We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900
Open access books available

185,000
International authors and editors

200M
Downloads

Our authors are among the

154
Countries delivered to

TOP 1%
most cited scientists

12.2%
Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



13

Supplementation and Change of Nutritional Habits for the Prevention and Treatment of Iron Deficiency Anaemia in Gaza Children: A Case Study

Michele Magoni, Ghassam Zaqout, Omar Ahmmed Mady,
Reema Ibraheem Al Haj Abed and Davide Amurri
Terre des Hommes
Italy

1. Introduction

Iron deficiency anaemia (IDA) is one of the most severe and widespread nutritional disorders in the world. Children and pregnant women in resource-poor areas represent the most vulnerable groups. Iron deficiency impairs the cognitive development of children from infancy through to adolescence. It damages immune mechanisms and is associated with increased morbidity rates. Iron deficiency commonly develops after six months of age if complementary foods do not provide sufficient absorbable iron, even for exclusively breastfed infants (World Health Organization [WHO] et al, 2001). The WHO recommends universal iron supplementation when prevalence of anaemia is more than 40% (WHO, 2004).

In the Eastern Mediterranean regions there is an endemic high prevalence of iron-deficiency anaemia (Verster, 1996) due to low total iron intake, low bioavailability (in many diets over 80% of iron is of non-haem origin) and high intake of inhibitors of iron absorption (unleavened bread and tea are severe inhibitors of iron absorption and are consumed in large amounts everywhere). Anaemia and stunting prevalence in Gaza have always been found to be very high in recent years (Abdeen, 2002; Rahim et al 2009).

1.1 Emergency situation

In the Gaza Strip the basic living conditions of all the inhabitants have deteriorated constantly in recent years, particularly after the "Cast Lead" operation in January 2009: the blockade and the closure of terminals for the movement of goods and people created a very tense situation which severely affected the wellbeing of all the inhabitants: 98% of private businesses closed and the unemployment rate increased to 48.8%, while 80% of the population lives below the poverty line and 79% is aid-dependent. The rate of food insecure households in Gaza has also increased to 75%, up from 56% before the Cast Lead operation. Furthermore, the growing inability of the population to consume iron-rich animal proteins and fresh fruit and vegetables, which contain the vitamins required for iron absorption, is bound to have a critical impact on the already high prevalence of mild and moderate iron

deficiency anaemia in the Gaza Strip, habitually already about 20% higher than in the West Bank (WHO, 2009; World Bank, 2009).
The National Nutrition Surveillance System Report (PNA, MOH, 2010) has confirmed a worsening level of anaemia and chronic malnutrition in the Gaza Strip, with an overall anaemia prevalence of 76.2% (45.5% in the West Bank) among children 9-12 months old and 58.6% (9.5% in the West Bank) among school children. Stunting prevalence in school children was 7.9% in the Gaza Strip and 4.4% in the West Bank. The national survey does not provide any data for children between the ages of 12 months and 5 years.

1.2 Present humanitarian intervention

Terre des Hommes Italy[1] (Tdh-It) and its Palestinian partner Palestinian Medical Relief Society[2] (PMRS) started operating with several humanitarian projects in Gaza in 2009, targeting pre-school children in a holistic way, where the prevention and treatment of anaemia have played a fundamental role. The projects were supported by the Italian Cooperation and other European donors.
It is worth pointing out that the Tdh-It and PMRS projects were designed and implemented as (and in the framework of) humanitarian interventions and not study; nevertheless, the projects have also been supported by a strong monitoring and evaluation system that has provided us with a massive and structured quantity of information allowing us to present the projects' impact and data as a case study, although the possibility of bias in the sample selections has to be borne in mind.
There is a strong need for a more evidence-based approach in humanitarian medical work and although a substantial body of knowledge has been accumulated regarding the effectiveness of interventions in acute emergencies, especially in refugee settings, the evidence base is much weaker for situations of protracted conflict with longer-term programmes in less controlled settings. (Banatvala and Zwi, 2000; Robertson et al, 2002; Roberts and Hofmann, 2004)

2. Method

2.1 Nutritional health projects

The interventions that Tdh-It and PMRS implemented included the following components:

- screening for IDA and malnutrition in 22 kindergartens (South Gaza: Rafah and Khan Younis Governorates) and 4 paediatric clinics (North Gaza: Northern Governorate);
- iron and vitamin supplementation based on therapeutic or preventive WHO protocols for all children contacted;
- medical follow-up for anaemic and malnourished children;
- provision of a home visit service for anaemic and malnourished children in order to:
  - assess families' and children's nutritional habits (24-hour recall questionnaire)

[1] Terre des Hommes Italia (Tdh-It) was founded in 1989 in Milan (Italy) and is part of the Terre des Hommes International Federation. It is a non-profit non-governmental organisation (ONLUS) whose mission it is to carry out humanitarian relief and international development projects for the benefit of children, their families and communities.
[2] Palestinian Medical Relief Society (PMRS) is a grassroots, community- based Palestinian health organization founded in 1979. PMRS operates with 4 Primary Health Care Centres (PHCCs) in the Gaza Strip, providing preventive and curative services, and specialized health care for women and children.

- provide family nutritional counselling
- support behavioural health change;

- health education sessions for mothers and fathers - held at the clinics, in kindergarten and during home visits.

Children who were still anaemic after intervention underwent further clinical investigation, treatment and longer follow-up.

The following table summarizes the activities and treatment protocols for the different projects.

Period	Area	Target	Intervention for anaemics	Treatment for anaemics*
September 2009 - June 2010	South Gaza (1)	Children in 12 kindergar-tens and their siblings	Screening and treatment, monthly follow-up with haemoglobin control after 4 months, health education, home visit for anaemic children	Iron polymaltose complex 5mg/kg and multivitamins daily for 4 months, followed by preventive iron (1mg/kg daily)
January 2010 - December 2010	North Gaza	Children from 3 local communities invited to local clinics	Screening, treatment, follow-up after 3 months with haemoglobin test, health education, home visit only for some anaemic children	Iron polymaltose complex 3-6mg/kg and multivitamins daily for at least 3 months, followed by multivitamin including iron (1mg/kg daily)
September 2010 - June 2011	South Gaza (2)	Children in 11 kindergar-tens and their siblings	Screening and treatment, monthly follow-up with haemoglobin control after 4 months, health education, home visit for anaemic children	Iron polymaltose complex 5mg/kg and multivitamins daily for 4 months, followed by preventive iron (1mg/kg daily)

**A paediatrician or medical doctor changed the dosage and length of treatment when required by the child's clinical condition.*

Table 1. Summary of Tdh-It/ PMRS nutritional projects in Gaza.

2.2 Data collection

Data were collected using two questionnaires, which were also used during the monitoring process:

1. *CHILD FILE (annex-1)*: basic information about family and screened children gathered in the kindergarten during screening and follow-up visits. 10,445 children were screened for anaemia (blood test), including the main anthropometric indicators (height, weight), between October 2009 and March 2011: 3,941 (37.7%) children were screened at 3 paediatric clinics in northern Gaza (Izbet Beit Hanoun, Umm El Nasser, Jabalia/Beit Lahia) while the other 6,504 were screened in the kindergartens (including siblings aged less than 6 years) in southern Gaza (eastern areas of Khan Younis and western areas of Rafah City).

