Nutritional assessment of asylum seekers' children in The Netherlands
Stellinga-Boelen, Annette Agnes Maria

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2007

Link to publication in University of Groningen/UMCG research database

Citation for published version (APA):

Copyright
Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

Take-down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): http://www.rug.nl/research/portal. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.
CHAPTER 4

Iron deficiency Among Children of Asylum Seekers in The Netherlands

Annette A.M. Stellinga-Boelen¹, Huib Storm², P. Auke Wiegersma³, Charles M.A. Bijleveld⁴, Henkjan J. Verkade⁴

1. Community health Service for Asylum Seekers
(Medische Opvang Asielzoekers Noord Nederland) P.O. Box 584
9700 AN Groningen, The Netherlands
2. Department of Clinical Chemistry, KCL, Medical Center Leeuwarden,
P.O. Box 888, 8901 BR Leeuwarden, The Netherlands
3. Department of Health Sciences, University Medical Center Groningen
University of Groningen, P.O. Box 30.001 9700 RB Groningen,
The Netherlands
4. Pediatric Gastroenterology, University Medical Center Groningen
University of Groningen, P.O. Box 30.001 9700 RB Groningen,
The Netherlands

Acknowledgement

The authors thank the participating children and their parents and
Mrs. Tina de Vries, dietician, for her skilful contribution to the dietary interviews.
We are especially grateful to the technicians of the laboratory for clinical chemistry,
who made invaluable contributions to completing the data.

Journal of Pediatric Gastroenterology and Nutrition. 2007 in press
Chapter 4

Abstract

Objectives: To investigate in asylum seekers’ children in The Netherlands, biochemical iron status and the prevalence of iron deficiency (ID) and anemia in relation to age, region of origin, length of stay in The Netherlands, body mass index (BMI), and dietary iron intake.

Patients and Methods: Hemoglobin (Hb) and plasma ferritin concentrations were determined in 122 asylum seekers’ children (median age, 7.1 years; range, 2-12y). ID was defined by plasma ferritin <15 µg/L. Anemia was defined as Hb levels < 6.8 mmol/l (11 g/dL) for children <6 years of age and Hb levels < 7.1 mmol/L (11.5 g/dL) for children between 6 and 12 years of age. Nutritional status of the children was assessed by BMI and dietary intake of iron was estimated by 24-hour recall.

Results: Twenty percent of the children had compromised iron status (16% with ID, 4% with ID anemia, [IDA]). Another 6% of the children had anemia caused by thalassemia. ID was significantly more prevalent in children <6 years of age and in children of African origin. The iron status was not significantly correlated with the length of stay in The Netherlands (r=0.6, P=0.48). Higher BMI-Z scores were positively correlated with iron status. Adequate or marginal dietary iron intake was not significantly related to the presence of ID (r= 0.02, P=0.9) or anemia (IDA and thalassemia) (r=0.15, P=0.9).

Conclusions: Iron deficiency is highly prevalent among the children of asylum seekers in The Netherlands. Our data indicate that systematic biochemical screening for ID is warranted in asylum seekers’ children.

Keywords: Anemia, Asylum seekers, Biochemical screening, Iron deficiency
Iron deficiency (ID) is one of the most common nutritional deficiencies in childhood. ID is highly prevalent in developing countries, but in European countries it is still considered one of the main nutritional disorders.\textsuperscript{1,2} Iron requirements for growth and development are relatively high, which renders children vulnerable to ID.\textsuperscript{3} Clinical symptoms of ID are rather a specific (e.g. tiredness, anorexia, poor concentration) and often remain unrecognized until ID is severe.\textsuperscript{4,5} ID, even in the absence of anemia, has been associated with an increased risk for permanently impaired psychomotor development.\textsuperscript{6-8} We recently demonstrated that asylum seekers’ children in The Netherlands frequently have low dietary iron intake.\textsuperscript{9} However, it has remained unclear to what extent iron status of asylum seekers’ children is compromised during their stay in The Netherlands. Hematologic screening of anemia and iron status of asylum seekers’ children entering The Netherlands has not been systematically done despite theoretical vulnerability because of previously exposure to nutritional risks, socio-economic situations and ethnic background\textsuperscript{10-12}. In asylum seekers’ children in The Netherlands, we investigated the prevalence of ID and anemia, in relation to age, country of origin, and length of stay in The Netherlands, body mass index (BMI) and dietary iron intake.

