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# Agenda-setting for iron deficiency anaemia prevention and control policies in Iran by multiple streams framework

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## Abstract

**Background** According to the WHO report and evaluations, Iran has a moderate prevalence of iron deficiency anaemia (IDA). The present study evaluates Iran's IDA prevention and control policies by analysing the agenda-setting policy using the multiple streams framework (MSF).

**Methods** The present study used Kingdon's MSF model to analyse policies related to IDA in Iran qualitatively. First, the policy documents were reviewed ( $n = 12$ ), and then in-depth interviews were conducted with key stakeholders ( $n = 33$ ) using the framework analysis method. MAXQDA version 2020 was used to categorize the data codes of the interviews and extract related themes.

**Results** The main factors of the problem stream were the prevalence of IDA among Iranian pregnant women, children and adolescents and its risk factors in Iran. The policy stream focuses on mounting the staff in health centres, preventing non-communicable diseases and parasites in the health system, and promoting health programs, such as supplementation, education and fortification. The current political stream regarding IDA shows that national and international support can provide the right political atmosphere for this issue. There are challenges and obstacles related to implementing these policies in Iran, including the preference for treatment over prevention in the health sector, the existence of many economic problems and the limitation of distribution and access to health services owing to some unforeseen issues, such as sanctions or the spread of coronavirus disease 2019 (COVID-19).

**Conclusions** The topic of IDA prevention policymaking has entered a new phase. Responsible organizations, such as the Ministry of Health, should emphasize more in allocating budgets for preventive programs, and key organizations, such as the WHO, should support low- and middle-income countries to empower them towards important preventive strategies.

**Keywords** Iron, Iron deficiency anaemia, Agenda setting, Kingdon's multiple streams, Policy

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## Introduction

Iron deficiency (ID) is the primary reason for anaemia and a prevalent lack of essential micronutrients, impacting almost one third of the global population [1, 2]. According to the 2016 Global Burden of Disease Study, iron deficiency anaemia (IDA) ranks as the fourth most significant contributor to years lived with disability worldwide, accounting for 34.7 million years [3]. Global research conducted in 2010 revealed that the prevalence of anaemia exceeded 2 billion individuals worldwide. Approximately 50% of anaemia cases are attributed to ID [2, 4]. IDA is the most prevalent nutritional deficiency condition and the leading cause of childhood anaemia in underdeveloped nations [5]. The prevalence of IDA varies with factors, such as age, socioeconomic status, ethnic composition, criteria used for diagnosis and dietary habits [6]. The prevalence of IDA usually decreases among school-age children and then increases again during adolescence [7]. Possible causes for IDA can be insufficient intake or absorption of iron, increased need for iron during specific periods, such as infancy, adolescence, pregnancy or lactation to increase blood volume, compensation for increased excretion in menstrual blood or chronic bleeding owing to injury or wound, bleeding haemorrhoids, parasites or malignant disease [8].

The results of studies in 2016 showed that about 250 million, which is approximately 43%, of children living in low- and middle-income countries, did not reach their full growth and development potential, that is, physical, motor, social-emotional and cognitive development. This means that early childhood development (ECD) up to the age of 8 years is very important [9, 10]. Many consequences for ID and IDA have been mentioned, including impaired growth and motor coordination, psychological and behavioural effects (fatigue, inattention, fast heart-beat or shortness of breath), reduced physical activity in infants and children, impaired language development and academic achievement. IDA during pregnancy has been linked to higher rates of low birth weight, morbidity and mortality in both the mother and the fetus [8, 11, 12]. Iron is consumed in two forms: heme and non-heme. The heme form of iron derived from meat is easily absorbed by the body, and as a result, vegetarians are more prone to ID [13]. IDA is most frequent in children between 9 months and 3 years [14]. Severe and chronic IDA in early life might cause neurodevelopmental and cognitive abnormalities that may not be fully curable [15–17].

Iran is also one of the countries where the lack of micronutrients is very important and its side effects are very significant [18]. The Islamic Republic of Iran is a country in West Asia that has faced epidemiological and demographic changes and has diverse geographic, economic, cultural and social characteristics that affect its

health status. Iran is experiencing the third epidemiological transition which is associated with a decrease in the death rate caused by infectious diseases and an increase in the prevalence of non-communicable diseases [19]. Notably, socioeconomic and cultural factors have an effect on level of access to vitamin resources to the population [20]. According to WHO estimates, in 2006, the prevalence of anaemia in Iranian pregnant women, non-pregnant women of reproductive age and in preschool children was 40%, 33% and 35%, respectively [21]. The first national survey to assess micronutrient status, the National Integrated Micronutrient Survey I (NIMS-I), showed that IDA is common in all age/sex groups [22]. The frequency of anaemia was 22, 17 and 13% in the first, second, and third trimesters of pregnancy, respectively [23]. The prevalence of ID and IDA in Iranian children under 6 years of age was 27.7% and 18.2%, respectively. [24]. The results of a meta-analysis study on Iranian girls showed that the prevalence of IDA in girls is about 8.5%. Moreover, the incidence of anaemia and IDA was 27% and 14%, respectively, in school-age girls [25]. It seems that the prevalence of anaemia, especially in women of reproductive age, is increasing in recent years in Iran owing to economic conditions and sanctions [23, 26].