FAMILY INFORMATION

1) Name of the family's head (four names) _____

a. Name in Arabic _____

2) ID number of the family's head: _____ **Family code** _ _/_ _ _ _

3) Full Address: _____4) Telephone n._____

5) Number of family's members: ___; below 5 years: _ _; 5-18 years: _ _;

6) Mother's personal status: Living with husband divorced Widow
Married but living alone Married but living with her family Dead mother

7) Mother's education: Illiterate can read & write elementary
Preparatory secondary lower diploma bachelor and more

8) Father's education: Illiterate can read & write elementary
Preparatory secondary lower diploma bachelor and more

9) Father Job:
(1) Worker (2) Government/Municipality employee (3) Self employee
(4) Business (employing others) (5) Peasant (6) Shepherd
(7) Driver (8) Unemployed (9) Other

10) Mother age _____ **11) n. of pregnancy**_____ **12) n. of deliveries** _____

13) Pregnant now Yes Not **N° of death children**

	<1 year	1-5 years
M		
F		

CHILD FILE

14) Date of visit _ _/_ _/_ _ _ _ Family code_ _/_ _ _ CODE of the Child _ _ _

15) Name of the Child ..... **16) Date of birth** _ _/_ _/_ _ _ _

17) ID number of the child: ..... **18) attending KG** Yes Not

19) Sex: M F **20) Weight (kg)** _ _, _ _ **21) Height (cm)** _ _ _

22) Percentile weight for age _____ **23) Hb level** _ _, _

24) Referred for doctor visit Yes Not **25) Referred to clinic** Yes Not

Reason ..... **Reason** .....

25b) does the child suffer from a chronic disease? Thalassaemia G6PD Other .....

26) Already receiving fortified food? Yes Not **comments**.....

27) N° of iron bottles given: _ _ **(ml/day**_____**)** **28) N° of MULTIVITAMIN given:** _ _

FOLLOW UP FILE

CODE of the Child Date of follow up _ _/_ _/_ _ _ _ visit N° **1**

Medication taken: regularly (>=5days/week) irregularly (4-2days/week) not taken (<=1)

Have drugs given been finished? YES NO why? _____

Weight (kg) _ _, _ _ Height (cm) _ _ _ C° weight for age ____ Hb level _ _, _

N° of iron bottles given: _ _ **N° of MULTIVITAMIN given:** _ _

ANNEX 1. Extract from the CHILD FILE.

2. *HOME VISIT (annex-2)*: details of the families of anaemic children were collected twice during home visits (coinciding roughly with the start and end of treatment) and concerned mother's knowledge, nutritional habits of all the children, iron treatment compliance and adoption of healthy life styles.

In the project implemented in northern Gaza only some families received home visits and there was also a problem with coding of the children, so the link between data collected during screening and the home visit was not available; for this reason we analysed only data from the kindergarten visits carried out in southern Gaza. A total of 1,733 families of anaemic children screened in kindergartens were visited at home.

NUTRITIONAL QUESTIONNAIRE

Is the child presently breastfed?

Child 1	Child 2	Child 3	Child 4
Yes No **if yes no. of times_____**	Yes No **if yes no. of times_____**	Yes No **if yes no. of times_____**	Yes No **if yes no. of times_____**

How many meals the child has on average per day? Child 1_____ Child 2_____
Child 3_____ Child 3_____

	Child 1	Child 2	Child 3	Child 4		Child 1	Child 2	Child 3	Child 4
Indicate number of "portion" of the following food *(or number of items where indicated)* **that the CHILD has eaten in the last 24 h?** (One portion is big as the person's fist)									
Vegetables					Cheese and dairy products				
Fruits					Bread				
Legumes					Rice				
Nuts and Seeds					Pasta				
Meat					Potatoes				
Chicken					Biscuits/cake				
Fish					Chocolate bars (n.)				
Eggs (n.)					Sweets and candies (n)				
Chips (n. of sachet)					Jam/ cream (n. of big spoon)				
Indicates how many cups/glasses the CHILD had of the following drinks in the last 24 h? (mark with X)									
Milk (with sugar)					Tea (outside meal)				
Milk (without sugar)					Tea (with main meal)				
Water					Fresh Juice				
Soft drink					Packed Juice				

How many times is the child eating junk food outside main meals? Child 1_____ Child 2_____

KNOWLEDGE OF THE MOTHER ASSESSMENT (don't prompt the mother before she has finished to answer the all questions)

- **Why anaemia is bad for the child?** Doesn't know____; mental retard ____; weakness____; infection vulnerability_____; poor school performance____; other answers____; AHA.....?????
- **What are the causes of anaemia is bad for the child?** Doesn't know____; tea___; Tea with meal____; lack of meat/chicken /fish ____, lack of rich iron vegetable (she can mention one) ____; some diseases _____; poverty_____; other answers_____;
- **What can be done to prevent or treat anaemia?** Doesn't know____; good diet___; iron supplementation _____, food fortification _____, wrong answer_____;
- **What is the GOOD food for the child growth?** doesn't know____; Breast feeding___; Vegetables____; Legumes____; Fruits____; Meat____; Chicken ____; Fish____; Eggs____; Milk___; Cheese and milk products____; fresh juice _____; other answers_____;
- **What are the food BAD for the child growth?** doesn't know____; Sugar____; Soft drinks___; Chips____; Salted biscuits___; Butter___; Biscuits___; Cakes ____; Chocolate bars ___; Sweets and candies ____; ice cream_____; jam and cream _____; other answers_____;

ANNEX 2. Extract from the HOME VIST FILE (nutritional questionnaire and mother's knowledge assessment).

Data were collected for 3,619 children (2,024 anaemics and 1,595 non-anaemic siblings) of these families concerning:

- drug adherence, tolerance, storage and administration
- mother's knowledge of anaemia and nutrition
- nutritional habit (24-hour recall nutritional questionnaire)

The second visit took place on average 111 days (SD=46) after the first visit.
The home visit data included children on iron preventive treatment, not only anaemics.

2.3 Haemoglobin assessment

Blood samples taken at kindergarten were analysed using the Haemocue rapid test.
Blood samples in clinics were tested using an aXE-2100D automated haematology analyser (Sysmex).

2.4 Definition of anaemia and malnutrition

Anaemia. Children with a haemoglobin level below 11g/dl were considered anaemic. Anaemia was defined as mild for a haemoglobin level of 10-11g/dl, moderate for 7-9.9 gm/dl and severe for less than 7gm/dl.
Malnutrition. The software used to calculate Z score was "WHO ANTHRO, Software for Calculating Anthropometry, Version 2.0" and "WHO ANTHROPLUS". Segments of the population below -2 Z score (2SD) were considered as suffering from wasting (acute malnutrition, weight/height), underweight (weight/age) and stunting (chronic malnutrition, height/age). Segments of the population above 2Z of body mass index for age were considered as overweight (WHO, 2009).

2.5 Statistical analyses

Statistical analyses were performed using STATA software (Stata Statistical Software release 9.2, 2007; Stata Corporation, College Station, Texas). Uni- and multivariate binary regression and chi square test were used where appropriate. All statistical tests were two sided, and P values of < 0.05 were considered significant.

2.6 Main objectives

As already mentioned, the intervention was not conceived or performed as a study, thus the monitoring and evaluation (M&E) system was a tool for correct activity management and for evaluating the impact of the project, but it did allowed us to gather useful information:

- for comparing the prevalence of anaemia and malnutrition before and after the project in the pre-school child population;
- for identifying risk factors for anaemia;
- for assessing compliance and tolerability of treatment and their association with lack of improvement;
- for assessing change in the families' knowledge of anaemia and nutrition (mothers);
- for assessing nutritional habits and evaluating changes promoted by intervention;
- for evaluating anaemia prevalence 1 year after intervention (long-lasting impact);
- for monitoring and evaluating anaemic children who did not improve during the first phase of the project, including identification of non-iron deficiency anaemia (e.g. thalassaemia).

2.7 Ethical approval

The Helsinki Committee of Palestinian Ministry of Health gave approval for publication of present paper.

