.3, 32±0.9, and 15±1.5 for food additives, respectively. **Conclusion:** The participants' knowledge, attitude, and practices were at a poor level. So, people should receive the necessary education and training in terms of food additives as well as food labels in order to prevent misinterpretations regarding food additives.

Keywords: *Knowledge; Attitudes; Practices; Food additives*

Introduction

Nowadays, numerous processed foods are manufactured and consumed as a result of developments in food technology and alteration in dietary patterns. In Iran, remarkable changes have occurred in food consumption patterns in recent decades, so that most consumers are demanding healthful, safe, suitable, and cheap foods.

Food additives play a crucial role in food industry. More than 2,500 food additives are used to achieve the intended goals or increase the food product's shelf life. However, many additives were excluded globally or in some countries over the past years (Carocho *et al.*, 2014). Food additives are not generally consumed as food alone.

They are used for technological purposes in production, preparation, refinement, packaging, transportation, and maintenance of food products (Esfandiari *et al.*, 2017). According to the European classification, additives are categorized based on their usage to: sweetening, coloring,

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preservative, antioxidant, carrier, acid regulating, acidic, anti-caking, anti-foaming, voluming, emulsifier, emulsifying salt, stiffening, flavor enhancing, foaming, gelling, glazing, humectant, modified starch, packaging gas, propellant, rising, sequestrant, stabilizer, thickening, and flour improving agents (Carocho *et al.*, 2014). These chemicals has positive effects on the food quality, but their application above the standard and acceptable daily intake values can have adverse effects on human health (Esfandiari *et al.*, 2013, Esfandiari *et al.*, 2016).

Some additives have negative influence on children since they may cause insulin resistance, decrease immune, lead to hyper active practices, and change thyroid hormone function (McCann *et al.*, 2007, Trasande *et al.*, 2018). Therefore, laws and standards focus on controlled consumption of food additives (Council Regulation (EC), 2008).

According to the regulations of Iranian National Standard Organization, permitted additives used in food products must be indicated on the food labeling (Institute of Standards and Industrial Research of Iran (ISIRI), 2009). Consumers all around the world are worried about food safety (Shim *et al.*, 2011). Several studies investigated the consumers' knowledge, attitudes, and practices toward food additives (Bearth *et al.*, 2014, Choe *et al.*, 2005, Shim *et al.*, 2011). However, no studies have ever investigated the knowledge, attitudes, and practices of people toward food additives in Iran. In fact, increased level of knowledge toward food additives can decrease the consumers' fear in choosing the processed food (Shim *et al.*, 2011). To this end, the knowledge, attitudes, and practices of the personnel of Isfahan University of Medical Sciences were studied toward food additives.

Materials and Methods

Design and participants: In this cross sectional study, the participants' knowledge, attitudes, and practices were evaluated toward food additives using a self-administered questionnaire. The participants included 800 volunteers selected randomly from Isfahan University of Medical Sciences, Iran.

Measurements: The questionnaire was designed based on the classification of food additives by the European Union and Iranian national standard (Carocho *et al.*, 2014, Council Regulation (EC), 2008, Institute of Standards and Industrial Research of Iran (ISIRI), 2009). The validity and reliability of the questionnaire were assessed by the faculty members of School of Nutrition and Food Science, Statistics and Epidemiology, as well as the food experts in Iran-Food and Drug Administration: IFDA in Isfahan University of Medical Sciences.

The questionnaire comprised of demographic information questions as well as some items that evaluated the participants' knowledge (n = 18), attitudes (n = 20), and practices (n = 13), respectively. In the knowledge section, food additives were introduced. Correct answers received one score, while incorrect answers were scored zero (**Tables 1**). The next part of the questionnaire was designed to assess the respondents' attitudes using a Likert scale ranging from zero (strongly disagree) to 4 (strongly agree) (**Tables 2**). The final part of the questionnaire included the participants' practices with regard to food additives that should be answered in a 5-point Lickert scale containing "always", "often", "sometimes", "seldom", and "never" options scored from 0 to 4, respectively (**Tables 3**). The total attainable score of the questionnaire was 100.

