ACTA SCIENTIFIC NUTRITIONAL HEALTH

Volume 3 Issue 5 May 2019

Research Article

NTDs and Other Pediatric Nutrition Problems in Georgia

Robizon Tsiklauri*, P Imnadze, L Jijeishvili, J Morgan and N Saganelidze

NCDC Georgia, US CDC, Georgia

***Corresponding Author:** Robizon Tsiklauri, NCDC Georgia, US CDC, Georgia.

Received: March 06, 2019; **Published:** April 02, 2019

Abstract

Several assessments of nutritional status have been done in the recent past in Georgia, but they do not contribute substantially to the estimation of nationwide prevalence rates of nutritional outcomes. In fact, until 2015 there was not any effective surveillance system in Georgia, which could provide with reliable data for developing national strategy of micronutrient deficiency elimination and improving the nutritional status of population. With the support of US CDC, in 2015, NCDC of Georgia launched collaborative project - "strengthening of micronutrient deficiency surveillance in Georgia". For nutrition surveillance system (GNMSS) had been used sentinel surveillance approach, selecting 4 regions and 8 sentinels (2 sentinels in each region/children and pregnant health facilities).

Methodology: Iron deficiency was studded in pregnant and 12-23 months old children (toddlers) and folate deficiency in pregnant. Iron deficiency was measured using ferritin concentration in plasma with cut-off points of <12 µg/l in toddlers. Below 3.0 ng/ml was considered as a cut-off point of Folate (in plasma) deficiency in pregnant (1st trimester). For anemia detection for children U2 has been used Hb cut-off points of <11 g/l. Dietary reference intakes for vitamin D and calcium suggested that persons with serum 25(OH) D concentrations of less than 30 nmol/L (12 ng/mL) are at risk for deficiency; those with concentrations of at least 30 but less than 50 nmol/L (12 to less than 20 ng/mL) are at risk for inadequacy; and those with concentrations between 50-75 nmol/L (20-30 ng/mL) are considered sufficient. Hypocalcemia was measured as a total serum calcium concentration < 8.8 mg/dL (< 2.20 mmol/L) in the presence of normal plasma protein concentrations.

Findings: In 2018, the study showed 35.6% prevalence of anemia, and 74% prevalence of iron deficiency in children, and 30% prevalence of folate deficiency in pregnant women. Severe anemia cases were not identified in this study. Neural tube defects (NTDs) prevalence per 1000 live births (registered in sentinel sites) was very high (6.28). Vitamin "D" deficiency was identified in 4.4%, and inadequacy in 15.3% of toddlers. Hypocalcemia was identified in 10.2% of studied children.

Conclusion: Study results show that anemia and iron deficiency are prevalent among children of the specified age group in Georgia. Additionally, folate deficiency was quite common during the 1st trimester of pregnancy. Our findings will inform public health policy decision makers to take relevant decisions on required interventions, such as health education, distribution of relevant supplements, and food fortification.

Keywords: NTDs; Nutrition; Georgia

Introduction

Globally, micronutrient deficiencies affects approximately 2 billion people. Major morbidity and mortality are associated with vulnerable populations notably children under five and pregnant woman. Major micronutrient deficiencies include iron, folate and iodine.

In 2013, iron deficiency anemia affects 27% of the world's population. More than 89% of the burden comprises low income countries. Iron-deficiency anemia causes more than 60% of anemia in the general population. Children under five and women of reproductive age are particularly vulnerable by anemia, which occurs when red blood cells are below the normal level.

Iron is essential to make hemoglobin. The symptoms of iron deficiency anemia can be mild at first and are not diagnosed until they have a routine blood test. Potential health complications of iron deficiency anemia include rapid or irregular heartbeat, pregnancy complications of premature birth or low birth weight, and delayed growth in infants and children.

Folate insufficiency manifests in neural tube defects (NTDs), which is caused by low concentration of vitamin B9 (folate) in blood. Approximately 190,000 neonates are born with NTD in low Income Countries. TDs are serious and most common consequence of folic acid deficiencies. NTDs occur when neural tube closure is completed by embryonic day 28 of pregnancy and arise when the neural tube cannot close properly. The most common NTDs are the following: anencephaly and spina bifida.

Several assessments of nutritional status have been done in the recent past in Georgia, but they do not contribute substantially to the estimation of nationwide prevalence rates of nutritional outcomes. In fact, until 2015 there was not any effective surveillance system in Georgia, which could provide with reliable data for developing national strategy of micronutrient deficiency elimination and improving the nutritional status of population.

With the support of US CDC, in 2015, NCDC of Georgia launched collaborative project - "strengthening of micronutrient deficiency surveillance in Georgia". For nutrition surveillance system (GNMSS) had been used sentinel surveillance approach.