In 1995, a 3-day meeting was held in the region's countries with representatives of the WHO and the United Nations Children's Fund (UNICEF), and then in 1998 in Beirut, after which several solutions were presented to control and prevent IDA. The solutions included four main strategies: food enrichment with iron compounds, iron supplementation, control of parasitic and infectious diseases and proper nutrition education, which were communicated to all countries. In Iran, wheat flour is the staple food of the people and is enriched [27–32]. The authorities launched the National Flour Fortification Program as a major strategy to control iron and folic acid deficiency [22, 30, 33, 34]. WHO provides estimates and tools for tracking anaemia nationally; however, current reports need more subnational variability to inform annual changes for tracking anaemia severity and nationwide planning. Maps of comparable estimates in space and time at policy-relevant administrative levels are critical for tracking progress towards international anaemia goals, identifying the most vulnerable populations and providing decision-makers and policymakers with tools to aid targeted interventions [35]. For the effectiveness of ID preventive policies, it is necessary to adapt them from the agenda-setting stage as the earliest step of the policy-making process. Despite the significant incidence of IDA in numerous countries worldwide, there have been limited comprehensive studies on IDA prevention policies in low- and middle-income countries. In this study, to address this gap, Kingdon's Multiple Streams Framework

(MSF) model was used to identify existing streams and examine how IDA prevention policies are placed as a political priority for policymakers in Iran's agenda.

### Conceptual framework

The MSF is the first step of a three-part process in the policy-making process and consists of three separate parts: the problem stream, the policy stream and the political stream [36]. The focus of this model is on the use of streams to make opportunities called "policy windows". It highlights the significance of essential policy players inside and outside the government. This framework emphasizes three currents and specifies that "(1) problem streams, (2) policy streams and (3) what were the political streams at that time?" and ultimately, "what caused the window of opportunity to open?" As the three streams converge in Kingdon's model, this issue is put on the agenda by policymakers more seriously. The problem stream, which includes data indicators, advocacy organizations and policy reports, influences policymakers considering this matter. The policy stream illuminates several ideas competing for acceptance and offers solutions to dissolve the problem. The fortuity of accepting the ideas can derive technical feasibility and acceptance of values. Eventually, the political stream mentions the international and national climates and political points affecting the issue on the agenda. According to this framework, a "window of opportunity" will open when the three streams converge at critical time junctures [37, 38].

MSF has proven to be a great framework for health policy analysis owing to its capacity to capture the complex interplay of elements that shape policy decisions in the healthcare sector. By scrutinizing the convergence of problem identification, policy proposals and political contexts in health policy development, MSF provides a systematic approach to recognizing the policy-making process. This framework highlights the pivotal role of policy stakeholders, the noteworthiness of seizing policy windows and the crucial requirement of aligning policy solutions with political feasibility. These aspects provide a nuanced analysis of complex, multi-stakeholder health policies, such as IDA and their implementation [39]. On the basis of the previous studies, MSF can lead to a greater understanding of policy governance. There is an interaction between politics, policies and problems in predicting critical deviations from the existing situation in the adoption and implementation of practical and effective policies, and policy adoption and implementation are not independent from each other. As a result, it presents a state of chaos of problems that exist in society and need to be solved or determined how to solve them, and where policy makers have to make sense of incomplete information. The ultimate goal of MSF is to bring

order to this existing chaos. Where politics, problems and policies flow independently until policy entrepreneurs connect them during policy windows. Policy adoption is much more likely when this happens[40]. So MSF is a strong fit for in addressing and analysing complex and multi-stakeholder health issues, such as micronutrient policies in Iran, by noting its strengths.

### Material and methods

In this qualitative study, the MSF-based approach was used to investigate the key factors affecting the flow of the IDA problem, various solutions to prevent anaemia, and factors and political situations affecting the creation of IDA prevention and control policies in Iran.

### Documents review

Document review is practical for comprehension policy content across time and geographies. First, we searched for nutrition-related documents on internal websites. The criteria for entering the documents were the national policy documents developed by the Ministry of Health and Medical Education (MOHME) and other organizations. Then we reviewed all available documents related to IDA policies, including policy documents, laws, regulations, government reports, national studies, scientific studies and newspaper articles. All government reports, research sites and web pages of the Ministry of Health and Medical Education (MoHME), Iranian Universities of Medical Sciences and Iranian government organizations ( $n=12$ ) were searched. The research team reviewed the documents several times on the basis of the research objectives. The included materials are listed in Table 1.

### Key informant interviews

Using the purposeful and theoretical snowball sampling method, the first author, a Ph.D. student in Food and Nutrition Policy, conducted semi-structured interviews of key stakeholders at their workplaces. The interviewer first explained the research objectives to the interviewees, avoided any bias or prejudice during the interview and continued the interviews until data saturation. In advance, the guide to the primary subject of the study was tested, and the necessary changes were applied. Interviews with key informants and actors were conducted using a conceptual framework guideline. In total, 33 interviews were undertaken with stakeholders from different levels of the MoHME, 8 of whom were academics and researchers, 5 were from the National Nutrition Food Technology Research Institute, 1 was from the Food and Drug Organization, 13 participants were from Health Department and various related units of the MoHME, 1 was Ministry of Education, 1 was Islamic Republic of Iran Broadcasting, 1 was Ministry of Agriculture Jihad, 2

**Table 1** List of reviewed documents on Iron deficiency anaemia prevention and control policies in Iran

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1) Decisions of the Supreme Council of Health and Food Security
2) National program on promoting nutrition culture and literacy
3) Planning and organizing research document on nutrition science and food industries
4) Research priorities of the deputy minister of health of the Ministry of Health, Treatment and Medical education
5) Constitution of national nutrition and food technology research institute
6) National trans-sectoral document on the development of food and nutrition security
7) National document on nutrition and food security
8) Special nutritional training package for health care workers in the health transformation program in the field of health
9) National document for the prevention and control of non-communicable diseases
10) The country's sixth development plan
11) Micronutrient deficiency prevention program and national flour fortification program with iron and folic acid
12) Comprehensive scientific health map of the country

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were from flour industries and 1 was Association of bakers. Overall, 31 interviews were conducted face-to-face and 2 were conducted over the telephone owing to distance restrictions. Informed consent was obtained from all interviewees, and all interviews were audio recorded and transcribed verbatim. The interviews (average time: 34 min) were conducted at the participants' offices between October 2022 and November 2023.