Ethical considerations: The inclusion criterion was voluntary participation in the study. Also, the informed consent was obtained from all respondents. This study was approved by the Ethics Committee of Isfahan University of Medical Sciences (IR.MUI. RESEARCH. REC. 1398.269).

Data analysis: Statistical analyses were performed based on mean ± standard for the participants' knowledge, attitudes, and practices via SPSS 22 (IBM, Armonk, NY, USA) considering the significant level of less than 0.05. Later, the Mann-Whitney test was run to

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determine the relationship of educational level, age, and gender with knowledge, attitudes, and practices of the participants.

Results

Of the 800 personnel participating in the study, 460 were female and 340 were male within the age range of 30 to 50 years. About 69.6%, 20.2%, and 10.2% of the respondents had BSc, MSc, and PhD degrees, respectively. The participants' scores of knowledge, attitudes, and practices had no significant difference in terms of their demographic specifications ($P > 0.05$).

Knowledge, attitude, and practice scores of the personnel toward food additives were 30.6 ± 1.3, 32.0 ± 0.9, and 15.0 ± 1.5, respectively (**Tables 1–3**). Analysis of the differences between the three main variables did not show any significant difference between the study groups. Overall, no significant difference was found between the mean scores for knowledge ($P = 0.65$), attitude ($P = 0.41$), and practice ($P = 0.48$) with respect to food additives.

Table 1. Percentage of correct answers in the section devoted to knowledge toward food additives in personnel of Isfahan University of Medical Sciences, Iran

Number	Phrase	Percent
K1	Food additives include various substances that are used for preserving, flavoring, stabilizing and preventing growth of molds and germs, etc. in foods.	46.9
K2	Substances that are added to food to dissolve, dilute, disperse, or physically modify foods are called carriers.	37.5
K3	Substances that are added to food to enhance the sour taste are called acids.	39.25
K4	Substances that are added to food to minimize changes in quality are called preservatives.	37.25
K5	Substances added to food to extend shelf life have a preservative property.	31.25
K6	One important application of food preservatives is controlling microbial growth.	36.9
K7	Substances added to food to prevent formation of lumps are called anti-caking agents.	37.9
K8	Antifoam is added to food to prevent formation of foam.	40.65
K9	Additives such as starch, collagen, egg yolk, agar, gelatin and pectin absorb water in food and increase viscosity of product.	43.0
K10	Maintaining firmness of fruits or vegetables is achieved by adding substances known as stiffing agents.	41.75
K11	Gel formation in food is achieved by adding substances called gelling agents.	46.25
K12	Foaming agents are substances that lead to homogeneous dispersion in the gaseous phase in liquid or solid foods.	40.25
K13	In food industry, it is possible to create a shiny appearance and a protective coating by adding substances known as glazing agents.	41.25
K14	Absorption of excess water and prevention of crystallization in food is achieved by additives such as propylene glycol, glycerol, sorbitol and xylitol as adsorbents.	37.5
K15	Modified starch is added to products such as sauces and yogurt.	43.75
K16	Foods not resistant to oxidation or susceptible to microbial spoilage are exposed to gases such as nitrogen and carbon dioxide during packaging. These substances are called propellants.	40. 5
K17	Substances that are added to improve quality of baking flour or dough are called flour treatment agents.	45.0
K18	Benzoate is used as an antimicrobial substance for to expand shelf life of food.	35

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Table 2. Percentage of answers in the section devoted to attitudes toward food additives in personnel of Isfahan University of Medical Sciences, Iran

