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Perceived Barriers and Facilitators to Dairy Consumption among School-Age Children: A Qualitative Study

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ABSTRACT

Background: To improve dairy consumption among children, it is crucial to explore probable barriers and facilitators toward it. The current qualitative study aims to discover barriers and facilitators of dairy intake among school-age children in Tehran to suggest strategies to improve it based on the optimal components of social marketing. **Methods:** In a qualitative study, 111 school-age children (mean age 10.08 ± 0.57 years) were selected by purposive sampling with maximum diversity from primary schools in three areas of Tehran. Sixteen focus group discussions (FGDs) were separately conducted among students in different grades. Contents of the FGDs were analyzed using MAXQDA 2010. **Results:** Food and nutrition literacy, improvement of attitude and trust-building, training taste and food preferences were the main facilitators to increase dairy products among school-age children. Barriers related to dairy products consumption included negative attitudes toward dairy products, unsound tastes, and unhealthy food preferences. The main suggested strategies to increase dairy consumption were improvement of the products' sensory and non-sensory characteristics, providing the milk and dairy products consumption experience for free, improvement of the quality of preserving places, enhancing physical and economic availability of dairy products. Dairy stores and school buffets were mentioned as the best places for supply. Encouragement and motivation, education and information, modeling and promoting appropriate culture were suggested as the main promotion strategies. **Conclusion:** To provide practical strategies for increasing dairy consumption among children, the perceived barriers and facilitators mentioned by them should be addressed.

Keywords: Milk; Dairy consumption; Social marketing; Qualitative study; School-age children

Introduction

Children and adolescents comprise more than one-sixth (1.2 billion of total) of the global population (UNICEF Staff, 2011).

Environment, genetic, and hormonal status is acknowledged as the factors affecting children's growth. Epidemiological studies have shown that

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environmental factors may play important roles in children's growth via influencing nutrition, psychology, physical activity, and climate states (Wei and Gregory, 2009).

The speed of children's growth (6 to 12 years) is relatively high; however, it is slower than adolescence. Since adults' food habits is shaped in childhood, it is essential to pay close attention toward childhood dietary patterns (Ambrosini *et al.*, 2014).

Dairy products provide children and adolescents with essential micronutrients and macronutrients in developed countries (Dror and Allen, 2014). Dairy calcium is highly bioavailable and accounts for more than 50% of total calcium intake. Besides, dairy products provide high-quality protein with peptides and bioactive factors that have specific effects on growth. The lipid of dairy supplies energy and essential and nonessential fatty acids (Scholz-Ahrens *et al.*, 2019).

Despite the recognized advantages of milk and dairy products as components of a nutrient-rich and balanced diet, children and adolescents' dairy consumption in many countries has waned in recent decades (Dror and Allen, 2014).

Although many local dietary guidelines recommend children consume 2-3 servings of milk and dairy products per day (500-700 gr), many children do not follow this advice (Bao *et al.*, 2018). A national study on 21,111 school-age children in Iran revealed that fruit and vegetables, milk and dairy products, and snacks (sweet, salty, or fatty) had a similar consumption frequency of approximately two times a day (Kelishadi *et al.*, 2007). Another survey in Tehran showed that 25% of children consumed milk and dairy products less than one cup a day (Amirhamidi *et al.*, 2019).

Despite a significant population of adolescents (more than 50%) in Iran, no studies have identified strategies for improving dairy consumption in school-age children. Several studies have been conducted about adult behavior toward dairy products worldwide (Esmerino *et al.*, 2017, Maitiniyazi and

Canavari, 2021, Rahn timer and Rajabpour, 2017). They concluded that consumers experience positive emotion (e.g., enjoyment, pleasure, comfort, and feeling relaxed), functional value-health and composition were the main influential factors for consumers' choice behavior toward dairy products.