3. RESULTS

3.1 Anaemia prevalence at screening

10,445 children were screened for anaemia between October 2009 and March 2011: 3,941 (37.7%) of them were screened at the PMRS paediatric clinics in northern Gaza, while the other 6,504 (including siblings) were screened at the 22 kindergartens in southern Gaza.
51.6% (5,391) of the screened children were male. The mean age of the screened children was 39.7 months (SD=18.0), with no difference between the sexes.
5.877 (56.3%) of the tested children were not anaemic and 4,568 (43.7%) were anaemic (HB level <11g/dl); 421 of the anaemics (4.1%) had a haemoglobin level below 9g/dl.
The prevalence of anaemia was similar in males (44.0%) and females (43.4%, p=0.5) and strongly and inversely associated with age, as shown in Figure 1 and Table 1: anaemia had a very high prevalence in children below 24 months, peaking at 6-11 months (76.2%) and 12-23 months (72.2%). The percentage was much lower in older children (17.0% for children > 5 years old).
When considering only the under-5 population, the prevalence of anaemia was 49% (4,271/8,709), but it should be noted that children below 12 months of age were under-represented and our sample did not adequately represent the under-5 population of Gaza.

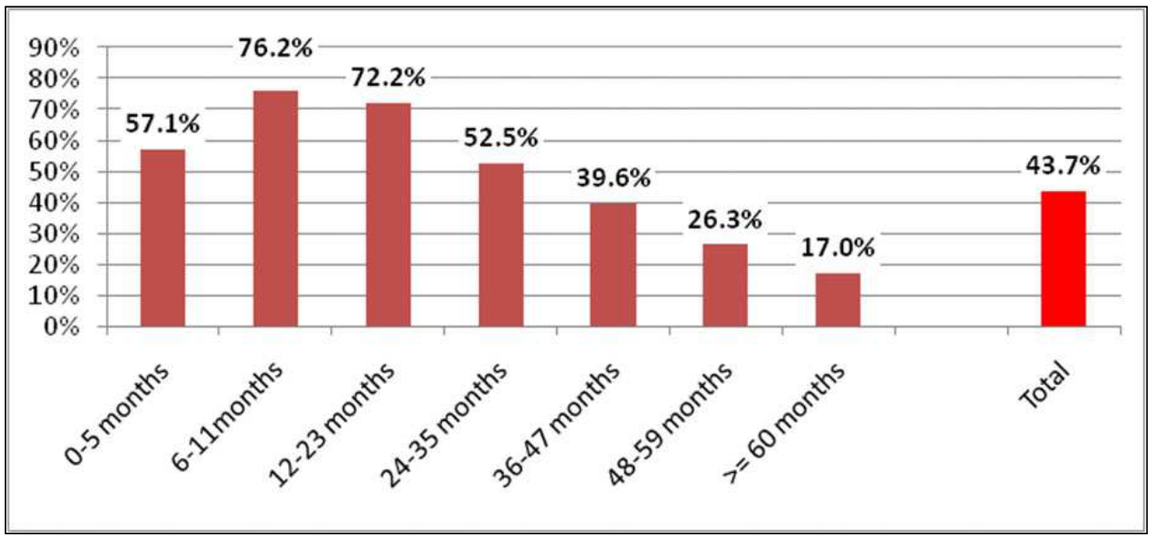


Fig. 1. Prevalence of anaemia by age group.

Age groups	N° of screened	N° of anaemics	% of anaemics	% of stunting	% of underweight	% of wasting	% of overweight
0-5 months	56	32	57.1%	0.0%	3.6%	8.9%	5.4%
6-11 months	513	391	76.2%	6.9%	2.7%	5.5%	5.7%
12-23 months	2,026	1,462	72.2%	10.7%	2.9%	2.9%	7.2%
24-35 months	1,973	1,036	52.5%	10.8%	2.2%	3.6%	8.2%
36-47 months	1,967	778	39.6%	9.6%	2.5%	3.2%	6.3%
48-59 months	2,174	572	26.3%	6.6%	2.6%	2.7%	5.3%
≥ 60 months	1,726	294	17.0%	6.2%	2.1%	1.8%	3.8%
Total	10,435	4,565	43.7%	8.7%	2.5%	3.1%	6.2%

Table 2. Prevalence of anaemia and malnutrition by age group.

As shown in Table 3, anaemia was also associated with:

- mother's poor education, regardless of child's age ($p<0.0001$)
- stunting in children over 24 months of age
- not having received fortified food (data collected for kindergarten children only).

		Children below 24 months (2,595)	Children over 24 months (7,850)
Mother's education	No education (278)	88%	54%
	Primary (1,380)	82%	49%
	High school (5,887)	71%	31%
	University (2,423)	69%	30%
Stunting	No (9,495)	73%	33%
	Yes (901)	73%	45%
Received fortified food *(only children screened at kindergarten)*	No (2,172)	73%	30%
	Yes (4,312)	60%	24%

Table 3. Anaemia prevalence by age group and other variables.

A multivariate logistic analysis showed that being anaemic was associated with:

- child's younger age (odds ratio=0.95 for every month of age, $p<0.0001$)
- mother's education (OR=0.73 for each level, $p<0.0001$)
- stunting (OR=1.36, $p<0.0001$)
- not having received fortified food (OR=1.35, $p<0.0001$).

No association was found between anaemia and: mother's age, number of pregnancies, father unemployment or sex of the child.

Prevalence of underweight and wasting (acute malnutrition) were low (around 2-3%), similar to the level registered in the normal healthy population according to WHO standards; prevalence of stunting was high (8.7%), and overweight was moderately higher (6.2%) than in the healthy population.

3.2 Anaemia improvement after intervention

4,077 of the anaemic children were monitored until a second haemoglobin test was performed, on average after 175 days (SD=43) of treatment. Table 4 below shows that:

- of 4,077 children anaemic at enrolment 2,690 (66.0%) were no longer anaemic and 1,387 (34.0%) were still anaemic after 4-6 months of treatment;
- severe and moderate anaemia was reduced from 9.4% to only 1.7%;
- of the 1,387 children still anaemic 360 (26.0%) had an improvement in haemoglobin $\geq$1g/dl, a clinically significant result, bringing to 74.8% the percentage of anaemic children with improved status;
- the mean haemoglobin level increased from 9.99 g/dl to 11.0 g/dl.

Type of anaemia	Admission n.	%	Last follow-up n.	%	p value
Severe and moderate anaemia <9g	383	9.4%	71	1.7%	**<0.0001**
Mild anaemia	3,694	90.6%	1,316	32.3%	
No anaemia	0		2,690	66.0%	
Mean haemoglobin level among 1,211	9.99 g/dl		11.09 g/dl		**<0.0001**

Table 4. Anaemia status before and after treatment.

Anaemic children at screening were classified as "improved" if they recovered from anaemia or if they had at least a >1g/dl increase in haemoglobin level. A strong link between improvement and child age was noticed: improvement was much lower for younger children (less than 60%) compared to older ones (around 80%), as shown in Figure 2.