Aim and overall design of the Georgia nutrition monitoring and surveillance system

The primary aim of the "Georgia Nutrition Monitoring and Surveillance System" (GNMSS) is to systematically track trends in the effective implementation of large-scale nutrition interventions, especially food fortification, in the country, over time. GNMSS design guarantees a feasible and sustainable using a purposive selection and convenience sampling approach based on sentinel site data collection to track trends in a limited number of program output and impact indicators. It is important to note that a sentinel site nutrition monitoring and surveillance system is not intended to report "statistically representative" findings on the population of a geographic area for each point-in-time of data collection. Instead, it is expected that the resulting trends in the indicators of interest among the sentinel populations would be "reflective" of the pattern of change occurring in the overall population [1]. Thus, an essential feature and strength of a sentinel monitoring and surveillance system is on-going periodic and systematic data collection over time.

"A sentinel site-base nutrition monitoring and surveillance system is intended to illustrate trends in the indicators if interest among the sentinel populations that are "reflective" of the changes occurring in the overall population".

The collection of surveillance data related to the micronutrient indicators is proposed to assess the anticipated impact of the national flour fortification and multi-micronutrient powder (MNP) programs which are expected to be implemented in Georgia in the near future.

"The primary aim of the GNMSS is to systematically track trends in the quality, coverage and impact of large-scale nutrition interventions over time".

Furthermore, it is expected that following large-scale implementation of mandatory flour fortification, future GNMSS data would detect declining trends in the prevalence of iron and folate deficiency among women of childbearing age, and substantial reduction in the birth prevalence of NTD among newborns in Georgia. In addition, with the on-going implementation of a MNP intervention program to enable in-home fortification of complementary foods for children 6 to 23 months old, the GNMSS would likely detect a rapidly declining trend in the prevalence of pediatric anemia and stunted growth among toddlers over time.

Thus, with the implementation of the above programs, the proposed GNMSS would meet the important principle of "no (nutrition) intervention without surveillance, and no surveillance without (nutrition) intervention" [2].

Finally, although GNMSS data collection approach has been implemented in a limited number of regions in the country, it could be expanded to additional areas over time based on need and available resources. In either case, the success of the system hinges on the collection of quality and reliable data, rapid analysis of the same, and regular reporting of the findings to all stakeholders ... especially those entities that submit data for analysis.

Study design and methodology

- **Selecting the sentinel sites:** Sentinel sites selection has been undertaken considering the main characteristics of representativeness (geographical, social, ethnical, urban/rural, religion, etc.) and existing information about malnutrition and dietary habits. All people living in selected region had an equal chance to participate in the study. 8 sentinel sites (health facilities) in 4 Regions of Georgia (Tbilisi, Kakheti, Achara, Samegrelo) were selected for this pilot project, 4 sites for gating nutritional status data from children and, 4 sites - from pregnant.

- **Selecting the target groups:** Potential target groups for surveillance of micronutrient deficiency are toddlers. Toddlers are vulnerable to micronutrient deficiencies, are accessible for the assessment in child health clinics and community surveys and are an indicator of risk in the general population. Surveillance of calcium and vitamin “D” deficiency is focused on these vulnerable groups. Pregnant women in third trimester are at risk because micronutrients deficiency (e.g Folate) effects the mother and child health and normal growth, physical and mental development of the child.

- **Selecting the nutritional indicators:** 4 nutritional status indicators were selected for this project (Iron, Folate, Ca and vitamin “D”).

- **Data Collection:** Two types of data collection were used: extracting existing data from selected health facilities (sentinel sites): Hemoglobin Data and Anthropometric measurement data. For both types of data collection relevant ‘Data Collection forms’ were utilized. Second type of data collection - was coming from laboratory results of blood.

- **Trainings:** Project team (manager and local consultants) conducted trainings for sentinels’ staff on 2 main themes: 1. Nutrition status surveillance and monitoring specifics and special program forms preparing (electronic form of data base) and submitting, 2. Rickets and vitamin “D” deficiency study, management and prevention.

- **Laboratory methodology**: Laboratory testing of blood samples were used in this study project/well-accepted. For nutrition surveillance system (GNMSS) had been used sentinel surveillance approach, selecting sentinel sites. Iron and Folate deficiency was studded in pregnant (1st trimester); Iron deficiency in children (12-23 months old) and Ferritin concentration in plasma with cut-off points of <12 µg/l was used for Iron deficiency measure in toddlers, and <15 µg/l in pregnant. < 3.0 ng/ml was considered as a cut-off point of Folate deficiency in pregnant. For anemia detection for children U2 has been used Hb cut-off points of <11 g/l. Dietary reference intakes for vitamin D and calcium suggested that persons with serum 25(OH) D concentrations of less than 30 nmol/L (12 ng/mL) are at risk for deficiency; those with concentrations of at least 30 but less than 50 nmol/L (12 to less than 20 ng/mL) are at risk for inadequacy; and those with concentrations between 50-75 nmol/L (20-30 ng/mL) are considered sufficient. Hypocalcemia is a total serum calcium concentration < **8.8 mg/dL (< 2.20 mmol/L) in the presence of normal plasma protein concentrations.**

- **Data Analysis:** The Statistic Package for the Social Sciences (SPSS) and Anthro were used for Data Analysis.