A deep and more thorough understanding of the reasons for reducing dairy product consumption among children and teenagers is critical to address successful strategies to promote dairy consumption. Social marketing has unique characteristics that distinguish it from other models, such as being based on behavior change, following the client's needs, and relying on proposing interesting offers to persuade them to change their behavior (Andreasen, 2002). Among seven phases of the Social Marketing Assessment and Response Tool (SMART) (Neiger and Thackeray, 2002), this study only reports part of preliminary planning and the consumer analysis stage of this framework. The other SMART steps were conducted in a previously published study on adults (Bazhan *et al.*, 2018). The current study was performed due to an information gap related to identifying barriers and facilitators to milk consumption in school-age children. It aims to understand better children's preferences toward different aspects of dairy products (4Ps of the marketing mix), including price, place, product, and promotion to develop unique strategies to achieve the desired behavior change among children.

Therefore, the current study aims to: (i) discover barriers and facilitators that may influence milk and dairy consumption in children; (ii) identify the optimal components of a marketing mix concerning product, place, price, and promotion to increase milk and dairy consumption.

Materials and Methods

The investigation was guided by a social marketing approach (Grier and Bryant, 2005). In contrast to 'top down' interventions that originate in health professionals' identification

of the problems and solutions (Stead *et al.*, 2007), this approach begins by studying the audience to whom the intervention will be targeted.

Participants and data collection: Qualitative data were collected in the schools via sixteen focus group discussions (FGDs), with an average of seven participants per group and a maximum of ten, between May and November 2018. The participants were selected by purposive sampling, which is defined as a form of non-probability sampling in which researchers have prior knowledge about the purpose of their studies and rely on their own judgments to choose eligible participants (Robinson, 2014).

The characteristics of participants are shown in **Table 1**.

The first and corresponding authors conducted the FGDs. All the researchers were female, and four of them were PhD. holders, and one had an MSc. Two of the researchers were faculty members of the Gastrointestinal and Liver Diseases Research Center in Iran University of Medical Sciences (IUMS) and National Nutrition and Food Technology Research Institute (NNFTRI) in Shahid Beheshti University of Medical Sciences (SBMU). Two of them were a researcher in NNFTRI, and one of them was a researcher in Faculty of Nutrition Sciences and Food Technology connected to SBMU. The first, corresponding and fifth authors had previously conducted qualitative studies and were highly qualified to perform qualitative studies. The fifth author was trained and had participated in some qualitative studies. The third author was introduced in the current research for the first time. At the first step, Tehran's nineteen educational districts, Iran's capital, were categorized into three socio-economic categories (affluent, semi-affluent, and deprived). Secondly, one district from each of the three socio-economic categories was chosen, and two schools (girl's and boy's schools) from these three districts were selected randomly. Finally, students at second to sixth-grade levels from each school were randomly selected. FGDs were

separately conducted among students in different grades.

Before the commencement of the interviews written, informed consent was obtained from the participants and their parents. The moderator, who was open-minded and eager to build rapport with the children in face-to-face FGDs, moved systematically through a list of questions that probed participants' views about dairy consumption, facilitators and barriers to dairy consumption, preferred communication channels, and favorable campaign messages and slogans. The participants got familiar with the goals of the study through the initial introduction of the moderator. The researcher regularly checked if she had understood the children's ideas correctly. During the discussion, no one was present besides the participants and researcher(s). An interview guide was developed for the current study, which included some semi-structured questions developed based on the research's objectives (**Appendix 1**). The interview guide was evaluated for its content by two experts before the study, and based on their feedback, it was finalized. It consisted of open-ended, probing questions, enabling respondents to fully explain their personal opinions, perceptions, and experiences. Each focus group was facilitated by a researcher. A co-researcher audiotaped the proceedings and took notes. Each session took 45 to 60 min. All focus groups were audiotaped and transcribed. Written informed consent was obtained from students prior to the commencement of FGDs. Figure 1 provides an overview of the FGD process. The qualitative study results and comprehensive review were merged to provide a thorough understanding and perspective to extract the dairy consumption barriers and facilitators as well as strategies to improve dairy consumption in school-age children.

Data saturation which can be defined as the point when "no new information or themes are observed in the data" (Saunders *et al.*, 2018) was achieved at interview 16.

Ethical consideration: Ethics committee of the National Nutrition and Food Technology Research

Institute, Shahid Beheshti, University of Medical Sciences approved the study (No: IR.SBMU.nnftri.Rec. 1397.008). Before the commencement of the interviews written, informed consent was obtained from the participants and their parents. We were also allowed to do the study by the schools' staff.

