Practices of Introduction of Complementary Feeding and Iron Deficiency Prevention in the Middle East and North Africa

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ABSTRACT

Background: Iron deficiency (ID) with or without anemia is associated with impaired mental and psychomotor development. Given the paucity of information on physicians' knowledge and practices on iron (Fe) supplementation and impact of ID in the Middle East and North Africa, it was felt important to conduct a survey.

Method: A group of expert physicians developed a questionnaire that was randomly distributed among Middle East and North Africa doctors to assess their knowledge and practices on introduction of complementary feeding, impact of ID, its prevention, and their impression on prevalence of ID. Descriptive statistics were used.

Results: We received 2444 completed questionnaires. Thirty-nine percent of physicians do not follow the European Society for Paediatric Gastroenterology, Hepatology and Nutrition guidelines regarding age of introduction of complementary feedings. Approximately 62% estimate the prevalence of ID anemia to be 40% to 70%; however, only 17% always monitor hemoglobin between 9 and 12 months of age, 43% do so ''almost'' always, whereas 36% do so ''rarely'' or (4%) ''never.'' For the prevention of ID in infants older than 6 months of age, almost all recommend introducing Fe supplements. Ninety-seven percent agree that untreated ID during infancy may have long-term negative effects on cognitive function, whereas 53.26% consider that Fe-enriched infant cereals result in staining of the baby teeth, constipation, and dark stools.

Conclusions: Although there is awareness of the impact of ID, there are some misconceptions regarding age of introduction of complementary feedings, surveillance of Fe status, and side effects of Fe-enriched infant cereals. There is a need for educational initiatives focusing on prevention of Fe deficiency.

Key Words: infant cereals, nutritional deficiencies, survey

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What Is Known

- A systematic review of nutritional deficiencies in the Middle East estimated the prevalence of iron deficiency anemia in preschool children to be 20% to 67%. No studies have, however, documented Middle East physician practices and their knowledge related to iron deficiency in infants and its prevention.

What Is New

- This study presents the responses of 2444 Middle East and North Africa physicians regarding their practices and recommendations about introduction of complementary feedings and their awareness regarding the impact of iron deficiency and the steps they take toward prevention and monitoring of iron deficiency during infancy.

Iron deficiency (ID) is the most common nutritional disorder in the developed world (1,2). According to the World Health Organization (WHO), in the Eastern Mediterranean Region, approximately 149 million people suffer from ID or ID anemia (IDA), predominantly children and women of childbearing age (3). A systematic review of nutritional deficiencies in the Middle East estimated the prevalence of IDA in preschool children to be 20% to

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67%, and 12.6% to 50% in school age children (4). ID, with or without anemia, is associated with impaired mental and psychomotor development, even when treated successfully (5,6). Myelination, monoamine neurotransmitter function, neuronal and glial energy metabolism, and hippocampal dendritogenesis are a number of physical brain developments that require iron (Fe) (7). Furthermore, numerous case-control studies have demonstrated a strong association between Fe deficiency anemia in infancy and cognitive and behavioral performance (7). In the authors' experience, nutrition is, however, not a strong component of the pediatric curricula, it is likely that not all physicians are familiar with the impact that ID has on neurodevelopmental outcome. Diet is one of the ways to provide enough Fe to prevent ID. The European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) has published recommendations regarding the timely introduction of complementary feeding to decrease the risk of allergy and celiac disease (8) and also regarding Fe needs and prevention of ID (7). Although there are several reports detailing the burden of anemia across different age groups in the Middle East and North Africa (MENA) region, no studies have documented physician practices related to introduction of complementary feeding and prevention ID in infants.

Therefore, a group of experts from across the region was brought together with the aim of developing a questionnaire to be distributed among colleagues to assess their knowledge and practices in the prevention of ID and adherence to international recommendations.

METHODS

A questionnaire was developed by the "ad hoc" group of experts in the field of pediatric gastroenterology and nutrition made up from representative countries across the MENA region including Egypt, Iran, Kingdom of Saudi Arabia, Kuwait, Lebanon, Morocco, and the United Arab Emirates in collaboration with international experts from Argentina, Belgium, and Italy. The questionnaire is available as supplementary material online (Questionnaire, Supplemental Digital Content 1, *http://links.lww.com/MPG/B432*).

The questionnaire consisted of 2 parts. The first focused on the responders' personal and professional characteristics. The second included specific closed-ended questions with regards to recommendations on timing of introduction and choices of complementary feeding in general and prevention of ID in particular and knowledge on consequences of ID and practices for monitoring Fe status. The questionnaire was in English or French, the latter for distribution in Algeria and Morocco. The face validity of the questionnaire used was established by experts and peers of the respondents.