Number	Phrase	Strongly Agree	Agree	No Idea	Disagree	Strongly Disagree
A1	It is important to use food additives in food products.	5.0	32.5	25	12.5	25.0
A2	Using antioxidants in food products is essential to prevent the oil oxidation.	5.0	17.5	42.5	7.5	27.5
A3	Using salt and sugar in food products is essential for enhancing flavor and preservative properties.	42.5	30.0	22.5	2.5	2.5
A4	Using food additives such as synthetic dietary supplements, colorants, permitted colors and preservatives is safe.	10.0	20.0	50.0	2.5	17.5
A5	In my opinion, food additives are used in food industry to improve taste, color and appearance of food as well as providing consumer with full access to required nutrients.	7.5	15.0	42.5	30.0	5.0
A6	I am worried about cancer disease caused by food additives.	7.5	17.5	60.0	12.5	2.5
A7	I am worried about a possible food allergy caused by food additives.	2.5	15.0	45.0	30.0	7.5
A8	Using government-approved food additives in processed foods does not cause food safety problems.	10.0	2.5	37.5	40.0	10.0
A9	Buying processed foods containing food additive is safe for health.	2.5	2.5	75.0	15.0	5.0
A10	Using flavor enhancers (monosodium glutamate) in meat products pose no safety problems.	7.5	7.5	77.5	2.5	5.0
A11	Using benzoate (as a preservative) in mayonnaise sauces pose no safety problems.	10.0	5.0	70.0	12.5	2.5
A12	Using tomatin and stevia in food products as sweeteners and flavor enhancers is essential.	12.5	2.5	65.0	10.0	10.0
A13	Using natural antioxidant substances such as vitamin E in food products is essential to prevent oxidation process.	5.0	5.0	85.0	2.5	2.5
A14	Using stevia is essential in beverages, desserts and sauces.	2.5	7.5	80.0	7.5	2.5
A15	Using nitrite is essential in sausage and meat products.	22.5	25.0	40.0	5.0	7.5
A16	When buying chocolate, attention should be paid whether lecithin has been used as an emulsifier.	12.5	7.5	62.5	10.0	7.5
A17	When buying fish-based products, attention should be paid whether black cumin have been used as a flavoring agent.	5.0	10.0	60.0	15.0	10.0
A18	Using turmeric, shallots and parsley extracts pose no safety problems due to their properties for antimicrobial and antioxidant.	2.5	5.0	77.5	12.5	2.5
A19	Using synthetic flavors and other natural substances with antimicrobial and gelling properties such as acetic acid is essential.	2.5	2.5	82.5	7.5	5.0
A20	Alginates are hydrophilic colloidal carbohydrates used in food industry.	2.5	2.5	90.0	2.5	2.5

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Table 3. Percentage of answers in the section devoted to practices toward food additives in personnel of Isfahan University of Medical Sciences, Iran

Number	Phrase	Always	Often	Sometimes	Rarely	Never
P1	When buying processed foods, I pay attention to information on food label related to additives as ingredient.	0.0	2.5	5.0	7.5	85.0
P2	I obtain the information required about food additives from authority related health.	2.5	2.5	10.0	12.5	72.5
P3	Receiving information approved by health authorities helps to make better choices about processed foods containing additives.	5.0	7.5	7.5	15.0	65.0
P4	Presence of cyclamate as an artificial sweetener mentioned on food labelling effects on choosing food.	0.0	2.5	5.0	5.0	87.5
P5	Presence of safflower as a colorant mentioned on food labelling effects on choosing food.	2.5	2.5	2.5	10.0	82.5
P6	Presence of Stevia as a natural sweetener mentioned on food labelling effects on choosing Gaz[a], cookies and drinks.	0.0	7.5	7.5	10.0	75.0
P7	Presence of benzoate as preservative mentioned on food labelling effects on choosing mayonnaise.	2.5	5.0	7.5	5.0	80.0
P8	Presence of pectin as stabilizer mentioned on food labelling effects on choosing jam.	7.5	2.5	10.0	17.5	62.5
P9	Presence of glutamic acid as flavoring mentioned on food labelling effects on choosing ready-made soups.	0.0	0.0	7.5	25.0	67.5
P10	I add thyme, a natural spice, to minced meat when preparing food for the family.	35.0	32.5	25.0	5.0	2.5
P11	Presence of carrageenan as stabilizer mentioned on food labeling effects on choosing cocoa milk.	12.5	17.5	10.0	22.5	37.5
P12	The term 'probiotic' on food labelling effects on choosing dairy products.	10.0	17.5	7.5	20.0	45.0
P13	Presence of methyl paraben as preservative mentioned on food labelling effects on choosing food product.	20.0	2.5	2.5	30.0	45.0

[a]: A kind of Iranian nougat.