Data analysis: Transcripts of all sixteen FGDs were imported into MAXQDA, 2010. For data analysis, directed thematic analysis (Guest *et al.*, 2012) was utilized. The data were analyzed by constant comparative analysis. To increase the findings' accuracy and reliability, coding was undertaken by two independent coders (A.D & M.B). Inter-rater reliability was calculated using percent agreement ($r = 0.90$) (Rourke *et al.*, 2001). The themes were derived from the data. All research details, including procedures, actions, and decisions, were documented for transferability purposes. Validity was confirmed by the triangulation strategy in which data were collected from different sources, such as interviews and observations.

Results

After analyzing the students' views, facilitators and barriers related to consumers and their preferences about milk and dairy consumption (according to the 4Ps of the marketing mix) were identified. A thematic framework was constructed, consisting of categories and sub-categories, which is shown in **Tables 2 and 3**.

Facilitators related to consumers: Facilitators related to the consumer were one of the concepts developed through analyzing and comparing data. This concept encompasses the three sub-categories, including "food and nutrition literacy", "attitude improvement and trust-building", and "taste and food preferences".

1. Food and nutrition literacy

From the students' points of view, the awareness of the benefits of milk and dairy products and their importance in health; the capability to read, understand and analyze the food labels; try new product flavors, and modify

the taste of dairy products as desired, were the most important facilitators to improve milk and dairy consumption. These codes were categorized into the emerging theme as food and nutrition literacy.

A fifth-grade student from an affluent district said that,

"I know that milk and dairy products are useful, so I modify their taste by adding corn flakes or fruits to make it tasty."

2. Improvement attitude and trust-building

Many of students believed that negative thoughts toward adding preservatives and additives in milk and dairy products should be changed. In this regard, some of them suggested strategies for trust-building.

"I think it is best to take the student to the factories to see closely that they do not add preservatives and additives into milk" (a fourth-grade student from a semi-affluent district).

3. Taste and food preferences

Selection of the favorite (dairy) products and no parental compulsion were mentioned as the facilitators for dairy consumption. One of the third-grade male students from an affluent district commented that:

"Don't force the children too much and let them eat any dairy products they like, so children eat more".

Barriers related to consumers/students: Barriers related to the consumer were a concept that emerged in the process of analyzing and comparing data. The concept consists of four sub-categories as follows:

Lack of knowledge and food and nutrition literacy

Most participants believed that low awareness regarding the benefits of dairy products and lack of food label literacy can lead to reduced consumption of milk and dairy products among children and their peers.

"Children don't eat enough milk, yogurt, and cheese because they don't know their benefits." (A 2th grade female student from a semi-affluent district)

"If children read the food labels on the package, they will choose the best product and learn more about its health benefits." (A 5th-grade male student from a semi-affluent district)

Negative attitudes toward products: Undesirable experience in children was a significant barrier to consume dairy products.

"If children have an unpleasant experience of any kind of milk and dairy intake, they will not eat other kinds of dairy products" (A 3th grade female student from an affluent district).

Forcing children to consume milk and dairy products by parents was another mentioned barrier. Children preferred to select and eat any kind of dairy product they liked. Distrust towards information on the products packing, producers, and the related commercials was named as a negative attitude affecting milk and dairy consumption in children.

"In the past, they were all original, especially rural milk, but nowadays most of them have a lot of water, and we are not sure if the claims on the packages are true." (A 5th grade male student from the deprived district).

The conception of adding preservatives and additives to milk and dairy products was another barrier for dairy consumption among the students. They preferred using dairy products without preservatives and additives. In this regard, one of the students said:

"In my opinion, the packaged pasteurized milk isn't delicious because it has additives and preservatives." (A 5th grade female student from an affluent district).

Destroying the tastes and unhealthy food preferences:

Children develop a natural reference for the foods they enjoy the most. The participants believed that unpleasant taste of some milk and dairy products, a strong willingness for junk foods, and other misconceptions and unhealthy eating habits lead to eating foods that are unhealthy but tasty.

"Children like junk foods, such as chips and fries because they are delicious. The more nutritionally worthless a food is, the tastier it

is" (A 5th grade male student from the affluent district).