The following questions were asked from the stakeholders:

1. Problem stream: what are the problems related to IDA policies in Iran? How did IDA enter the agenda? What are the unresolved issues in Iran's IDA field?

2. Policy stream: what measures have different groups taken to tackle IDA-related problems in Iran? What settings do different organizations address to solve IDA issues in Iran?

3. Political stream: how do political determinants affect IDA prevention policies in Iran? What political variables influence the implementation of IDA prevention policies in Iran? Does Iran's highest government level provide political backing for IDA policymaking?

#### The rigour of the study

We included stakeholders of several IDA policymaking sectors to improve the current study's conformability. Using inter-observer reliability, disagreements were settled through dialogue. A peer check was also completed by providing another co-author (F.M.N.) with the extracted themes. Following every interview, a member check was conducted to display the notes and inquire about any insights gained from the interviewees. We gathered and examined the data at the same time.

#### Data analysis

Two researchers analysed the collected materials using framework analysis. Then, the available documents and

transcribed interviews were read and reviewed several times. Two independent authors open-coded and categorized all materials to extract related themes. Any disagreements were solved through discussion between researchers. The themes that were retrieved were analysed on the basis of MSF's problem identification, policy solutions and policy opportunities. Data were analysed using MAXQDA software version 2020.

#### Ethical issues

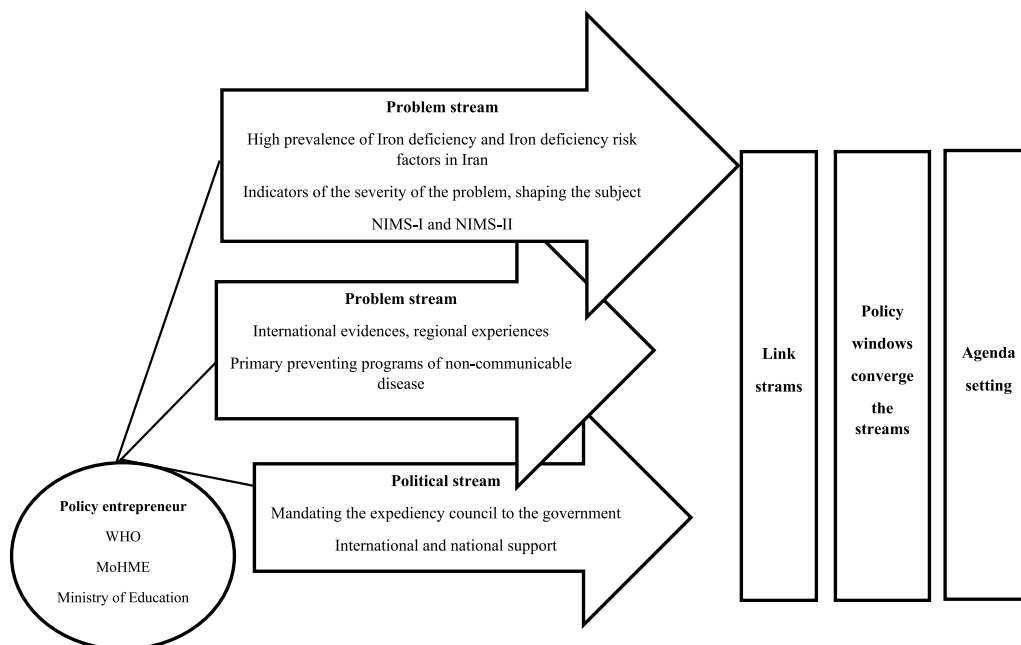
The ethics committee of Tabriz University of Medical Sciences, Tabriz, Iran, approved the study protocol (code: IR.TBZMED.REC.1401.032). All participants signed the informed consent form. The interviewees' quotes and employment status were anonymous.

#### Results

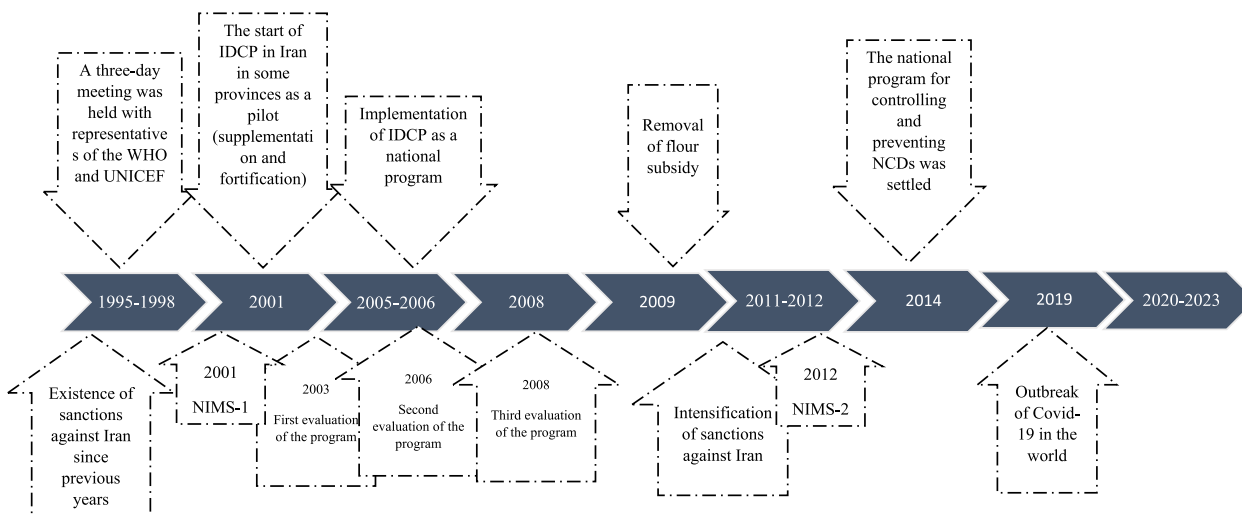
The present study's results are based on Kingdon's MSF model (Fig. 1). Timeline of the formulation and adoption of IDA control and prevention policies in Iran based on document analysis has been illustrated in Fig. 2. Table 2 shows the characteristics of conducting interviews with 33 key informants. The following streams were extracted from both document review and interview analysis.