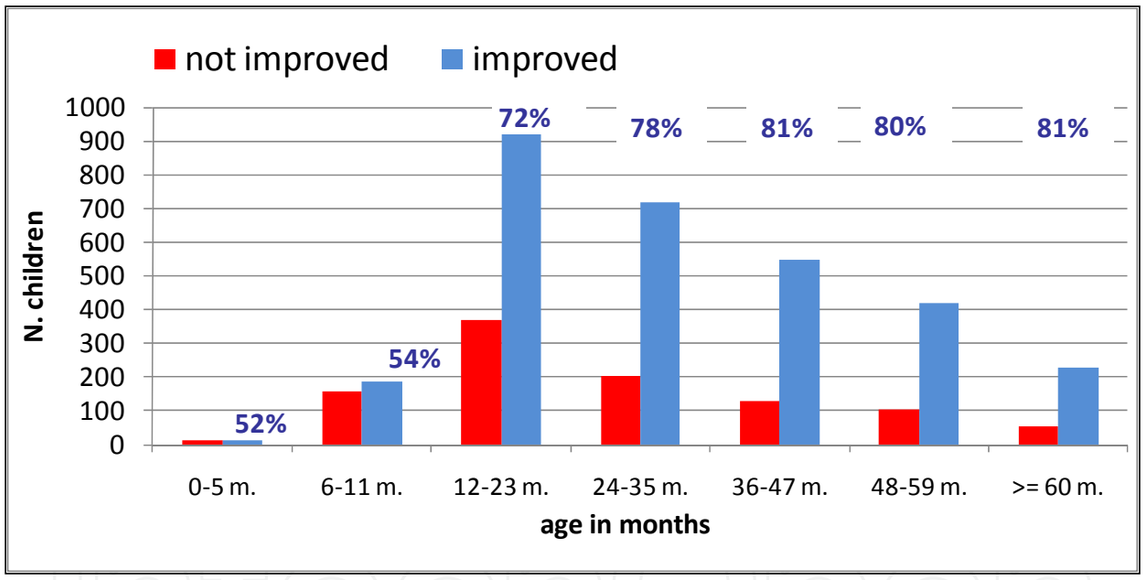


Fig. 2. Anaemia improvement after treatment by age group (number of children and % of improved).

Improvement was not associated with mother's education or other family variables collected.

In order to investigate the reasons for not improving we linked data collected via the CHILD FILE and HOME VISIT file to establish whether improvement was associated with:

- drug adherence
- drug tolerance
- mother's level of knowledge
- change in nutritional habits.

The above information was not available for all the children enrolled and is presented in detail in the following subsections (3.3 to 3.6).

3.3 Adherence to iron supplementation

In the first two phases of the project (South Gaza-1 and North Gaza) we were unable to associate improvement with good adherence to iron supplementation; this was due to the fact that almost all the mothers reported having given the iron as prescribed. A more careful investigation in a subsample of still anaemic children showed that in order to obtain more reliable answers:

- the questions on adherence had to be more precise and more specific
- the investigator was not to blame the mothers.

For this reason a more precise and more sensitive data collection method was introduced in SOUTH GAZA-2; therefore, with regard to drug adherence, we present data limited to this project. Information on drug adherence was collected for all the 2,804 children enrolled, during each distribution at the kindergarten and during the home visit. Specific questions were asked, such as whether the drugs had been taken regularly (≥5 days/week), irregularly (4-2 days/week) or not at all (≤ 1/week) during the previous week. Figure 3 below shows that:

- drugs were taken regularly by 57% of the children after one month, the percentage decreasing constantly to 45.7%;
- the percentage of children who took drugs irregularly rose with time from 21.7% to 32.8%;
- the percentage of children not taking drugs or not showing for follow-up increased with time.

The major reason mentioned for not taking drugs regularly were careless mother and/or child's refusal.

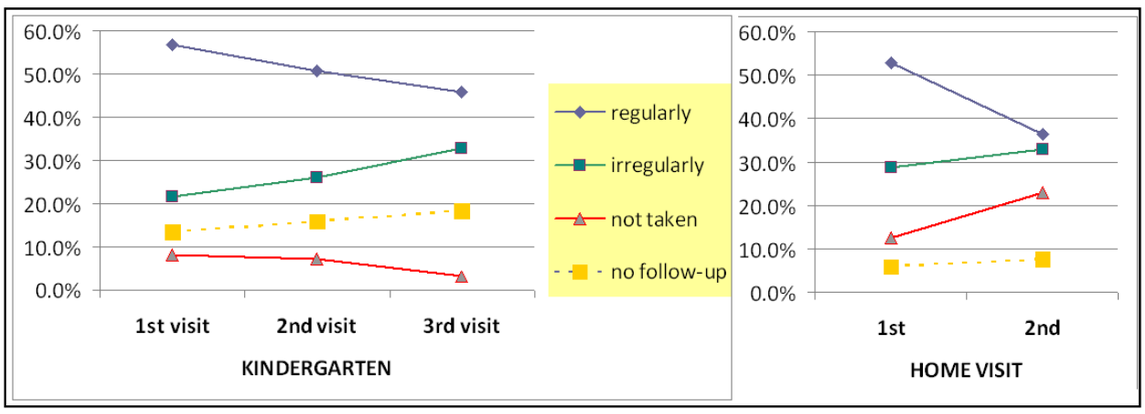


Fig. 3. Reported adherence among anaemic children.

To allow a better comparison we created a comprehensive index of drug adherence by combining all assessments performed, giving a score of 2 when the drugs were taken regularly, 1 when taken irregularly and 0 when not taken or the follow-up was missed. As shown in Table 5, there were 136 children who always took the drugs regularly, (score=10) and 31 who never took the medicine. We can further classify in 3 categories the level of adherence

Adherence category	Adherence score	No.	%	Cumulative %
POOR	0	31	3.6%	3.6%
	1	35	4.1%	7.7%
	2	49	5.7%	13.5%
	3	39	4.6%	18.1%
	4	72	8.4%	26.5%
FAIR	5	77	9.0%	35.5%
	6	99	11.6%	47.1%
	7	93	10.9%	58.0%
GOOD	8	116	13.6%	71.6%
	9	106	12.4%	84.1%
	10	136	15.9%	100.0%

Table 5. Adherence scores for anaemic children.

We found a significant association ($p<0.0001$) between improvement of anaemia and the treatment adherence score (as previously described). The percentage of improvement after adjustment for age was:

- *68.0% for children with good adherence (score 8-10)*
- *64.2% for children with fair adherence (score 5-7)*
- *60.5% for children with poor adherence (score <5)*

3.4 Drug tolerance, storage and administration

In the previous subsection we presented data on drug adherence recorded for anaemic children; the data here include non-anaemic children undergoing preventive treatment (prophylaxis).

There were very few reported complaints related to drug intake: around 2% in children with anaemia who received a higher dosage of iron and less than 1% for children on preventive treatment.

Vomiting and diarrhoea were the most common symptoms reported.

Drug storage was adequate in more than 90% of the cases during the first visit, the figure dropping slightly declined at the second visit. A similar pattern was noticed with regard to correct drug administration.

		1st visit	2nd visit
Drug-related complaints	anaemics	1.8% (38 cases)	1.8% (37 cases)
	non-anaemics	0.7% (11 cases)	0.4% (7 cases)
Adequate drug storage	anaemics	94.32%	93.08%
	non-anaemics	92.75%	89.33%
Correct drug administration	anaemics	89.65%	87.54%
	non-anaemics	86.26%	81.89%

Table 6. Drug tolerance, storage and administration among anaemic and non-anaemic children.

3.5 Mother's knowledge of anaemia and nutrition

A total of 1,724 mothers answered a questionnaire on anaemia and nutrition (annex-2) twice during the two home visits. The questions were open-ended and the social workers did not prompt any answers to them.

Considering the average number of good/correct answers given by mothers, it is clear for each section that there was a significant increase in knowledge (p-value paired t-test was always <0.0001).

The average number of good answers increased by 35%, from 7.7 to 10.4. The number of mothers improving their score was 1,205 (70%), while 247 showed the same and 272 a lower score.