**Patients and Methods**

Iron status was estimated in a cross-sectional study among children ages 2-12 years living in an asylum seekers’ center in the northern part of The Netherlands. The study was approved by the Ethical Committee of the Medical Center Leeuwarden. Parents and children were invited to participate in the study using an informative letter translated into their native languages. The procedure was explained with the use of an independent language interpreter and formal permission to participate in the study was obtained from the parent (or caregiver) of each child. The study subjects (n=135) were healthy children who had been in The Netherlands ≥1 year. The mean length of stay in The Netherlands of the children participating in the study was 3 years. Nineteen percent of the children had been born in The Netherlands. With regard to age, sex, and region of origin, the studied children constituted a representative sample of the ≥12.000 children ages 2 to 12 years remaining in Dutch asylum centers for ≥1 year.\textsuperscript{13} A total of 122 children (90\%) allowed blood withdrawal and a dietary history was taken of 116 children. For comparative analyses, the geographical origin of the children was categorized into 3 regions: Africa, n=44 (Angola n=18, Somalia n=18, Sudan n=7), central Asia, n=36 (Afghanistan n=17, Iraq n=9, Iran n=6, and others n=4) and, eastern Europe, n=42 (Azerbaijan n=13, former Yugoslavia n=14,
Russia n=13 and others n=2). Blood samples were collected at the laboratory ward of the hospital facility. In nonfasting venous blood samples, haemoglobin (Hb) and erythrocyte indices were measured using a CellDyn4000 automated hematology analyzer (Abbott laboratories, Hoofddorp, The Netherlands), and plasma ferritin was determined using a sandwich enzyme-linked immunosorbent assay (Sandwich ECLIA, Roche, Almere, The Netherlands). Anemia was defined by an Hb level < 6.8 mmol/L (11 g/L) for children < 6 years of age, or <7.1 mmol/L (11.5 g/dL) for children 6 to 12 years of age, in accordance with Centers for Disease Control and Prevention criteria. ID was defined by a plasma ferritin level <15 µg/L, in accordance with previous studies. To aid in the interpretation of ferritin levels complement reactive protein (CRP) was measured to determine an acute phase response. ID anemia (IDA) was defined as ID and anemia with a cutoff value for the mean corpuscular volume (MCV) of ≤75 fL for children <6 years of age and ≤80 fL for children 6 to 12 years of age. Samples in which the MCV divided by the erythrocyte count was <13, were analyzed for hemoglobinopathy and thalassemia by Hb electrophoresis and DNA polymerase chain reaction analysis for the major α-thalassemia deletions (ie, 3.7kB, 4.2kB, SEA,MED). Anthropometrical measurements were performed following the standard procedures as described in Paediatric Morphometrics using a Seca medical precise weight scale and the standing height with a Seca 208 stadiometer (RvS Nederland, Almere, The Netherlands). All anthropometric measurements were collected by one trained medical doctor and indexed on the Dutch growth reference of 1997. Standard deviation scores were calculated for each child using the computer based Growth Analyser Information program (version 2 Dutch Growth Foundation 2001-2003). The dietary assessment was based on a 24-hour recall with language interpreters to minimize misunderstandings. All of the dietary histories were taken by 1 experienced dietitian. In addition, pictures developed for dietary assessment of other migration populations and standardized samples were used to estimate the size of the portions eaten. From the dietary assessments, food quantities were estimated using BECEL, a nutritional software package developed by Unilever (Vlaardingen, The Netherlands). The data were compared to the Dutch list of recommended daily allowance (RDA) for sex and age(18;19). Iron intake <80% of the RDA was graded as marginal.20

Data were analyzed, with the SPSS statistical software package (version 11.5;SPSS, Chicago, IL). P=0.05 was taken as threshold for statistical significance.
Iron deficiency