Strategies to improve milk and dairy consumption among school-age children:

1. Strategies related to the products

1.1 Sensory characteristics: According to the students' viewpoints, desirable taste and texture as well as the diversity of flavors were the most important sensory characteristics.

The majority of participants mentioned that the good taste and flavor of the products are the most important sensory characteristics that encourage students to eat unhealthy foods, such as high-fat dairy products.

"I like the Seven (a kind of full-fat yogurt), because of its delicious taste and desirable texture." (A 4th grade male student from a semi-affluent district).

1.2 Non-sensory characteristics: The majority of the students mentioned low fat, absence of preservatives and additives, and the naturalness of the product in the health dimension. The most important factor in improving milk and dairy product consumption in children was the safety and quality of the product, including having production and expiration date, as well as health and standard logos. The majority of the students emphasized the characteristics.

"I always pay attention to production and expiration date and health logo of dairy products while shopping and never buy the expired ones." (A 5th grade female student from a semi-affluent district).

Students believed that packing appearance in an attractive and childlike manner is important for children. The brand was another identified factor affecting the consumption of dairy products. Some participants reported that people mainly buy brands that are well known, famous, and credible. Some of their statements are as follows:

"Brand is important for us. My family always buys famous products and recommends me to buy the well-known brand." (A 5th grade male student from an affluent district).

One of the students mentioned packet size as an important factor in purchasing dairy products. He said that

"I like that the school cafeteria sells the small size of yogurt; I would like eat it with my lunch at school." (A 5th grade male student from the deprived district).

2. Strategies related to the place

The majority of students stated that if the school milk program is implemented and the school cafeteria offer different kinds of milk and dairy products, they would consume them more. Most of the students also found dairy stores the most convenient place to buy dairy products. They believed that these places would provide better storage conditions for these products.

"I think milk and dairy products should be sold in dairy stores because they know better how to store them." (A 5th grade male student from a semi-affluent district)

3. Strategies related to price

The preferences of students based on price dimension categorized in two concepts, including *physical* and *economical availability*.

Some participants suggested that dairy products should be placed on the shelves in stores and shops in a way to be available for children. Besides, some students emphasized that milk products' prices should be reasonable.

"When buying milk from the school cafeteria, I buy as much as I can afford." (A 3th grade male student from an affluent district).

4. Strategies related to promotion

Preferences related to promotion categorized in three concepts as follows:

4.1 Encouragement and motivation: In the present study, the incentives approach, motivation, self-efficacy, and taste experiences of new products were considered as facilitators

of milk and dairy consumption among primary school children. One of the students suggested that

"Encourage children to drink milk and dairy products by promoting and rewarding".

4.2 Education and information: Students outlined different educational methods to promote milk and dairy products consumption. The methods included simple and comprehensible input delivered by teachers or related researches, practical education through school textbooks, training in cultural-educational camps, theater instruction, children's favorite entertainment and educational videos, milk products promotion by celebrities, peer education, visiting livestock and dairy factories through the scientific tour, and training in the area of milk and dairy products sales, as well as training by specialists.

"If I want to make the students eat more milk and dairy, I'll ask the manager to take us on a scientific tour like visiting a milk factory, teach us and ask us to do research." (A 5th grade male student from a semi-affluent district)

4.3 Modeling and promoting the appropriate culture: In addition to encouraging and informing, other examples referred by some student to promote milk and dairy consumption included sharing experiences with peers and teachers, establishing healthy food festivals, acting parents as a positive role model in consuming milk and dairy products among children, promoting food label reading skill along with teachers or parents in the stores and supply and implementation of school milk program. One of the students stated that

"Children should observe milk drinking by their parents" (a 4th grade female student from an affluent district).