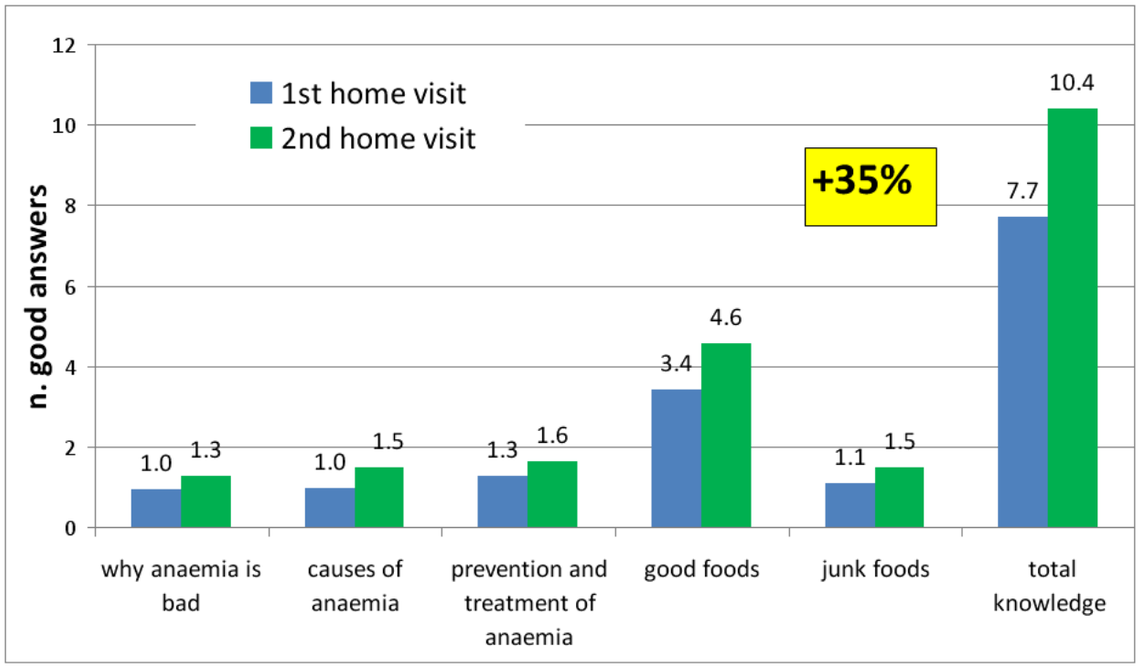


Fig. 4. Mother's knowledge of anaemia and nutrition at the first and second home visit.

When we considered as having a "good basic knowledge" women with a score of ≥ 10 with at least one good answer for every section, we found that the percentage of mothers with a good basic knowledge was only 20.2% at the first home visit, rising to 51.6% at the second home visit ($p<0.0001$).

The level of "good basic knowledge" was strongly related to mother's education at the first home visit, ranging from 10% in women with primary education to 28% for the highly educated ($p>0.0001$). At the second visit no difference in good basic nutritional knowledge was seen between mothers with different standards of education (apart from the 12 illiterate subjects).

This is particularly important since:

- less educated mothers displayed a proportionally higher increase in knowledge than highly educated ones;
- disparity was reduced at the end of the project;
- we proved that the nutritional messages given were well understood even by the less advantaged, who are more in need,

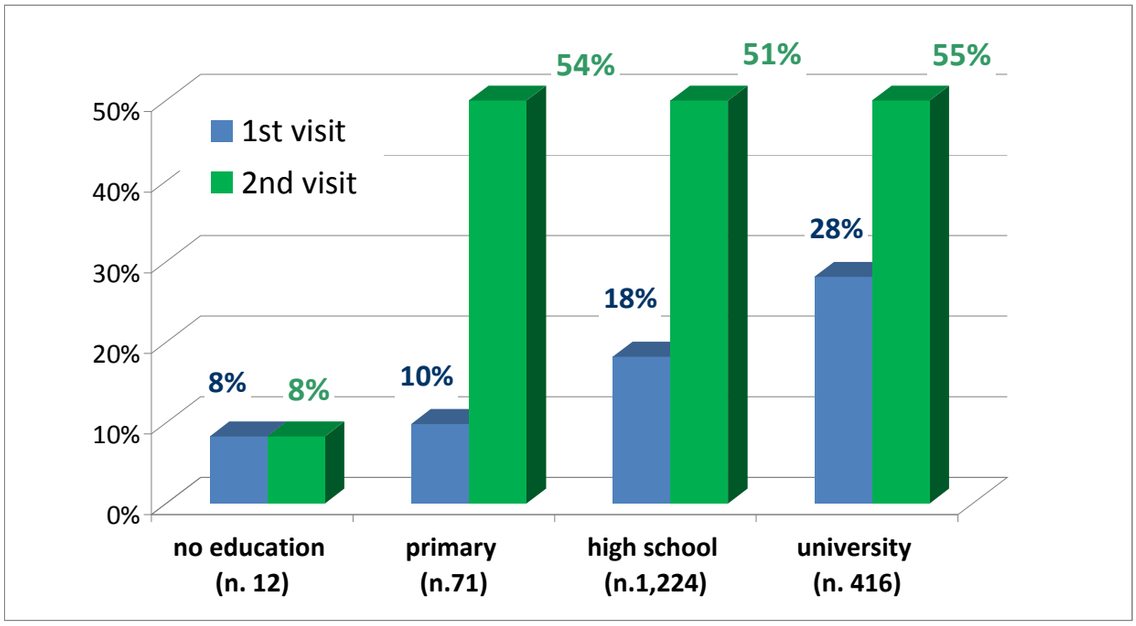


Fig. 5. Good-basic knowledge at the first and second home visit by mother's education level.

We found an association between improvement in anaemic status and mother's good basic knowledge at the second home visit: after adjustment for child's age, mothers with a good-basic knowledge were 24% more likely to have a child with improved status than mothers without a good basic knowledge (odds ratio=1.24, p=0.013).

Furthermore, in a sub-sample of children with available data, we found a significant association (p=0.016) between improvement of anaemia with mothers' and fathers' participation in awareness sessions at the kindergarten. The percentages of improvement stratified for participation were:

- 78.3% for the 69 children whose mother and father both participated in the awareness session
- 69.1% for the 162 children whose mother participated in the awareness session
- 62.3% for the 533 children whose parents did not participate in the awareness session.

3.6 Change in children's nutritional habits

In order to appreciate a possible impact in nutritional habit we compared the results of the 24-hour recall nutritional survey done during the first home visit with those of the same survey repeated 3-4 months later.

Since children below 2 years of age, who are at the weaning stage, can have a substantial change in their nutritional habit independently of the project, we analysed in a stratified way the results for children below 24 months of age (where considerable change is naturally expected) and those for older children (where changes can reflect project impact).

The specific messages of nutritional counselling were:

- stop tea consumption during meals;
- increase vegetable and fruit consumption;
- increase haem-rich animal food consumption (meat, fish, chicken);
- reduce junk food consumption.

3.6.1 Children over 24 months of age at screening

The overwhelming majority of children were having an average of 3 meals a day before and after the project.

When considering the average number of portions consumed the previous day, we noticed a 25% increase in the consumption of fruit and vegetables, +29% for staple food, +19% for animal products and +25% for haem-rich animal food.