Results

To investigate iron status and anemia among the children, they were initially examined for corresponding clinical signs. None of the children reported or exhibited classical symptoms of anemia such as pale mucosa, tiredness, or anorexia. Table 1 shows the prevalence of ID and IDA in relation to age group, origin, sex, and length of stay in The Netherlands. A total of 16% of the children had ID and 10% had anemia. The 10% incidence of anemia could be attributed to IDA (4%) and previously undiagnosed thalassemia (6%). The prevalence of ID was 20% higher in children <6 years of age compared with older children (P<0.05). Approximately 50% of the children <6 years of age were born in The Netherlands, but this was not associated with presence or absence of ID (P=0.12). Independent of age, the prevalence of ID was higher in children who has come from Africa than in children from central Asia or Eastern Europe (each P<0.05). The length of stay in The Netherlands of children from Eastern Europe was slightly longer than that of African children (P<0.05). Neither length of stay in The Netherlands nor sex of the children was significantly related to the prevalence of ID or IDA.

Table 1 Demographic parameters of children with ID or IDA.

<table>
<thead>
<tr>
<th>Demographic category</th>
<th>No. of patients</th>
<th>ID (n)</th>
<th>IDA (n)</th>
<th>Total of ID, IDA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africa</td>
<td>n = 41</td>
<td>10</td>
<td>4</td>
<td>34&lt;sup&gt;a,b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Central Asia</td>
<td>n = 32</td>
<td>3</td>
<td>1</td>
<td>12&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>n = 42</td>
<td>6</td>
<td>0</td>
<td>14&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>n = 49</td>
<td>9</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Male</td>
<td>n = 66</td>
<td>10</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 – 6</td>
<td>n = 44</td>
<td>11</td>
<td>2</td>
<td>35&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>6 – 12</td>
<td>n = 71</td>
<td>8</td>
<td>3</td>
<td>15&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Length of stay in The Netherlands (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 – 3</td>
<td>n = 60</td>
<td>11</td>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>&gt; 3</td>
<td>n = 55</td>
<td>8</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>n = 115*</td>
<td>19</td>
<td>5</td>
<td>21</td>
</tr>
</tbody>
</table>

* Seven children with thalassemia excluded

Anemia: Hb<6.8 mmol/L children less than 6y; Hb<7.1 mmol/L children aged 6-12y
ID: iron deficiency; plasma ferritin<15 µg/L
IDA: iron deficiency anemia (ID + Anemia)

Differences in prevalence of ID and IDA to origin and age: \( \chi^2 \) test a-c significance P<0.05
Chapter 4

Four of the 7 children found with thalassemia, originated central Asia and 3 originated from Africa. Mean Hb levels of these children (5.8±0.3 mmol/L) and MCV (59±4 fl) were significantly lower than those of the children without thalassemia (Hb: 7.6±0.5 mmol/L; MCV: 81±4; respectively; each P<0.01). Thalassemia was not associated with different plasma ferritin levels. Excluding the children with thalassemia, the Hb levels of the African children were slightly lower (7.4±0.5 mmol/L) than those in children from eastern Europe (7.7±0.5 mmol/L; P<0.05) or central Asia (7.7±0.4 mmol/L; P<0.05). Independent of origin, children <6 years of age had lower Hb levels and MCV (Hb, 7.4±0.5 mmol/L; MCV, 79±4 fl, respectively) than older children (Hb, 7.7±0.5 mmol/L, P<0.01; MCV, 82±4 fl, P<0.01).

Figure 1  Ferritin levels related to age and geographic origin

Box plot represents the first and third quartiles of ferritin levels plus the 3rd and 97th centiles
Analysis was done by the Mann-Whitney test
Differences in ferritin among age groups among Asian children were significant at P<0.01 Differences in ferritin levels within the elder age group between eastern European and African children were significant at P<0.05
Iron deficiency

Figure 1 shows the relation between plasma ferritin levels of the children in relation to age and origin. The CRP level of 97.5% of the children was <10mg/L; 4 children with a CRP level >10mg/L (11,12,17,19mg/L respectively) did not have high ferritin levels (.11,42,39,24µg/L respectively). The mean plasma ferritin level of the young children were less than those of the older children (24± 15µg/L vs. 30±15µg/L, respectively; P=0.005). Among the children from central Asia, the plasma ferritin levels of children <6 years of age were significantly lower than those of children >6 years of age (21± 9µg/L vs 31±9µg/L, P=0.001). In the groups >6 years of age, African children had lower plasma ferritin levels than eastern European children (26±18 vs 33±14 µg/L P=0.03). We did not find a significant relationship between the weight for height and the plasma ferritin levels (r=0.2, P=0.07). However, independent of age or origin, plasma ferritin levels of the children were positively related to higher BMI-Z scores (fig 2).