Convenience sampling was used to collect data with surveys distributed at national and regional pediatric meetings across the MENA region for anonymous completion. Descriptive statistics were used to summarize the demographics of the respondents and their responses to questions. Respondents received no form of compensation. Their names were not recorded.

RESULTS

Physician Characteristics

A total of 2800 questionnaires were distributed and 2444 physicians responded to the survey and their demographic characteristics are presented in Table 1. There was a slight majority of female respondents and of physicians younger than 40 years. Sex and country demographics are presented in Table, Supplemental Digital Content 2 (*http://links.lww.com/MPG/B433*).

Forty percent of the responders estimated that <25% of their patient population was exclusively breast-fed for at least 4 months; 31% estimated it was between 26% and 50%, 19% estimated between 51% and 75%; and 8% that the percentage was as high as 76% to 100%. The physician sex, type of specialty, practice setting, and country of practice had no correlation with their estimation of the duration of breast-feeding.

Two percent of physicians who responded to the survey recommend to parents to start complementary feeding at an age below 4 months and 36% over 6 months of age. These findings were similar across physician specialty, and not affected by area of practice (urban or rural). Importantly, close to half of the physicians (44%) recommend that complementary food should be homemade and about one third recommend commercially available infant cereals (33.31%). The main reasons that physicians cited for their reasoning for the choice of complementary foods they recommended were prevention of allergy and ID (Fig. 1).

TABLE 1. Physician demographics and self-reported characteristics

Demographic characteristics	N (%)
Total respondents	2444
Sex	
Male	1002 (41.00)
Female	1435 (58.72)
Not reported	7
Age group	
<40 y	1366 (55.89)
40–50 y	642 (26.26)
50–60 y	337 (13.79)
>60 y	79 (3.23)
Note reported	20
Specialty	
General physician	247 (10.11)
Pediatrics	1647 (67.39)
Paediatric gastroenterologist	229 (9.37)
Family physician	88 (3.6)
Others	179 (7.32)
Not reported	54
Practice setting	
Government	1386 (56.71)
Private facility	869 (35.56)
University/medical school	482 (19.72)
Others	19 (0.78)
Practice location	
Urban	2255 (92.27)
Rural	153 (6.26)
Not reported	36

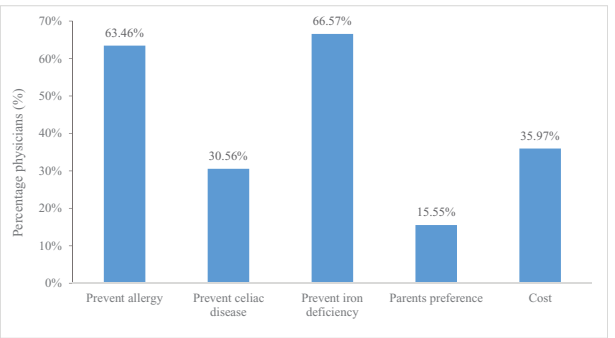

FIGURE 1. Reasons for choosing specific complementary foods.

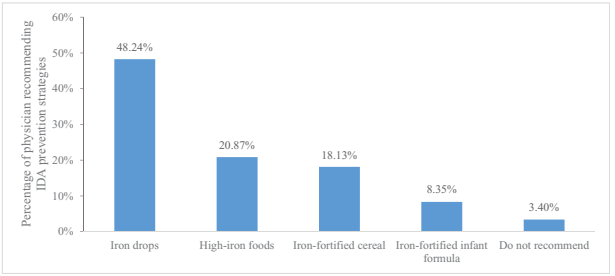

FIGURE 2. Physicians' preferences for Fe supplementation. IDA = iron deficiency anemia.

The majority physicians (61%) estimated that the prevalence of IDA (hemoglobin [Hb] <11 g/dL) in their patient population between the ages of 9 and 18 months falls between 40% and 70%, whereas 11% consider the prevalence to be >70%. Despite of this assessment, Hb and/or hematocrit testing is ''rarely or never'' conducted by 36% and 4%, respectively, of the respondents.