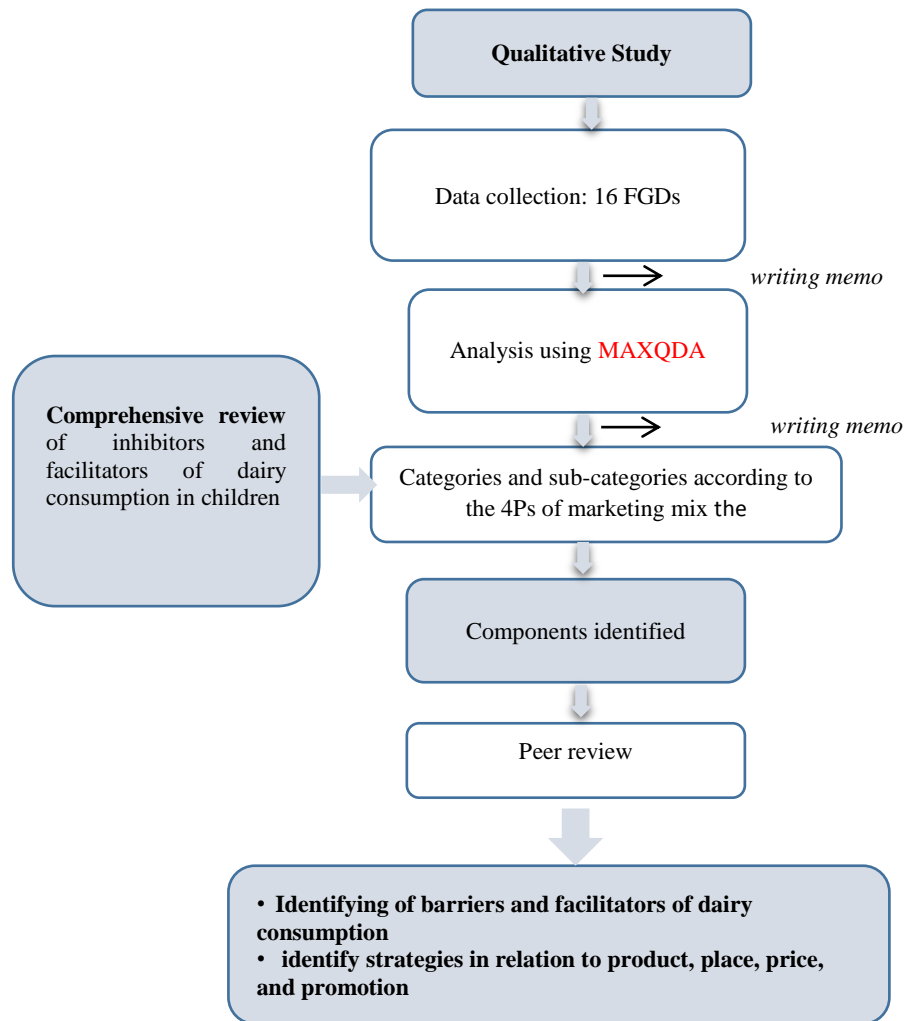


Figure 1. FGD Process

Table 1. Demographic characteristics of students who participated in FGDs (n=111, age range 8–12 years, Mean±SD=10.08±0.57 years).

Sex/Grade	FGD n=16	Girls (n=57)			Boys (n=54)		
		First half of primary school ^a (n=28)	Second half of primary school ^b (n=29)	Total (n=57)	First half school (n=28)	Second half school (n=26)	Total (n=54)
Area							
Affluent (district 2)	4	7 (25) ^c	10 (34.5)	17 (29.8)	7 (25)	7 (26.9)	14 (25.9)
Semi-affluent (district 9)	8	14 (50)	12 (41.4)	26 (45.6)	14 (50)	12 (46.2)	26 (48.2)
Deprived (district 19)	4	7 (25)	7 (24.1)	14 (24.6)	7 (25.9)	7 (26.9)	14 (25.9)

^aFirst half of primary school: Grade 1th, Grade 2th, and Grade 3th; ^bSecond half of primary school: Grade 4th, Grade 5th, and Grade 6th; ^cN (%).

Table 2. Facilitators and barriers of dairy consumption related to consumers/ students.