The dietary iron intake was estimated adequate in approximately 50% of the children. However an estimated adequate dietary iron intake was not related to the prevalence of ID (r=0.02, P=0.9) or anemia (r=0.15, P=0.9; fig 3).

**Figure 2**  Ferritin levels related to the sex- and age specific BMI Z-score

![Box plot representing first and third quartiles of ferritin levels plus the 3rd and 97th centiles. Analysis was done by the Mann-Whitney test. Differences in ferritin levels between <-1 and >1 standard deviation score were significant at P<0.05.](image-url)
**Discussion**

The prevalence of ID (16%) and IDA (4%) among 2- to 12-year-old asylum seekers’ in The Netherlands as reported in this study is much higher than among children who presented at an outpatient clinic of a Dutch hospital (incidence of anemia 0.8-2.6%), and similar to observations among 1-to 11-year-old children in besieged Sarajevo who were receiving food rations of the United Nations. Other studies among asylum seekers’ children reporting in Switzerland a prevalence of 2% IDA, and a prevalence as high as 67% in displaced and refugee children in Lebanon. We used 15µg/L as cutoff value for serum ferritin for all children >2 years of age in our laboratory. Serum ferritin reference values depend on the analytic method used. Serum ferritin levels <12µg/L have also been suggested to diagnose ID in children. Reducing the cutoff value to <12µg/L rather than <15 µg/L reduces the prevalence of ID from 16% to 10% in our total study population. Corresponding to other reports, anthropometric measurements, clinical symptoms, and dietary assessment were not of great value to identify children at risk for ID in our study. The present demographic risk factors for ID among asylum seekers’ children in The Netherlands who are <6 years of age and of African descent corresponds with the high
Iron deficiency

prevalence of ID in their countries of origin. Together with the lack of relation between the iron status of the children and the length of stay in The Netherlands this suggest that solely improving demographic factors and food availability is insufficient to recover from ID.

World-wide, the high prevalence of ID among refugee children (according to reports on behalf of the United Nations) have led to improvement of the micronutrient content of ration food and supplements provided in refugee camps. However, in The Netherlands, asylum seekers are not provided with food rations but with a small budget to prepare their own food.

Because ID, (ie, depletion of iron stores without anemia) adversely affects the cognitive performance (eg. poor attention, memory, verbal performance), behaviour, and growth of infants, pre-school and school aged children, the high prevalence of ID and anemia in young asylum seekers’ children imposes a serious concern. Prevention or early detection and treatment is of great importance, especially because ID in pre-school children may cause prolonged neurological effects confounding the interpretation of iron supplementation in later childhood. Guidelines for screening and treatment of ID in pregnancy and among adopted children are being developed in The Netherlands. Hematological screening with the biochemical marker ferritin is reported to be corner stone to identify ID in early stage of compromised iron status. Hematological screening of asylum seekers’ children could be of great value to identify children for whom iron supplements (2-4 mg/kg, day for 2-5 months) are justified. Additionally it should be realized that verification of hemoglobinopathy is important among the anemic children of asylum seekers. In summary, our data indicate that asylum seekers’ children in The Netherlands frequently have compromised iron status, particularly children <6 years of age and those originating from Africa, which may threaten an adequate psychomotor development. The present study indicates that with a relatively simple screening a high number of children with thalassemia, ID or IDA can be identified. The high percentage of children with inadequate dietary iron intake underlines the importance of adequate nutritional education and support of those children, in addition to haematological screening.
Chapter 4

Reference

(17) Hinchcliffe and Lileyman (eds.). Practical Paediatric Haematology Wiley & Sons 1987
Iron deficiency


Chapter 4