In general, 68% physicians routinely recommend that infants take some form of Fe supplementation or fortification after 6 months of age. This result is not affected by physician specialty or location of practice (urban vs rural). For prevention of ID in infants older than 6 months of age, close to one half of the responding physicians recommend Fe drops in a question that simply provided common options (Fig. 2). According to the physicans' responses, the highest tolerance and acceptance is for Fe drops (38% of physicians), followed by Fe-fortified cereal (29%), and Fe-fortified infant formula (29%). In addition, for infants older than 6 months of age already receiving Fe drops, 37% recommend continuing the Fe drops, 26% adding Fe-fortified cereal, and 15% adding vitamin C. Also, 20% of physicians recommend stopping Fe drops and introducing Fe-fortified infant cereals.

As shown in Table 2, the majority of physicians agreed that untreated ID during infancy may have long-term negative effects on cognitive function. Table 2 also provides a summary of physicians' perceptions and practices in relation to ID. Almost 48% considered that an effective way to meet Fe needs in the infant is by non-supplemented home prepared baby foods, particularly meats.

DISCUSSION

Surveys regarding pediatrician's practices have been carried out in Europe regarding treatment of acute diarrhea (9) and 1 on functional gastrointestinal disorders (10) showing discrepancies between recommendations and actual practice. The first one included 2997 responses and the second 278. This is the first survey regarding feeding practices in the MENA region and we received 2444 responses. In interpreting these results, we need to remember that the degree of nutrition training for these physicians vary considerably and unless they are pediatric gastroenterologists, they may not be aware of the ESPGHAN guidelines on introduction of complementary feedings and screening, treatment, and prevention of IDA.

Complementary Feeding Practices

The introduction of complementary foods marks an important transition from milk feeding to family foods, and is necessary for both nutritional and developmental reasons. According to the recent evidence-based recommendations by ESPGHAN (9) and the European Food Safety Association (11) for Europe, complementary foods such as solid and liquids other than breast milk or infant formula, should not be introduced before 4 months of age and not be delayed beyond 6 months of age; in contrast, the WHO recommends exclusive breast-feeding during the first 6 months of infancy. In our survey, close to two thirds of physicians recommend introducing complementary feeding between 4 and 6 months, approximately one third advocate delaying complementary foods until after 6 months of age. Although Fe needs are largely met during the first half of infancy, if an exogenous source of Fe is not provided, exclusively breast-fed infants are at risk of becoming ID during the second half of infancy (12).

The optimal timing of introducing complementary foods is still debatable; however, it can be concluded that not all of the recommendations on the timing of introducing complementary foods by physicians practicing in the MENA region are in line with global practices.

The ESPGHAN position paper (2013) on Fe requirements of infants and toddlers discusses the risk factors for ID and IDA, which include low meat intake, low intake of Fe-fortified products, and a high intake of cow milk (7). The position paper also outlines a number of strategies for the prevention of ID at different ages, which include Fe supplementation of infants, Fe-fortified formula, meat products, Fe fortification of follow-on formula and complementary food, and avoidance of cow's milk.

Iron Deficiency Anemia Prevention

A recent cross-sectional epidemiological study that included 500 infants aged 6 to 24 months from Saudi Arabia, found that one

TABLE 2. Summary of physician perception and practices

Statements	True N (%)	False N (%)
Untreated iron deficiency during infancy may have long term negative effects on the cognitive function	2316 (94.76)	103 (4.21)
For infants at risk of developing iron deficiency anemia (preterm or exclusive breast-feeding), iron supplementation may be started at 4 months of age, without further investigations	1598 (65.38)	821 (33.59)
Routine iron drops supplementation is the preferred method for preventing iron deficiency	1415 (57.9)	998 (40.83)
A natural and effective way to meet iron needs in the infant is by nonsupplemented home prepared baby foods, particularly meats	1133 (46.36)	1243 (50.86)
Commercially available infant cereal enriched with iron is a natural and effective way to meet iron needs in the infant	1529 (62.56)	872 (35.68)
Although ferrous sulfate is more bioavailable than others, its characteristics makes it inappropriate for food supplementation	1478 (60.47)	861 (35.23)
Phytate content of infant cereals, even if supplemented with iron, makes the iron largely nonabsorbable	1623 (66.41)	710 (29.05)
Iron-enriched infant cereals with iron result in staining of the baby teeth, constipation, and dark stools	1118 (45.74)	1274 (52.13)
Commercially available infant cereal enriched with iron has the advantage of better absorption due to the addition of vitamin C	1902 (77.82)	479 (19.60)
Routine iron fortification/supplementation before 12 months of age is not recommended because it is associated with increased risk of infection	638 (26.10)	1765 (72.22)
For partially breast-fed infants, iron supplements are recommended through iron fortified foods, beginning at 4 months of age	1602 (65.55)	797 (32.61)