Category	Sub-category	Codes
Facilitators related to consumers/ Students	Food and nutrition literacy	Awareness of the benefits of milk and dairy products and their importance in health Food label literacy Try new product flavors Skill and ability in improving the taste of dairy products as desired
	Improvement attitude and trust-building	Change negative thoughts Attention to health benefits of milk and dairy products Visit the milk factories and see the production line directly to build trust
	Taste and food preferences	Not forcing by parents Select a favorite product
Barriers related to consumers/ Students	Lack of knowledge and food and nutrition literacy	Inadequate knowledge of students toward the benefits of milk and dairy products Inability to read and comprehend food labels Not trying the new and different kind of milk and dairy products Not eating breakfast and dairy products Lack of resistance toward unhealthy foods
	Negative attitudes toward products	Undesirable experience Forcing children to consume milk and dairy products by parents Misconceptions of adding preservatives and additives Absence of trust in information on the packaging Absence of trust in producers and their advertisements
	Destroying the tastes and unhealthy food preferences	Unhealthy food cravings and the consistency of these foods with personal tastes Unhealthy food habit Not accepting product flavor Milk intolerance Getting used to eating a particular product

Table 3. Strategies to increase milk product consumption by school-age children.

Category	Sub-category	Cods
Strategies related to the product	Sensory characteristics	Desirable taste and texture Variety of flavors
	Non-sensory characteristics	Health dimension <i>Low fat percent</i> <i>Healthy product</i> <i>Absence of preservatives and additives</i> <i>The naturalness of the product</i> Safety and quality of product <i>Having production and expiration date</i> <i>Having health logo</i> <i>Having standard sign</i> Attractive and childlike packaging Well-known brand(s) Variety of product according to size and shape
Strategies related to the place		Distribution of free milk in schools Milk and dairy products supply in school buffet Dairy stores as the best place of supply Improvement the quality of preserving place
Strategies related to price	Physical availability	Visibility of various products in stores Correct layout of products according to production and expiration date
	Economical availability	The supply of no high price products in school buffet (proportional to pocket money) Distribution the free products at school

Table 3. Strategies to increase milk product consumption by school-age children.

Category	Sub-category	Cods
Strategies related to promotion	Encouragement and motivation	Encouragement and motivational strategies to increase milk and dairy consumption by teachers and parents Creation a free experience of different kinds of milk and new dairy products at school
	Education and information	Information in a simple and understandable way practical education through school textbooks Training in cultural-educational camps Children's favorite theater, entertainment and educational videos Product advertisement by children's favorites celebrities Peer education Research and investigating Visiting dairy farms and factories and training by producers Training in dairy products stores Training through specialists
	Modeling and promoting the appropriate culture	Sharing experiences of dairy consumption with peers and teachers Daily consumption of milk and dairy products by parent Promote food label reading with teachers and parents at home, in the cafeteria, at the store, and in fast-food restaurants Organize the hours of milk distribution at schools

Discussions

The findings will be discussed in two main sections separately.

Barriers and facilitators to increasing milk product consumption: In the current study, girls' and boys' views, opinions, and beliefs from Tehran about milk and other dairy products consumption are presented. Although the report identifies the main barriers and facilitators of dairy consumption in terms of social marketing, it can be concluded that in general, the main barriers to dairy consumption can be divided into two main categories. They include discretionary and non-discretionary barriers for children as well as parents (or caregivers) and teachers (and teaching staff).

Disinterest toward dairy products due to the development of preferences for unhealthy foods and poor food and nutrition literacy were among the discretionary barriers for the children. Negative attitudes toward dairy products can be the result of an unpleasant experience with dairy consumption. In that case, if the children are compelled to consume dairy products, the unpleasant experience may be multiplied. Obviously, to prevent negative attitudes and improve children's attitudes towards dairy consumption, it should be possible to increase the likelihood of dairy consumption in children and make it a pleasant experience. It has

been documented that being exposed to a new food for 10-15 times can increase preference for that food (Williams *et al.*, 2008).

To promote dairy consumption among children and adolescents, its exposure was amplified in several interventions. The impact in one-third of the studies was promising (Marquez *et al.*, 2015).

On the other hand, if dairy consumption experience in childhood becomes a pleasant experience, it may be less likely to turn a child into less nutrient-dense food products, such as fatty, sweet, and salty snacks. This may shape food preference for healthier options, as well (Larson *et al.*, 2006).