Discussion

The existing data show conflicting information about the advantages and disadvantages of food additives as well as the consumers' information is inadequate in this regard. Therefore, the consumers' awareness, attitude, and practice should be evaluated. According to our findings, the personnel's awareness, attitudes, and practices about the food additives were weak.

Less than half of the participants answered the items correctly for the questions of knowledge (**Table 1**). The total knowledge score was 30.6 ± 1.3 that was poor. Most respondents were unaware of the functions and benefits of food additives. According to **Table 1**, the most correctly answered question (46.9%) was associated with general information about additives in food (K1), while the most incorrectly answered question (31.25%) was related to application of preservatives as additives for increasing the product's shelf life (K5). Given the importance of using preservatives in food industry, four questions were designed with regard to food preservative knowledge (K4, K5, K6 and K18) (Akbari-Adergani *et al.*, 2018, Esfandiari *et*

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al., 2013, Esfandiari *et al.*, 2016) Additives are used for a variety of reasons: improving the food quality, increasing shelf life, and controlling microbial growth in foods. Regarding the responses, most respondents believed that food preservatives were the most disadvantageous additives in terms of food safety. This finding was also reported in other countries showing the low level of awareness in terms of preservatives in different communities. In South Kore, although the participants' information was at a good level about preservatives, they were worried about to preservatives among the studied additives such as colorants, flavor enhancers, and sweeteners (Shim *et al.*, 2011). In another study, colorants and preservatives were found to cause the greatest anxiety among the participants (Choe *et al.*, 2005). The discrepancy in findings of the present study and the aforementioned research can be attributed to the lack of information among the public about preservatives in Iranian society. However, the most correctly answered question was about the introduction of additive agents in food products, which could be due to the self-expressing etymology of this term (Shim *et al.*, 2011). A study carried out in Switzerland over food additives revealed that awareness about reliance on rules, consumption of natural products, and awareness about the hazards and benefits were among the important variables for accepting food additives in the community. The study researchers also recommended enhancement of the public awareness about the hazards of food additives (Bearth *et al.*, 2014).

Table 2 provides a detailed explanation of the participants' attitudes toward food additives. More than 90% of our respondents selected "no idea" when they were asked about their attitudes toward food additives. The total score for attitudes was 32.0 ± 0.9. A section of the administered questionnaires was devoted to different dimensions of food additives and their role in the development of some diseases such as cancer and allergies. Some of the questions were also devoted to government and health-care authority organizations for introducing and confirming the safety of these additives. According to the participants, food additives can cause such diseases because the study findings revealed that chemicals such as colorants, preservatives, and materials used in packaging may exert a detrimental effect on the community health, especially with respect to children. Recently, the American Academy of Pediatrics has urged serious changes and revisions in food additives in the legislation process (McBride, 2018, Trasande *et al.*, 2018). Given the participants' low level of awareness and information, the authorities are suggested to educate and inform the public via mass media. A study in China investigated the factors affecting public attitudes toward food additives. The researchers found that people's attitudes played an important role in opting for safe foods. Moreover, raising the public awareness in respect to food additives is a major factor in reports on food safety hazards. In this regard, enhancing the public awareness plays an important role in the development and deployment of risk management policies regarding food safety. As a result, the government policy should be revised on food safety (Wu *et al.*, 2013). A study in Spain evaluated the level of awareness and perception of participants regarding the use of food additives such as stiffeners. The results showed that most participants had limited awareness about this type of additive and informed participants had a negative attitude toward such substances. In addition, individuals had limited information about gum, starch, and wheat flour as additives. Due to the natural content of these additives, educational interventions should be carried out to introduce them (Varela and Fiszman, 2013). The discrepancy between our findings and the research conducted in Spain may be related to the application of words and language differences in the questionnaire. It seems that using the word "hydrocolloids" caused confusion for the Spanish respondents since they were not familiar with the expression. A review of 26 articles published in Canada on food safety indicated the necessity of increasing knowledge and awareness among vulnerable people (elderly and children) about food safety and high-risk foods containing additives. In addition, these studies

suggested educational intervention (Nesbitt *et al.*, 2014).