Table 7a		Anaemic children ≥ 24 months			
		1st visit	2nd visit	change	p value paired t-test
Number of children		1,251			
Average no. of meals		2.93	2.96		
% of children having fewer than 3 meals		**10.27%**	**6.59%**	**-36%**	**0.0001**
Average number of portions* consumed the previous day	Vegetables, fruits and legumes	2.26	2.83	**25%**	<0.0001
	Staple food	2.11	2.73	**29%**	<0.0001
	Animal foods	2.42	2.88	**19%**	<0.0001
	Of which haem-rich food	*0.56*	*0.71*	**25%**	<0.0001
	Junk food	2.24	2.01	**-10%**	<0.0001
	Of which chips	0.82	0.57	**-30%**	<0.0001
	Of which candies	0.21	0.24	**18%**	0.03
	Of which soft drinks	0.11	0.08	**-28%**	0.026
Average number of times child eats junk food between meals		2.04	1.93	**-6%**	0.0001
Average cups/glasses consumed the previous day	Water	4.17	5.07	**22%**	<0.0001
	Tea No. of cups	1.18	0.76	**-35%**	<0.0001
	(Percentage drinking tea)	(67%)	(54%)	**-19%**	<0.0001
	Of which tea outside meals	0.90	0.61	**-33%**	<0.0001
	Of which tea with meals	0.28 (16.3%)	0.15 (10.6%)	**-45%** **-35%**	<0.0001 <0.0001
Table 7b		Non-anaemic children ≥24 months			
		1st visit	2nd visit	change	p value paired t-test
Number of children		1451			
Average no. of meals		2.95	2.99		
% of children having fewer than 3 meals		**6.72%**	**4.56%**	**-32%**	
Average number of portions* consumed in the previous day	Vegetables, fruit and legumes	2.26	2.77	**23%**	<0.0001
	Staple food	2.21	2.79	**26%**	<0.0001
	Animal foods	2.44	2.89	**19%**	<0.0001
	Of which haem-rich food	*0.58*	*0.69*	**19%**	<0.0001
	Junk food	2.26	2.12	**-6%**	0.003
	Of which chips	0.87	0.63	**-27%**	<0.0001
	Of which candies	0.21	0.29	**37%**	<0.0001
	Of which soft drinks	0.10	0.11	**16%**	0.13
Average number of times child eats junk food between meals		2.04	2.01	**2%**	**-3%**
Average cups/glasses consumed the previous day	Water	4.53	5.30	**17%**	<0.0001
	Tea No. of cups	1.18	0.78	**-34%**	<0.0001
	(Percentage drinking tea)	(65%)	(53%)	**-18%**	<0.0001
	Of which tea outside meals	0.92	0.64	**-30%**	<0.0001
	Of which tea with meals	0.26 (14.9%)	0.14 (10.2%)	**-46%** **-32%**	<0.0001 <0.0001

Table 7. Food consumption during previous 24 hours as recorded during first and second home visit for children over 24 months of age, anaemic (7a) and not anaemic (7b).

The increase in fruit and vegetable consumption may not be an effect of the project since we recorded at the same time an increase in staple food that the project did not promote.
Junk food consumption declined slightly, with chips and soft drinks up and candies down.
Tea consumption decreased by 35%, and tea with meals decreased even more (-45%). At the same time water consumption increased. Similar results were recorded in the non-anaemic population.
As shown in Table 8, the children of parents who participated in awareness sessions seem to have had a better improvement of nutritional habits, particularly in terms of reducing tea consumption during meals: -72% versus -32% when considering cups; -55% versus -10% when considering the percentage of children drinking tea.

		843 children with parents who did not attended awareness sessions			362 children with parents who attended awareness sessions		
		1st visit	2nd visit	Change	1st visit	2nd visit	Change
Average number of portions consumed the previous day	Vegetables, fruit and legumes	2.66	2.94	11%	2.77	3.48	26%
	Staple food	2.54	3.16	24%	2.49	3.34	34%
	Animal foods	2.60	2.76	6%	2.45	2.92	19%
	Of which haem-rich food	*0.61*	*0.69*	*13%*	*0.48*	*0.64*	*33%*
	Junk food	2.67	2.79	4%	2.29	2.26	-1%
Average number of times child eats junk food between meals		2.02	2.16	7%	1.94	1.86	-4%
Average cups/glasses consumed the previous day	Tea	1.37	0.87	-36%	1.43	0.89	-38%
	Of which tea with meals	0.25	0.17	-32%	0.25	0.07	-72%
	No. of cups	(13.3 %)	(12.0%)	-10%	(14.0 %)	(6.3%)	-55%
	(% drinking tea)						

Table 8. Food consumption during previous 24 hours stratified for participation of parents in awareness sessions.

3.6.2 Children below 24 months of age at screening

The overwhelming majority of children were having an average of 3 meals a day and the percentage was stable. However, the percentage of children receiving fewer than 3 meals a day was reduced from 15.5% to 8.4.% (breast feeding was not considered).
As expected, the consumption of all types of food increased, with the exception of junk food, which remained stable. The consumption of soft drinks and candies, however, increased significantly.
Tea consumption was high, even among small children, half of whom had drunk it the previous day. There was an 18% decrease in quantity, and tea with meals decreased even more (-40%). At the same time water consumption increased.
Similar values were found in the non-anaemic population (144 children).

		Anaemic children <24 months			
		1st visit	2nd visit	change	P
N. of children		773			
Average no. of meals		2.90	2.96		
% of children having fewer than 3 meals		**15.5%**	**8.4%**	**-46%**	<0.0001
Average number of portions consumed the previous day	Vegetables, fruit and legumes	2.04	2.61	**28%**	0.0014
	Staple food	1.85	2.27	**23%**	<0.0001
	Animal foods	3.00	3.28	**9%**	0.0014
	Of which rich haem food	*0.53*	*0.64*	**21%**	*0.002*
	Junk food	1.92	1.86	**-3%**	0.4
	Of which chips	0.62	0.50	**-20%**	<0.0001
	Of which candies	0.17	0.23	**39%**	0.001
	Of which soft drinks	0.06	0.09	**49%**	0.07
Number of times child eats junk food between meals		1.91	1.88	**-2%**	0.4
Average cups/glasses consumed the previous day	Water	3.73	4.69	**26%**	<0.0001
	Tea no. of cups	0.82	0.67	**-18%**	0.0008
	(Percentage drinking tea)	(49%)	(47%)	**-4%**	0.3
	Of which tea between meals	0.63	0.55	**-12%**	0.06
	Of which tea with meals	0.19 (12.2%)	0.12 (8.1%)	**-40%**	0.0007 0.002

Table 9. Food consumption during previous 24 hours as recorded during first and second home visit for anaemic children below 24 months of age.

WE COULD NOT FIND ANY ASSOCIATION BETWEEN IMPROVEMENT OF ANAEMIC STATUS AND CHANGE IN NUTRITIONAL HABIT

3.7 Anaemia prevalence after 1 year of intervention: a random sample of Phase 1 KGs children

One of the biggest challenges of any medical intervention is to maintain the benefit obtained in the short term also in the long term. This is particularly important for nutritional supplementation intervention, such as treatment for iron deficiency anaemia: it is reasonable to have an improvement after iron supplementation, but what happens then? It is true that even a temporary improvement in anaemia at a crucial age with regard to growth can have long-lasting benefits, but our task was to assess the level of anaemia 1 year after the end of the intervention.

3.7.1 Methods

We randomly selected 178 children who were anaemic when enrolled in October 2009 during the SOUTH GAZA-1 project and had improved by the end of the project (May 2010), and we re-tested them in May 2011, one year after the end of the project. To evaluate improvement we compared anaemia prevalence and haemoglobin level at the three different time points using the pair t-test (comparison of each subject with himself/herself).

3.7.2 Results

It can be seen from Table 10 below and Figure 6 that:

- at the end of phase 1 only 8 children were still anaemic (all of them had an improvement in Hb level ≥1g/dl; none had moderate or severe anaemia);
- 1 year later the vast majority of children (88.2%) were still not anaemic and only 21 had regressed to mild anaemia;
- the level of anaemia increased significantly after 1 year (from 5.5% to 11.8%; p=0.011) but was still much lower than found at baseline;
- none of the 21 anaemic cases in May 2011 had moderate or severe anaemia and only 2 had an Hb level below 10g/dl, meaning that even the children who were still anaemic were at the limit of normality. The average haemoglobin level among the children was lower than in May 2010, yet much higher than the level recorded at the beginning of the SOUTH GAZA 1 project.