Distrust towards dairy products, including distrust in food label information or related advertising, were other mentioned barriers to children's dairy consumption. In some cases, false beliefs, such as the addition of harmful substances to sterilized milk or other dairy products, have negatively affected children. Given the young age and inadequate experience of the children, this negative outlook seems to be mostly a result of the family's atmosphere and parental insights. In particular, some of the current study findings highlighted parents and teachers' ignorance and

inconsistency in training provided by them and their behavior as another barrier to dairy consumption. In this case, it is necessary to think of effective measures to inform families and school authorities alongside children.

Among the measures suggested by the children was increasing awareness through practical training, such as visiting the production line of dairy plants and talking to relevant experts and specialists. In an educational intervention, the effect of nutrition label training in children on improving nutrition knowledge and dietary attitude scores was observed only in the direct education group. After the intervention, the percentage of children who chose white milk (plain milk, calcium-rich milk, and low-fat milk) was significantly higher in the direct education group than those in the indirect education group (written message to parents) (Park *et al.*, 2010).

Several studies showed that the pattern of milk consumption in children was affected by the pattern of their parents' milk consumption. In other words, the parents' low dairy products consumption was directly related to their children's consumption (Babolian Hendijani and AbKarim, 2010).

Another barrier to promoting dairy consumption among the children was the lack of functional and practical education in school textbooks. A content analysis on the secondary schools' textbooks in the country showed that the textbooks' level of attention toward food and nutrition literacy, especially in skills and value categories, was low. However, based on the mentioned study, food and nutrition were highly used as instruments for education (Tork *et al.*, 2021).

Another factor cited in children's inadequate consumption of dairy products was insufficient food and nutrition literacy (Vaitkeviciute *et al.*, 2015). Food and nutrition literacy is a concept associated with the skills, capabilities, and knowledge to prepare a healthy diet and make healthy food choices (Vidgen and Gallegos, 2014). This skill helps children minimize the impact of restricted resources or other special situations on healthy food intake. It is documented that increases

in food and nutrition literacy were associated with higher dairy intake in young adolescents (Doustmohammadian *et al.*, 2020).

Lactose intolerance is another issue that may play an important role in the experience of feeling discomfort due to milk consumption (Kanth *et al.*, 2019). In this regard, a few simple dietary strategies, such as adjusting the amount of lactose consumed in each episode, drinking milk with a meal, and gradually increasing intake of lactose-containing foods may be helpful (Gaskin and Ilich, 2009).

One of the major barriers to dairy consumption that is not in control of children and families is the high cost of dairy products. This problem is particularly significant when the children state that junk foods' price is usually less than dairy products. They will certainly lose out in competition with these products. To address this problem, considering subsidies for dairy products seems to help cut down their price. It might be better to avoid paying subsidies in cash (Hosseini *et al.*, 2017).

Other barriers to dairy consumption that are not in control of children and their parents include deficiencies regarding the poor quality of dairy products, inappropriate packaging, inadequate product diversification and innovation, especially those whose main customers are children, and incorrect placement of products in shops. According to the latest research on product design and color, product packaging plays a key role in promoting product sales, and to attract customers' attention, special attention should be paid to the color scheme of the packages offered in stores (Mohebbi, 2014).

Strategies to increase milk and dairy consumption: Other suggested strategies to increase milk and dairy consumption are encouragement and motivational strategies by teachers and parents. Besides, the incentive to consume dairy products can be created through experiencing free milk and dairy products.

From the children's view, the major information about milk and dairy products was achieved via

social interaction with parents, classmates, and school principals, especially health instructors. This finding again highlights the importance of promoting awareness and literacy of food and nutrition for parents, school officials, and children. Based on studies with primary school children in Tehran, parents, classmates, friends, family members, and school officials were among the most popular sources for nutrition information (Abdollahi *et al.*, 2008).

Mass media and more recently, social networks (cyber world) that in the current study are named as influencing factors in dairy consumption have long been of interest to Iranian and international researchers for their impact on shaping children's food preferences and eating habits (Hameed *et al.*, 2014).

Although the studies have often criticized the media and social networks for their role in destroying children's tastes for healthy options, it should not be overlooked that their unique capabilities can be applied to raise awareness and improve dairy consumption among this vulnerable age group.

To the best of the authors' knowledge, the current study was the first qualitative study in Iran which reported barriers and facilitators to milk and dairy consumption among school children in depth. Although the present study could provide a broader range of information and offer the opportunity to seek clarification, which is defined as the strength of qualitative studies (Queirós *et al.*, 2017), the participants may not be representative of all children in the same age group.