Considering the people's awareness and attitude towards the packaged foods and effects of additives on health, 64.15% of the packaged foods consumers had a good level of awareness about the adverse health effects of these products. Interestingly, 70.96% of these respondents were still willing to consume these products. The results of this study revealed that consumers did not have enough information about the chemical properties of certain additives and their effects on health. As a result, we are faced with a serious need to promote the public awareness about health problems caused by food additives (Legesse *et al.*, 2016).

More than 90% of the participants selected the phrase "never" for the practice section, suggesting that a majority of participants did not pay attention to the information provided on the food labels about food additives (**Table 3**). The practice section of the questionnaire received the score of 15.0 ± 1.5, which emphasizes that food labeling is a communication tool for consumers to opt food. According to the National Iranian Standard Organization, the labels of products must contain information including the product's name and brand; date of production; expiration date; net weight; producer's serial number; substances or ingredients (including various food additives); name and address of the producer, packer, or importer; nutritional value table; traffic light table, product storage conditions and warnings; instruction; and the term 'Made in Iran' if it applies (Esfandiari *et al.*, 2019, Esfandiari *et al.*, 2021, Institute of Standards and Industrial Research of Iran (ISIRI), 2009). With regard to this section, the most frequent response was 'never" followed by "rarely" (**Table 3**). In comparison to the scores obtained in the knowledge (30.6 ± 1.3) and attitude (32.0 ± 0.9) sections, the lowest score was associated with the practices section (15.0 ± 1.5), showing the poorest condition of respondents. The results of our study are consistent with other surveys conducted in other countries in this area. A review of the literature indicated that positive attitudes toward additives do not necessarily lead to behaviors enhancing selection of the safe food (Wilcock *et al.*, 2004). A study over the knowledge and practices of people working in the take-out food stores in Turkey showed serious concern about food safety due to lack of awareness. The majority of the respondents had little information about additives and reported that these substances had adverse effects on health (Unusan, 2007). In another study conducted in India, awareness, attitude, and practice of adult girls were evaluated about food safety in four states. Based on the findings, participants did not have enough information about food safety labels used in India and consumers' confidence in food was generally based on the popularity of the brand. The researchers of this study also recommended increasing the public knowledge about permitted additives used in foods (Gavaravarapu *et al.*, 2009). The most interesting result of the practice section was related to the highest frequency of positive answers (always, often, and sometimes) concerning the application of natural additives such as thyme for flavoring and antimicrobial value (P10). This shows that respondents tend to use natural than artificial additives in food.

Consequently, Iranian food producers are recommended to represent the information about food additives on the food labeling. Based on some previous studies conducted in Iran, the food consumers are not informed about the importance of data on food labeling (Esfandiari *et al.*, 2019, Esfandiari *et al.*, 2021). In fact, labelling can be a valid source of information about food additives for consumers in choosing the food products. Totally, the results of practice section showed the respondents' lack of trust in processed foods due to their artificial food additives, which indicates the respondents' lack of awareness about the benefits of additives in food industry.

Some limitations of the present study include the self-reporting nature of the applied questionnaire, especially in the practice section, which may have affected the result's accuracy. Moreover, it was

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impossible to objectively examine the participants' purchasing behaviors in real time

Conclusions

The study revealed that personnel of Isfahan University of Medical Sciences in Iran had poor knowledge, attitudes, and practices with regard to food additives. This can be attributed to the lack of information on food additives, inadequacy of related education and trainings, and public relations. In order to develop a healthy society, people need to make informed choices based on appropriate information about food contents. Therefore, it is recommended to educate Iranian society toward the necessary information about food safety regarding additives as well as food labelling.

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Conflict of interest

There is no conflict of interest.

Authors' contributions

Bahreini Esfahani N, Ziaei H, and Esfandiari Z designed the study, administered and collected the questionnaires, analyzed the data, and wrote the manuscript. All authors read and approved the final manuscript.

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