Type of anaemia	October 2009 No.	%	May 2010 No.	%	May 2011 No.	%	P value
Severe and moderate anaemia <9g	18	10.1%	0	0%			<0.0001
Mild anaemia	160	89.9%	8	5.5%	21	11.8%	
No anaemia	0		170	95.5%%	157	88.2%	
Mean Hb level among 178 children	9.94 g/dl		11.98 g/dl		11.85 g/dl		<0.0001
Mean Hb level among 21 children still anaemic in May 2011	9.89 g/dl		11.71 g/dl		10.42 g/dl		<0.0001

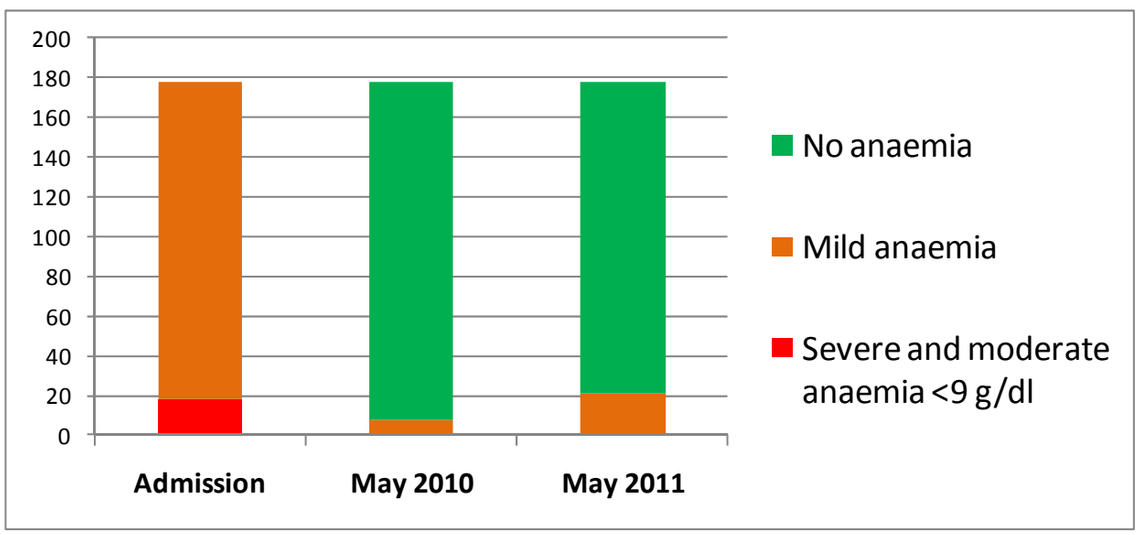


Table 10. and Fig. 6. Anaemia prevalence at three different time points.

Conclusions drawn:

- anaemia improvement achieved during the SOUTH GAZA 1 project persisted after 1 year;
- the overwhelming majority of children were still not anaemic after 1 year;

- there was still a fraction of children who regressed to anaemia after stopping supplementation, but their Hb levels were much higher than before project implementation.

3.8 Follow-up of still anaemic children

Children who were still anaemic after intervention underwent a more thorough clinical investigation, treatment and a longer follow-up.

Only 50 were diagnosed as having thalassaemia: the 0.48% of the 10.445 children screened and the 1.01% of the children found to be anaemic.

Out of the 296 children found to be still anaemic during follow-up screening at the end of the SOUTH GAZA-1 project, 159 (from 140 families) were still attending kindergarten in October 2010 and were enrolled in Phase 2 activities; the others had left, mainly to go to school. One hundred and twenty-nine of them were tested again; the other 33 refused to enter the new program.

After intensive counselling, the majority of children with no improvement in anaemic status were found to:

- have had poor drug adherence and/or
- have high tea consumption during meals and/or
- drink large amounts of tea.

Extra counselling was given to the mothers of these children.

The results for the 129 children re-tested in October 2010 showed a substantial change from their previous status (Table 11):

- 50.4% of children were no longer anaemic;
- the number of children with severe/moderate anaemia dropped from 17 to 3;
- 19 children were still anaemic, but improved their Hb value by at least 1g/dl;
- only 45 children did not improve.

Type of anaemia	June 2010 No.	%	October 2010 No.	%	p value
Severe and moderate anaemia <9gr	17	13.2%	3	2.3%	
Mild anaemia	111	86.2%	61	47.3%	**<0.0001**
No anaemia	1	0.8%	65	50.4%%	
Mean Hb level among 129 children	**9.62 g/dl**		**10.91 g/dl**		**<0.0001**

Table 11. Haemoglobin level and anaemic status of children not improving in the first phase.

4. Discussion

4.1 Anaemia prevalence

Our sample cannot be considered as fully representative of the under-5 population of the Gaza Strip because they were not randomly selected, and because children below 12 months of age were under-represented. We found an anaemia prevalence at screening of 43.7%, which was strongly associated with children's younger age (from 76.2% at 6-11 months to 17.0% for children over 5 years of age).

The prevalence we found is very similar to that reported by the local Ministry of Health (PNA MOH, 2011) for children below 12 months (prevalence 76.2% among children aged 9-12 months) but much lower for the oldest age group (prevalence 58.6% among school children in 2009). The lower prevalence noticed in our children over 5 years of age could be explained by the fact that there have been several instances in the last 2 years of iron-fortified-food distribution in kindergartens, and we found that children receiving fortified food had a significantly lower level of anaemia. However the fortified food distribution, which was not implemented within a public health scheme, does not seem to be able to tackle completely the problem and several kids were found anaemic despite it.

In addition to child's age and utilisation of fortified food, we found a significant association of anaemia with mother's poor education (an indication that low-social-status subjects are more vulnerable) and with stunting (not surprising since anaemia and stunting both reflect poor quality nutrition).

It is worth noting that children aged between 12 and 48 months, particularly those below 24 months, have very high prevalence of anaemia but are particularly difficult to reach because they do not attend the health clinic regularly (the vaccination program ends in the first year) or go to kindergarten: specific actions to target them should be implemented because anaemia can have very negative consequences for them (Walter, 2003).

Universal growth monitoring at least once a year for all under-5s, including haemoglobin level testing, could be one of the measures to take in the Palestinian context, where medical facilities and health workers are readily available and could easily provide this service. This would also provide the opportunity to monitor and contrast stunting, an age-old chronic problem, at an early stage, and also obesity, the new rampant one.

4.2 Anaemia improvement

Overall performance for anaemia was very good. Nearly 70% of the children treated were cured within 4-6 months. A review of the literature shows that this rate is in line, if not better, with what has been achieved in specific studies elsewhere (Rosadoet al, 2010) or in the region where children received iron daily or weekly (Faqih et al, 2006; Tavil et al, 2003), but these were clinical trials with a small number of participants and effectiveness in the field is always more complicated.

One good result seen is an impact of the supportive counselling, including home visits: this is backed up by the fact that mothers who gained a better knowledge had an additional 24% chance of having a child who recovered from anaemia. The effect of well-motivated parents - something rarely studied in trials, where almost all participants are well motivated - is confirmed by the better results achieved when parents participated in awareness sessions.

Of course we have to be careful in considering this difference as a result of the awareness sessions, since it is likely that we had a strong selection bias: parents most interested in "nutritional" topics even before the project probably attended more awareness sessions, and they were also more attentive in monitoring their children's adherence and nutritional habits.

The lower rate of improvement in children below 24 months of age confirms the high vulnerability of this age group.

The use of more palatable iron with fewer side effects, such as that used in our projects (Toblli et al, 2007), can explain the relatively good adherence and impact: and the link between adherence and improvement was clearly proven during our interventions.

As found in another study (Zlotkin et al, 2003), further supplementation is not needed to maintain non-anaemic status in most children previously treated for anaemia: almost all the children who recovered from anaemia were not anaemic 1 year later.

4.3 Nutritional habits: knowledge and practice

Knowledge of anaemia and nutrition was quite low, particularly for less educated mothers, but health education achieved a substantial increase in the level of knowledge, particularly in the less educated.