#### Problem stream

Remarkable prevalence of IDA in Iran: the participants stated that the prevalence of IDA in Iran has increased, especially among young people of reproductive age. The interviewees believed that the prevalence of IDA in Iran has various reasons, especially lack of awareness and limited consumption of iron-containing foods. Proponents of micronutrient deficiency prevention in Iran argue that IDA, especially in pregnant women and children, can impose economic costs on the country and the health system owing to its association with non-communicable diseases (NCD). In this regard, one of the interviewees



**Fig. 1** IDA agenda-setting in Iran based on Kingdon’s multiple streams framework. *NIMS* National Integrated Micronutrient Survey; *WHO* World Health Organization; *MOHME* Ministry of Health and Medical Education



**Fig. 2** Timeline and key milestones of the formulation and adoption of the IDA prevention and control policies in Iran. *IDA* iron deficiency anaemia, *WHO*: World Health Organization, *MOHME* Ministry of Health and Medical Education, *UNICEF* United Nations Children’s Fund, *IDCP* Integrated Iron Deficiency Control Program, *NCD* non-communicable diseases, *NIMS* National Integrated Micronutrient Survey

from the Secretariat of the Supreme Council of Health and Food Security stated at the policy level:

*“Previous studies had shown that iron deficiency and anaemia are one of the common problems in the country, and since it was one of the common nutritional problems, it was addressed as a priority in the country’s healthcare networks” and “In addition, people’s food situation is much worse*

*now owing to high prices, inflation and sanction, after all, access to animal protein sources, access to meat is very little or completely removed, or during the corona epidemic (2 or 3 years), there was no supplement at all. Both anaemia and iron deficiency became more prevalent” (participant 15).*

Another key informant said:

**Table 2** Characteristics of participants in interviews on IDA prevention and control policies

Ministry	Stakeholder's organizational affiliation	Participant no.	Education	Related role
MoHME*	National Nutrition and Food Technology Research Institute	P1	Ph.D. in nutrition	Expert in nutrition research
	Faculty of nutrition and food science, Nutrition Research Center, Tabriz University of Medical Sciences	P2	Ph.D. in nutrition	Researcher in nutrition research
	National Nutrition and Food Technology Research Institute	P3	Ph.D. in food science and technology	Expert in nutrition research
	National Nutrition and Food Technology Research Institute	P4	Ph.D. in food and nutrition policy	Researcher in nutrition research
	Scientific Association of Nutrition of Iran	P5	Ph.D. in epidemiology	NIMS** project manager
	Faculty of nutrition sciences and food technology, Shahid Beheshti University of Medical Sciences	P6	Ph.D. in nutrition	Nutrition lecturer and researcher
	Faculty of nutrition sciences and food technology, Shahid Beheshti University of Medical Sciences	P7	Paediatrician	Nutrition lecturer and researcher
	National Nutrition and Food Technology Research Institute	P8	Ph.D. in nutrition	Expert in nutritional research
	National Nutrition and Food Technology Research Institute	P9	Ph.D. in nutrition	Expert in nutrition research
	The Secretariat of the Supreme Health Council	P10	MPH of public health	Expert in public health
	The office of the community nutrition, Deputy of Health	P11	MSc in public nutrition	Expert in community nutrition
	The office of the community nutrition, Deputy of Health	P12	Ph.D. in nutrition	Expert in community nutrition
	The office of the community nutrition, Deputy of Health	P13	Bachelor of nutrition	Expert in community nutrition
	Non-communicable diseases department	P14	MD	Expert in non-communicable diseases
	the Secretariat of the Supreme Council of Health and Food Security	P15	Ph.D. in nutrition	Expert in community nutrition
	The office of the community nutrition improvement	P16	Bachelor of nutrition	Expert from the nutrition department
	Food and drug organization	P17	Ph.D. candidate in food and nutrition policy	Fortification expert
	Adolescent and youth health groups in schools	P18	Master of midwifery	Expert from the health and adolescent department
	The office of the community nutrition, Deputy of Health	P19	Bachelor of nutrition	Expert in community nutrition of the city health centre
	Population and family health department, Deputy of Health	P20	Bachelor of midwifery	Expert in population and family health
	Maternal health group, Deputy of Health	P21	Bachelor of midwifery	Expert in maternal health
	Faculty of Nutrition and Diet Therapy, Tehran University of Medical Sciences	P22	Ph.D. in nutrition	Nutrition lecturer and researcher, former NIMS project manager
	Infants, children and breast milk health group, Deputy of Health	P23	Bachelor of midwifery, master of management	Expert in infants, children and breast milk