Conclusions

The present study findings show the main barriers and facilitators and strategies toward milk and dairy consumption in primary school children. They can be categorized into "in control" and "out of control" barriers and/or facilitators. Obviously, interventions for behavior change of dairy products consumers will only work on the "in control" area. They include improving attitudes and food preferences to increase dairy consumption through effective education of children, parents, and school

officials; and preventing and/or treating lactose intolerance. On the other hand, revision of textbook content, promotion of nutrition literacy, strategies for the dairy price adjustment, diversification of packaging and layout, and improved dairy products supply control of food advertisements can be considered "out of control" issues. Before any action to promote dairy consumption among children, all potential barriers must be identified and taken into consideration. Further studies on tailoring effective interventions in this regard are highly recommended.

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Conflicts of interest

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

Authors' contributions

Doustmohammadian A contributed to conception and design, data collection, analysis and interpretation; drafted the manuscript; and agreed to be accountable for all aspects of work ensuring integrity and accuracy. Amini M contributed to conception and design contributed to data collection; contributed to analysis and interpretation; critically revised the manuscript; and agreed to be accountable for all aspects of work ensuring integrity and accuracy. Rabiee S contributed to conception and design; contributed to analysis and interpretation; critically revised the manuscript; and agreed to be accountable for all aspects of work ensuring integrity and accuracy. Bazhan M contributed to conception and design; critically revised the manuscript, and agreed to be accountable for all aspects of work ensuring

integrity and accuracy and Abtahi M contributed to data collection; critically revised the manuscript; and agreed to be accountable for all aspects of work ensuring integrity and accuracy. All authors read and approved the final manuscript.

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Appendix 1: Interview Guide

Research project: Analysis of opinions and views of primary school students in Tehran about the causes of low consumption of milk and other dairy products

A- Notes related to the interviewee

- The purpose of the interview should be stated to the participants at the beginning of the session.
- The informed consent should be signed by the participants.
- Participants' answers and comments should be written in the note sheets.

B- Questions

1. Do you think your friends and other kids know what dairy products are? Or what is called “dairy product”?
2. Do you think children know the benefits of milk and dairy products?
3. Do you think your friends and other kids consume enough milk and dairy products?
4. Which type of dairy product do you think children like and eat the most? Why? Do you know how much they eat every day?
5. When do children consume more milk and dairy products, day or night?
6. Which type of dairy product do you think is most useful for children?
7. Which dairy product do you think children consume less?
8. Why do you think some children do not consume milk and other dairy products? Or consume less (what are the reasons for consuming and not consuming milk and dairy products)?
9. Do you think families buy enough milk and dairy product for their children? Why or why not?
10. In your opinion, when children are buying milk and dairy products, what do they pay more attention to?
 - How do children prefer these products to be sold (i.e. where? with what appearance / packaging, etc.?) sensory and non-sensory characteristics of the product, place of supply and price and promotion for each product should be asked.)
11. Do you think that all the dairy products that children like are sold in school shops? (Accessibility)
12. Do you think children like the products to be sold in school shops?
 - If the products are sold at school shops, do the children buy them?
 - Which product(s) do children prefer more to be sold in school shops? Why?
13. Where do you think children acquire information about milk and other dairy products?
14. What should be done for children to consume more dairy products? (Ask about sensory and non-sensory characteristics such as taste, packaging, location of supply, price and method of promotion.)
15. In your idea, if children were to be taught about the properties of milk and dairy products,
 - a. Which method(s) do you think would be preferred by them?
 - b. By whom? (e.g., school health coaches, doctors, parents, nutritionists, artists, friends or classmates, etc.)
 - c. How? (e.g., via their textbooks, story and poetry books, educational booklets, shows (movies, cartoons, theater, television,), with competitions, via the Internet, cyberspace, etc.)
 - d. Where? (e.g., schools, home, parks, other places)
16. Do you think milk is distributed in primary schools of Tehran every day? If not, what do you think is the reason?
17. Do you think of anything else? Feel free to say anything else about consumption of milk and dairy products.