half of the those investigated had IDA and the authors concluded that Fe supplementation should be given at early infancy with universal screening of Hb and ferritin estimation to all infants at 12 months of age (13). The timing, however, may be too late as damage from ID may be irreversible even when it is later corrected. The WHO recommends daily Fe supplementation in infants and young children aged 6 to 23 months, living in settings in which the prevalence of anemia is ≥40% (14). Daily Fe supplementation may be given in the form of drops or syrups, providing 10 to 12.5 mg elemental Fe, given for 3 consecutive months in a year (14). Although there is insufficient evidence to support routine Fe supplementation in healthy European infants and toddlers of normal birth weight, ESPGHAN recommends giving Fe-rich (complementary) foods, including meat products and/or Fe-fortified foods from the age of 6 months. In addition, formula-fed infants up to 6 months of age should receive infant formula with Fe content of 4 to 8 mg/L (7). In this survey, 44% of physicians recommend homemade foods to start complementary feeding. Although meat may prevent a decrease in Hb, it may not replenish Fe stores. Engelmann et al (15), examined the effect of increased meat intake on Hb concentration, serum ferritin, and serum transferrin receptors in late infancy. Forty-one healthy, term, partially breast-fed 8-month-old infants were randomized into 2 groups: a low-meat group, in which infants received a diet with a mean meat content of 10 g/day and a high-meat group, in which infants received a diet with a mean meat content of 27 g/day. The intervention lasted for 2 months. The results suggested that an increase in meat intake can prevent a decrease in Hb in late infancy, probably by enhancing Fe absorption. There was, however, no effect on Fe stores or on cellular Fe deficiency. In our study, most physicians reported the prevalence of IDA to be between 40% and 70% during infancy; however, they did not routinely monitor biological parameters but recommended Fe supplementation in the form of drops, high-Fe foods, Fe-fortified cereal, and Fe-fortified infant formula, for the prevention of IDA in infants older than 6 months of age. It is well established that the combination of Hb and ferritin is the most sensitive method for monitoring iron requirements (7); however, a little more than one third of the survey respondents rarely monitored Hb during infancy, highlighting the need for continued education. In addition, in line with current literature (6,7), the majority of the responding physicians agreed that untreated Fe deficiency during infancy may have long-term negative effects on cognitive function.

Despite the fact that 62.6% considered Fe-supplemented infant cereal as an effective way to prevent ID, 66.4% considered that the phytate content of cereal prevented its Fe from being absorbed and 45.7% that it lead to side effects such as teeth staining, constipation, and dark stools. In fact, several studies confirmed good Fe absorption and no side effects from Fe-supplemented infant cereals. Among such studies, Davidsson et al (16) demonstrated that contrary to earlier concerns, their results do not indicate differences in usefulness between water-soluble and non–water-soluble Fe compounds in maintaining Hb concentrations and preventing Fe deficiency. Hurrell (17) stated that ferrous fumarate is currently recommended for use in the fortification of foods for infants and young children. This recommendation is based on the compound's good sensory properties. Ferrous fumarate–fortified complementary foods have been demonstrated to improve iron status in iron-deficient infants and, more recently, to prevent ID equally to ferrous sulfate in iron-replete infants (17). Commercial infant cereals in addition to Fe contain vitamin C, zinc, and other vitamins.

Study Limitations

This survey provides a snapshot of the current practices and knowledge in the prevention of Fe deficiency and introduction on complementary feeding in infants from the MENA region. Given that the reported information is primarily based on feedback from a select group of respondents, it may not be representative of regional practices. The physicians who completed the questionnaire were self-selecting (ie, causing a bias due to individuals selecting themselves into a group); therefore, we cannot be sure that the respondents were representative of the physicians in their country or region. This is particularly important because of the large and diverse physician population in this region. The results of this study were analyzed using descriptive methods; therefore, it is difficult to draw correlations or report significance of collected information. Given that the main goal of the survey was, however, to understand physician practices, inferential statistical models would not have provided any useful additional information.

CONCLUSIONS

This initiative provides an important insight into the current physician practices in the prevention of ID during infancy in the MENA region. Given that physicians play a key role in the identification, treatment, and monitoring of nutritional deficits during infancy, there is a need for targeted yet repetitive educational initiatives focusing on anemia prevention, timing of introducing complementary foods, selecting the right type of complementary foods, and optimizing overall nutrition during the weaning period. Although, the majority of the survey respondents appear to follow global recommendations related to the timing for introducing complementary feeding, there is a need to reinforce recommendations at regular intervals to maintain overall infant health and promulgate the importance of appropriate complementary feeding practices in the general public.

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