**Table 2** (continued)

Ministry	Stakeholder's organizational affiliation	Participant no.	Education	Related role
	Department of nutrition and pharmaceutical affairs	P24	Bachelor of Nutrition	Expert in the community nutrition of the city health centre
	Infectious diseases group	P25	MPH infectious disease management	Parasite control expert
Ministry of Education	The Food and Drug Organization	P26	Ph.D. in food science and technology	Fortification and supplementation expert
	Ministry of Education	P27	MD	Executive manager in the Ministry of Education
National standards organization	National Standards Organization Research Center	P28	PhD in the food industry	Expert of the National Standards Organization
Broadcasting Organization	Health council of Broadcasting Organization	P29	Specialists in children and adolescents	Expert in health education
Ministry of Industry, Mine and Trade	Deputy Minister of Industrial Affairs	P30	PhD in strategic management	Fortification expert
	Center of Trade Unions of Iranian Flour Industries	P31	PhD in chemistry	Fortification expert
	Bakers Union Education Committee	P32	Bachelor of teaching skills	Fortification expert
	Flour industry	P33	Ph.D. in food science and technology	Food technology expert

MoHME<sup>†</sup> Ministry of Health and Medical Education

NIMS\*\* National integrated micronutrient survey

*“One of the most common nutritional deficiencies is iron deficiency anaemia; among nutritional problems, it is one of the most prioritized, and this is a mission that should be the responsibility of the health centres or the health system of the country to think about this to reduce its prevalence” (participant 1).*

*The national and international investigations of the state of micronutrients in Iran* According to document reviews and the interviewees' statements, the results of the national investigations of the state of micronutrients in Iran were related to the years 2001 and 2012. The first National Integrated Micronutrients Survey (NIMS-I) was widely conducted in Iran in 2001 [22, 41]. The second national integrated survey of micronutrients (NIMS-II) was conducted to evaluate the nutritional status of four micronutrients, including iron, zinc, vitamin A and vitamin D, in 2012 [22]. Distribution of vitamin A and D supplements for children under 2 years of age, starting of iron supplementation with the initiation of complementary feeding in infants, during pregnancy and in students, and the use of zinc supplementation are among the critical programs implemented in the primary health care (PHC) system in Iran.

According to the report of the World Health Organization, the prevalence of anaemia in Iran is moderate

in preschool children, severe in pregnant women and moderate in women of reproductive age [42]. According to our latest systematic review and meta-analysis, the prevalence of IDA in pregnant women is 15.71%, and in young Iranian children is 19.91%. The prevalence of IDA in pregnant women in urban and rural areas was 16.32% and 12.75%, respectively [43]. The lowest prevalence of anaemia was observed in teenage boys (5.8%) compared with girls (12.1%), with a statistically significant difference [22]. Another comprehensive meta-analysis revealed that the overall prevalence of IDA in the Iranian population younger than 18 years was estimated to be 13.9%, and the total prevalence of ID was 26.9%. The prevalence of IDA was 7.9% and 8.5% in males and females aged under 18 years, respectively [25]. The estimated prevalence of anaemia in some regional surveys in Iran is reported to be about 10% [22, 44]. Improper nutrition followed by ID, menstruation or pregnancy are the most important causes of anaemia [45]. IDA varies on the basis of age, sex and geographical area. Other reasons that affect IDA status include lifestyle, diet, socioeconomic status, level of education and number of deliveries [46, 47].

The interviews showed that despite implementing the national iron supplementation program in Iran's high schools, IDA was still common among adolescents and adults. Interviewers explained that one possible cause

of IDA was that the iron supplementation program was stopped after the coronavirus pandemic and school closures. Another reason is the lack of workforce to implement it. Students' lack of knowledge also causes them not to use it, and some cultural issues, traditional medicine interventions and misconceptions are other reasons.

*"My experience in the field is that most of our students, especially our female students, have this iron deficiency, especially in deprived areas... How good it is that the Ministry of Education, in cooperation with the Ministry of Health, was able to become a part of compensating this deficiency. Naturally, if my student has a healthy and stable physical condition, he can be a more useful person in the future, spend less money on health and treatment in the country and then be strong parents who give birth to healthy children"* (participant 27).

*"In recent years, schools were closed owing to the spread of COVID-19, and this program was not implemented regularly because it was not possible to reach students and their parents and pregnant and lactating mothers. And owing to the fear of COVID-19, health visits decreased and supplements were not received"* (participant 16).

Most food industry experts believe that the needs of all people in age and gender groups are not the same, and the groups most in need of iron are pregnant and lactating women, children and adolescents in the growing age, girls and adult women. Adult and older men, especially men over 40 years of age, do not face iron deficiency and do not need to consume more iron [29].

In this context, one of the experts said:

*"In my opinion, we should investigate whether everyone needs this amount of iron through fortification? For example, men or patients who take a lot of other pills, is it not harmful to them?"* (participant 31).

### Policy stream

WHO's proposed key strategies: this is where the problem stream meets and aligns with the Policy stream to solve this problem. The policy stream concentrates on how solutions can be practicable for IDA prevention. The IDA prevention program was diligently applied at the start of the NIMS-II program in 2012 [22]. The WHO proposed key strategies to control and prevent IDA, which included iron supplementation, food fortification with iron compounds, proper nutrition education, dietary diversification and control of parasitic and infectious diseases [21, 28, 48, 49]. The WHO has established a worldwide objective in nutrition to reduce anaemia among women of reproductive age by 50% by 2025. These

global nutrition goals, including the anaemia reduction target, have been extended until 2030 [50–52].

Programs implemented in Iran in line with the proposed strategies: the Iranian Ministry of Health carried out the Integrated Iron Deficiency Control Program (IDCP) in cooperation with the Ministry of Education. One iron tablet per week is given to each female student of the first and second secondary level for 16 weeks or 4 months, and at the same time, they are given nutrition education. The daily dose is used for pregnant women, and iron drops are used for babies under 2 years old [27, 53]. The iron supplementation program was implemented in Iran in 2001 as a pilot in several provinces. Since 2005, as a national program, it has been integrated into the programs of the health departments of universities [54].