The 24-hour nutritional questionnaire was designed as a tool for diagnosis and family counselling, not for gathering information, but it provided some interesting data on food consumption:

- high prevalence of junk food in the under-5s, as also noticed for school children (PNA MOH, 2011);
- low consumption of fruit and vegetables;
- high consumption of tea, half of the children below 24 months of age having drunk some during the previous day.

During the second home visit we found a consistent decrease in tea consumption in all age categories, particularly during meals, but we were unable to establish a real reduction in junk food consumption and there was only a minimal increase in the intake of fruit and vegetables.

It is important to point out that food consumption was reported by the mothers, so the reported "good change" should be treated with caution because this could in part be the result of the mother's desire to give the (counselling) interviewer a good impression.

Our data confirm that increased knowledge did not immediately result in improved feeding habits, a constraint found in many interventions that try to address chronic nutritional problems such as obesity in children (Branca et al, 2007).

Little change in nutritional habits and the weakness of having only two monitoring measures of habits could explain why we were unable to establish a significant association between change in nutritional habit and anaemia improvement.

5. Acknowledgment

The article preparation was not funded by the donors in any way, and all its contents are published under the responsibility of Terre des Hommes Italia and the Palestinian Medical Relief.
Thanks go to the staff of PMRS, Tdh-It and kindergarten who implemented the projects

6. References

Abdeen, Z., Greenough, G., Shahin, M., Tayback M; 2002. Nutritional Assessment of the West Bank and Gaza Strip. Accessed on the internet on the 07/07/2007 at: http://www.usaid.gov/wbg/reports/Nutritional_Assessment.pdf

Azeredo CM, Cotta RM, Sant'Ana LF, Franceschini Sdo C, Ribeiro Rde C, Lamounier JA, Pedron FA. Greater effectiveness of daily iron supplementation scheme in infants. Rev Saude Publica. 2010 Apr;44(2):230-9.

Faqih AM, Kakish SB, Izzat M. Effectiveness of intermittent iron treatment of two- to six-year-old Jordanian children with iron-deficiency anemia. Food Nutr Bull. 2006 Sep;27(3):220-7.

Palestinian National Authority, 2011. National Nutrition Surveillance System. 2010 Report. Ministry of Health, Nutrition Department

Rahim HF, Wick L, Halileh S, Hassan-Bitar S, Chekir H, Watt G, Khawaja M. Maternal and child health in the occupied Palestinian territory. Lancet. 2009 Mar 14;373(9667):967-77. Epub 2009 Mar 4. Erratum in: Lancet. 2009 Jun 27;373(9682):2200.

Roberts, L. and Hofmann, C.A.; 2004. Assessing the impact of humanitarian assistance in the health sector. Emerg Themes Epidemiol. 1:3. Available from: http://www.ete-online.com/content/1/1/3

Robertson, D.W., Bedell, R., Lavery, J.V., Upshur. R.; 2002. What kind of evidence do we need to justify humanitarian medical aid? Lancet. 360, 330-333

Rosado JL, González KE, Caamaño Mdel C, García OP, Preciado R, Odio M. Efficacy of different strategies to treat anemia in children: a randomized clinical trial. Nutr J. 2010 Sep 23;9:40.

Rychetnik, L., Frommer, M., Hawe, P., Shiell, A.; 2002. Criteria for evaluating evidence on public health interventions. J Epidemiol Community Health. 56,119-127.

Tavil B, Sipahi T, Gökçe H, Akar N. Effect of twice weekly versus daily iron treatment in Turkish children with iron deficiency anemia. Pediatr Hematol Oncol. 2003 Jun;20(4):319-26.

Toblli JE, Brignoli R. Iron(III)-hydroxide polymaltose complex in iron deficiency anemia / review and meta-analysis. Arzneimittelforschung. 2007;57(6A):431-8. Review

Verster, A.; 1996. Guidelines for the control of iron deficiency in countries of the Eastern Mediterranean, Middle East and North Africa. World Health Organization, Regional Office for the Eastern Mediterranean. WHO-EM/NUT/177, E/G/11.96/1000.

Walter T. Effect of iron-deficiency anemia on cognitive skills and neuromaturation in infancy and childhood. Food Nutr Bull. 2003 Dec;24(4 Suppl):S104-10. Review.

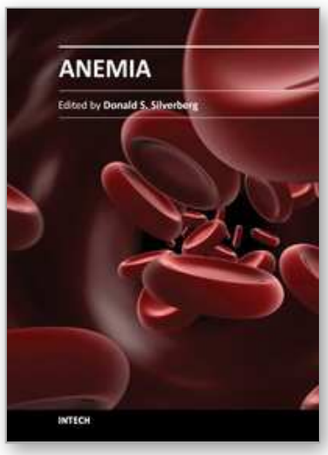
WHO and UNICEF; 2004. Focusing on anaemia. Towards an integrated approach for effective anaemia control. Accessed on the internet on the 05/10/2011 at: http://www.who.int/medical_devices/publications/en/WHO_UNICEF-anaemiastatement.pdf

Francesco Branca, Haik Nikogosian and Tim Lobstein, 2007. The challenge of obesity in the WHO European Region and the strategies for response. WHO Regional Office for Europe, Copenhagen, Denmark

WHO, 2009. Multicentre Growth Reference Study Group. WHO Child Growth Standards: Growth velocity based on weight, length and head circumference: Methods and development. Geneva: World Health Organization, 2009.

WHO, UNICEF, United Nations University; 2001. Iron deficiency anaemia: assessment, prevention, and control. Geneva, World Health Organization. WHO/NHD/01.3.

WHO; 2009. Health conditions in the occupied Palestinian territory, including east Jerusalem, and in the occupied Syrian Golan. Provisional agenda item 14 A62/24: Provisional agenda item 13 A59/INF.DOC./21 May 2009. Accessed on the internet on the 05/08/2011 at: h http://apps.who.int/gb/ebwha/pdf_files/A62/A62_R2-en.pdf



Anemia

Edited by Dr. Donald Silverberg

ISBN 978-953-51-0138-3
Hard cover, 440 pages
Publisher InTech
Published online 29, February, 2012
Published in print edition February, 2012

This book provides an up- to- date summary of many advances in our understanding of anemia, including its causes and pathogenesis, methods of diagnosis, and the morbidity and mortality associated with it. Special attention is paid to the anemia of chronic disease. Nutritional causes of anemia, especially in developing countries, are discussed. Also presented are anemias related to pregnancy, the fetus and the newborn infant. Two common infections that cause anemia in developing countries, malaria and trypanosomiasis are discussed. The genetic diseases sickle cell disease and thalassemia are reviewed as are Paroxysmal Nocturnal Hemoglobinuria, Fanconi anemia and some anemias caused by toxins. Thus this book provides a wide coverage of anemia which should be useful to those involved in many fields of anemia from basic researchers to epidemiologists to clinical practitioners.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Michele Magoni, Ghassam Zaqout, Omar Ahmmed Mady, Reema Ibraheem Al Haj Abed and Davide Amurri (2012). Supplementation and Change of Nutritional Habits for the Prevention and Treatment of Iron Deficiency Anaemia in Gaza Children: A Case Study, Anemia, Dr. Donald Silverberg (Ed.), ISBN: 978-953-51-0138-3, InTech, Available from: http://www.intechopen.com/books/anemia/supplementation-and-change-of-nutritional-habits-for-the-prevention-and-treatment-of-iron-deficiency

INTECH
open science | open minds

InTech Europe
University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
Fax: +385 (51) 686 166
www.intechopen.com

InTech China
Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821

© 2012 The Author(s). Licensee IntechOpen. This is an open access article distributed under the terms of the Creative Commons Attribution 3.0 License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

IntechOpen

IntechOpen