After the joint workshop of three organizations, The Micronutrient Initiative (MI), UNICEF and WHO, in 1998 in Beirut and the commitment of the honourable minister at that time for the fortification of flour with iron, a tripartite memorandum was signed by the organizations. In 2001, the fortification of flour in Bushehr province was officially selected, and it started as the first pilot province in Iran to fortify flour with iron and folic acid. In 2006, owing to many successes, this plan became a national plan, and the president approved its implementation for the whole country. In this program, the mixture of nutrients called Permixon contained 1.5 ppm of folic acid and 30 ppm of iron [29].

Training of health workers and other relevant staff about iron deficiency and general nutrition education for the people, holding national training workshops for doctors and nutrition and health experts and promotion of vegetable and summer home gardens were also carried out [55].

*"Regarding the distribution of supplement pills, especially iron, there was always resistance from the community, especially recently with the flow of traditional medicine is it essential to give all these supplements to students or pregnant mothers? Following these questions, we formed a national committee with the presence of experts, including nutritionists, gynaecologists, and paediatric specialists. Finally, this committee concluded that it is necessary to distribute iron supplements among students and pregnant mothers. From the scientific point of view, the committee that was formed Approved the distribution of these supplements"* (participant 13).

Another said:

*"The three major strategies that are fortunately being implemented in Iran are supplementation,*



*fortification and nutrition education – for example, promoting home gardens to obtain products that have more vitamins, especially vitamin C, which can have an impact on people’s nutrition, which is part of our educational program. Now these trainings have many methods. Training may be a webinar, a poster, a pamphlet or training. Each has its influence, but during a survey of the society, they chose the best and most engaging education through radio and television so that we can do many educational programs through radio and television” (participant 11).*

Additionally, another participant stated:

*“Regarding parasites in some provinces, especially with heavy rainfall, people’s contact with polluted water, and another issue, the culture of using native plants that are also used in food products was very effective in increasing the trend of this disease and the spread of parasites. In these years, we worked a lot in this field, as you know, to change people’s eating behaviour” (participant 25).*

From 2007 to 2009, this program was carried out successfully with the cooperation of the responsible organizations. Unfortunately, since 2009, owing to some problems in the process of flour fortification, for example, the removal of flour subsidy, the fortification program was stopped in some provinces of the country [29].

*“The main problem is that we do not have a good evaluation in our programs. Indeed, it goes well initially, but we cannot draw general conclusions later. This goes back to many social factors and financial limitations, direct supervision, and continuous change of managers in different periods, which may reduce the importance of a national program in a period. The issue of anaemia and IDA is interdepartmental, and the lack of coordination between different organizations creates an interruption in the way of its correct implementation. Also, the primary priority of the MoHME is not prevention” (participant 2).*

### Political stream

The problem stream and the policy stream meet with the political stream to seek support for the precise implementation of strategies. Additionally, the intersection of three streams leads to the creation of a window of opportunity and being placed on the agenda of the government, and this is where the issue of IDA is placed on the agenda of the government.

International and national support: the WHO is a critical player in managing NCD prevention and control globally. After the publication of the “Global Action Plan for the Prevention and Control of NCD 2013–2020” by the WHO, Iran’s National Program for the Control and Prevention of NCD was prepared [56]. This action plan was also negotiated at the WHO regional offices [57].

*“Before the implementation of the program, we had representatives from all the relevant organizations and centres, such as agriculture, industry sector, trade sector, standard sector and all the places that we thought were necessary at that time, and by involving them and holding specialized workshops and meetings, we were able to gain their opinion and support” (participant 22).*

Actions: since the formation of the specialized working group on health and food security (2013) and the accomplishment of the transformation plan of the health system (2013), nutritionists have been occupied in the health field. The national program for controlling and preventing NCDs was settled in 2014, and the National Integrated Micronutrient Survey outcomes were published. These actions attracted the policymakers’ attention to IDA policies. These streams opened a new opportunity window for the Community Nutrition Office of the MoHME to establish IDA policies. The prevention of any NCD is a multi-sectoral approach that requires the participation of all ministries, organizations and sectors related to health and relevant stakeholders. According to the results of the interviews, the focus and priority of prevention instead of treatment is necessary to improve the general health policies in Iran in the policy-making process.

*“Many countries have these different programs of supplementation and fortification, training and fight against parasites in their work program. It is supported by international organizations such as WHO and FAO and now a series of NGOs. Anyway, according to the situation of each country, they implemented programs to solve this deficiency” (participant 26).*

Strategies: currently, supplementation, fortification programs, educational services and parasite control are being carried out in Iran. However, owing to increasing prices and inflation, sanctions and during the COVID-19 epidemic, which led to changes in food intake and patterns, the intake of micronutrients has decreased. It has affected the proper implementation and fulfilment of many programs, including the provision of iron in schools or health centres. On the basis of inflation and economic conditions in Iran, anaemia caused by ID

is increasing, so the need to analyse and review existing policies to improve preventive policies and provide suitable policy options to policymakers is felt. For policy analysis, reviewing successful experiences and initiatives can be helpful.

**Barriers:** one of the key results of the present study is that in Iran's healthcare system, treatment is preferred over prevention. Therefore, among the crucial obstacles of this program in Iran, the following can be mentioned:

- lack of sufficient knowledge of IDA and its complications, as well as side effects of non-communicable diseases;
- lack of coordination and incomplete coordination between different government institutions;
- lack of statistics and accurate evaluations of the implementation process and their effectiveness;
- urbanization and modern lifestyle and tendency towards unhealthy lifestyle and environmental problems;
- the outbreak of COVID-19 and the inability to implement the program, especially in schools;
- Iran's current economic situation and sanctions and high inflation;

- cultural problems and traditional medicine interventions in not taking iron supplements.

Therefore, despite putting IDA policies on the agenda, these obstacles create problems for their implementation. Specific barriers in implementation, responsible stakeholders and suggested practical solutions for IDA control are given in Table 3.

## Discussion

The results of the document review and interviews conducted in Iran in this study showed that the main policy of prevention of IDA in Iran is supplementation strategy in children under 2 years old, high school students and pregnant women, as well as fortification of bread with iron and folic acid. Nutrition education and parasite control in endemic areas were recognized as another programs to improve iron intake. Nonetheless, owing to the heavy workload in healthcare and the lack of staff in the education system, this program has not performed well so far. However, flour mills voluntarily and mandatorily fortify flour with iron and folic acid. The convergence of three streams led to the agenda-setting of this policy, and the presence of political entrepreneurs joining these streams led to the opening of the window of opportunity.

**Table 3** Specific barriers in implementation, responsible stakeholders and suggested practical solutions for IDA control

Barriers	Stakeholders	Solutions
Lack of sufficient knowledge of IDA and its complications	- Ministry of Health and Medical Education - Ministry of Education - Islamic Republic of Iran Broadcasting - Ministry of Science Research and Technology	- Holding training classes for service providers and receivers in different departments of the Ministry of Health - Holding training classes for service providers in the Ministry of Education and students and their families in schools, school health curricula - Production and distribution of efficient and effective educational content in mass media and use of virtual platforms
Lack of coordination and incomplete coordination between different government institutions	- Ministry of Health and Medical Education - Islamic Consultative Assembly	- Holding meetings and coordinating and seeking support from various government institutions
Lack of statistics and accurate evaluations of the implementation process and their effectiveness	- Ministry of Health and Medical Education	- Conducting program evaluation as well as monitoring and reporting
Urbanization and modern lifestyle and tendency towards unhealthy lifestyle and environmental problems	- Ministry of Health and Medical Education - Agricultural Research, Education and Extension Organization	- Teaching a healthy lifestyle - Improving the level of accessibility and hygiene
The outbreak of COVID-19 and the inability to implement the program, especially in schools	- Ministry of Health and Medical Education - Ministry of Education	- Education of parents and students and distribution of supplements in health centres instead of schools in times of crisis
Iran's current economic situation and sanctions and high inflation	- Ministry of Health and Medical Education - Ministry of the Interior - Ministry of Welfare - Ministry of Industry, Mining and Trade	- Planning and allocating funds and identifying food insecure areas and families and helping them - Improving the condition of agriculture and animal husbandry - Reallocating resources or prioritizing preventative measures over treatment
Cultural problems and traditional medicine interventions in not taking iron supplements	- Ministry of Health and Medical Education	- Education and culturalization and prevention of non-scientific traditional medicine interventions

### Problem stream

The Comprehensive study of food consumption pattern and nutritional status of the country in 2001–2000 showed that iron intake in almost 70% of Iranian households are insufficient [58]. Iran is currently experiencing a nutritional transition owing to rapid changes in lifestyle, food consumption and socio-economic factors. Changes in people's food consumption patterns in recent decades have affected the status of micronutrients [59]. Any recommended strategy should be adapted to socio-economic status, attitude, behaviour, culture and food pattern variables. The National Nutritional Anaemia Prophylaxis Programme (NNAPP) among all vulnerable age groups, especially mothers and children in India, as a measure to prevent high prevalence of anaemia through primary health centres (PHCs) and sub-centres were also started in 1970 and was revised and expanded to the National Iron Plus Initiative (NIPI) programme in 2011. However, the prevalence of anaemia has continued to remain high during the last 60 years [60].

Malaria is a significant contributor to anaemia in regions where malaria is widespread, particularly in Africa, where it is more prevalent. Therefore, malaria control in different countries can be considered as one of the programs for preventing IDA [66]. The results of studies have shown that educational sessions through lectures, small group discussions, films, pamphlets, etc., can increase people's awareness and positive attitude towards dietary behaviours that prevent IDA [33].

On the basis of the results of interviews and studies, reasons, such as health inequalities and potential reproductive preferences, female sex, retirement and being a housewife, living in rural areas, being in the third and fourth quartile of wealth, lack of weight, lack of sleep, physical activity, being weak and suffering from some diseases were associated with an increased risk of anaemia [61, 62]. Integrating IDA awareness into school health curricula, holding training classes for service providers and receivers in different departments of the Ministry of Health and Medical Education in addition to Ministry of Education, Production and Distribution of efficient and effective educational content in mass media and use of virtual platforms has been suggested.

### Policy stream

Iron supplementation is known to be the best approach which is safe, flexible and fast-acting and can be used specifically in high-risk groups [63]. Changes in the use of iron supplements in terms of the type and form of its product, duration, dose and frequency of administration, which play a fundamental role in achieving the desired level of effectiveness and patient satisfaction, have led to

different findings [64]. The results of the studies showed that in most cases, iron supplementation before delivery improves pregnant women's iron indicators, such as haemoglobin or serum ferritin concentration [65]. However, there are concerns that iron supplementation could increase rates of infectious diseases, including malaria [66]. Another concern about the adverse effects of iron is its role in producing reactive oxygen species and evidence of associated oxidative stress. With lower doses in the long term, especially in men, it can also lead to cancer and cardiovascular diseases [33, 67].

Food fortification has been introduced as the best solution by experts to control IDA. As it is highly effective, the possibility of side effects owing to its excessive consumption is also minimized. It is an effective and safe strategy to fight IDA, and compared with supplementation, it has the advantage that in fortification, the cooperation of the target groups and the participation and cooperation of the community are not necessarily needed [29, 68, 69]. According to domestic and foreign experts, the only cost-effective way to deal with IDA is food fortification, especially flour, which can be effective from all points of view, both therapeutic and economic [29]. In healthy people belonging to the lower economic deciles of society, owing to the high consumption of bread, and in the upper economic deciles of society, owing to receiving enough iron from iron sources, it may have risks [70]. The mixing of premix and flour is solid and powdery, and the systems used to combine flour with iron with the help of factory machines are probably not carefully controlled. As a result, the fortified flour in the factories rarely meets the fortification instructions [29, 71].

A policy review study in China showed that maternal anaemia control services provided in clinical settings, including anaemia screening, nutrition education and population-based interventions, such as iron fortification, have yet to be scaled up. There is also the limited number and capacity of health professionals. Policy changes should focus on integrating public health service packages into routine antenatal care services and the integration of evidence-based interventions, simplification of reimbursement for outpatient expenses, standardization of provision and dosages of iron supplementation and capacity building of health professionals [72]. One critical challenge in this field is the lack of national IDA evaluation reports after implementing the supplementation and fortification program. Regardless of the available data, the IDA program is uniformly applied across all country regions, with insufficient consideration given to individuals with unique circumstances. Conducting program monitoring and evaluation in different regions and age–sex groups can be considered a practical solution in improving IDA control and prevention strategies in Iran.

### Political stream

It is essential to present evidence-based research to convince politicians on a health issue and to put it on the agenda or to revise the policy [73]. The present study's findings confirm the need to focus on the role of political support at national and international levels in determining the agenda of IDA. The Iranian Ministry of Health presented the action plan for preventing non-communicable diseases after the WHO formulated the global action plan for preventing and controlling NCDs in 2013–2020. Iran's health reform program was endorsed in 2013, emphasizing the significance of managing NCDs [74].

Initiatives and practical solutions should be applied after opening the window of opportunity in an issue. Nevertheless, actors other than those working in the health sector do not have sufficient motivation to work on this matter, even though Iran's health and treatment sector has been built strategically from the top down at the national, provincial and city levels. However, lower-level actors and executive stakeholders do not have enough participation in policy formulation [75]. Almost all policies are implemented with an absence of enthusiasm. This is because the policymakers at the top are often not involved in the concerns and matters of the stakeholders at the lower and local levels [76]. Hence, it is imperative to reevaluate this universal approach. On the basis of the interviews, a combination of strategies that target different groups and well-crafted rules with ongoing monitoring systems can enhance the status of IDA in the community.

In China, many existing policy documents tailored to regional contexts were not accompanied by monitoring and evaluation mechanisms, process indicators or targets and implementation plans for anaemia reduction. This has led to inadequate provision and uptake of maternal anaemia interventions across the country. To create standardized and effective service delivery, governments can learn from the experiences of other countries and establish service standards for the control and prevention of maternal anaemia [72]. Advocating for sustained funding for IDA prevention and control despite economic challenges by the Ministry of Health and Medical Education as well as coordinating and seeking support from various government institutions for more inter-sectoral cooperation can be helpful.

### Limitations and strengths

According to our knowledge, this study is the first to identify the key points for implementing IDA prevention policies in Iran. Using the agenda-setting approach was another strength of the study. This study provided

several points regarding the provocative forces behind the agenda-setting of IDA policies, which can propose policy. The current research has a qualitative design, and the data obtained from interviews and document reviews were used. Therefore, the generalizability of the findings is low. The current study had limitations, such as the problem of recalling data details regarding events and processes linked to bygone policymaking and legislative processes owing to some interviewees' long era of analysis.

### Conclusions

In general, Iran's IDA control agenda-setting procedure followed MSF. The current research results showed that contrary to Kingdon's theory, three policy and politics streams have completely influenced each other regarding the IDA program. Using the MSF agenda-setting approach provides insights into the factors that influence the development of policies related to IDA prevention that can lead to the development of policy solutions. Now, a new window of opportunity to prevent IDA has opened. Although "general health policies" emphasize prevention over treatment, this is not implemented in practice owing to local and governmental problems. Some challenges and obstacles, such as insufficient capacity and facilities in the health sector and the outbreak of COVID-19, have hurt the implementation of policies in Iran. Regarding political recommendations, responsible organizations, such as the Ministry of Health, should emphasize more in allocating budgets for preventive programs, and key organizations, such as the WHO, should support low- and middle-income countries to empower them towards important preventive strategies.

### Abbreviations

FAO	Food And Agriculture Organization
ID	Iron deficiency
IDA	Iron deficiency anemia
IDCP	Integrated iron deficiency control program
MI	Micronutrient initiative
MoHME	Ministry of Health and Medical Education
MSF	Multiple streams framework
NCD	Non-communicable diseases
NGO	Non-governmental organization
NIMS	National integrated survey of micronutrients
PHC	Primary health care
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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### Author contributions

A.D. contributed to data collection and statistical analysis; A.D., FMN., M.R., R.Kh.Z. and N.T. participated in the design and interpretation of data; A.D.

wrote the first draft of the manuscript, and F.MN., M.R. and R.KhZ. commented on previous versions. All authors read and approved the final content.

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### Availability of data and materials

The data analysed as part of this qualitative study are available from the corresponding author upon reasonable request.

### Declarations

#### Ethics approval and consent to participate

The study was approved by ethics committee of Tabriz University of Medical Sciences, Tabriz, Iran (code: IR.TBZMED.REC.1401.032). All participants provided consent prior to participating in sessions.

#### Consent for publication

Not Applicable.

#### Competing interests

The authors declare no competing interests.

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