- **Laboratory control was realized by the following study scheme:** 1. Hemoglobin/in children (12-23 months of age) visiting sentinel site, for immunization 2. Iron, Ca and vitamin “D” deficiencies (laboratory testing) in children 12-23 months of age. 3. Anthropometric measurement was used for children. 6. And, NTDs prevalence monitoring is also involved in surveillance system. 4 folate deficiencies (laboratory testing) were studded in pregnant (1st trimester).

Laboratory testing’s on iron, folate, Ca and vitamin “D” deficiencies were conducted in Tbilisi reference Laboratory.

Objectives related to surveillance of micronutrients status and physical growth of children 12 - 23 months old

1. Track trends in the prevalence of anemia in children 12 - 23 months old (annually).
2. Track trends in the prevalence of iron, vitamin”D”, and calcium deficiencies in children 12 - 23 months old.
3. Track trends in the prevalence of chronic malnutrition (stunting) in children 12 - 23 months old.
4. Track trends in the prevalence of acute malnutrition (wasting) in children 12 - 23 months old.
5. Track trends in the prevalence of overweight in children 12 - 23 months old.

Results of project implementation

The study in children (12-23 months of age) showed 35.6% prevalence of anemia in 303 children enrolling in study;

Anemia prevalence (percentage) in children by regions

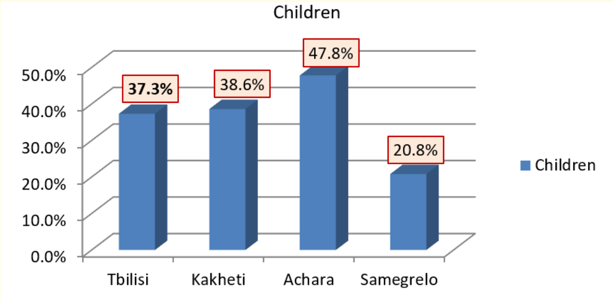

Figure 1

Severe anemia cases were not identified in toddlers.

In regards to regional profiles, we have detected that prevalence in toddlers in Samegrelo region (20.8%) anemia percentage is 1.5 - 2 times less than in other three regions, especially when comparing with Achara region (47.8%), which has the highest result compared to the other two regions (Kakheti with 38.6% and Tbilisi-37.3%). Total percentage for all four regions is 35.6% (Table 1, and 2).

Iron deficiency prevalence (percentage) in children by regions

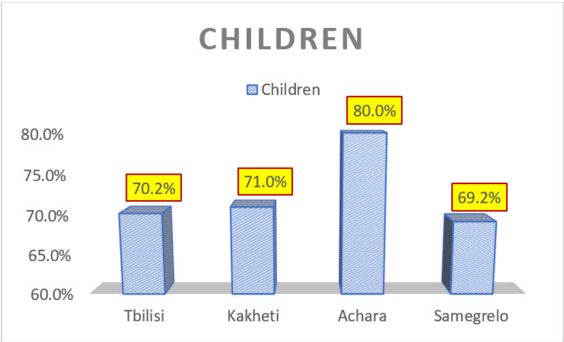

Figure 2

The study in children (12-23 months of age) showed 74% prevalence of iron deficiency in total (303 children with lab. testing on ferritin).

Vitamin "D" and Calcium deficiency prevalence (percentage) in children by regions.

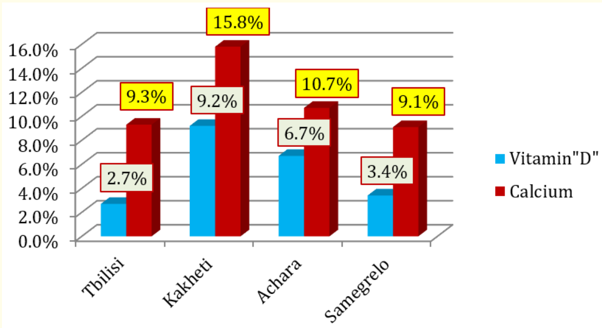

Figure 3

Results by Tables

1. Hemoglobin was defined in pregnant (1st trimester) visiting (1st visit) sentinel site for consultancy, and in children aged 12-23 months visiting sentinel site for immunization (Table 1, and 2).
2. Folate deficiencies (laboratory testing) were studded in pregnant (1st trimester) (Table 4).
3. NTDs prevalence monitoring is also involved in surveillance system (Table 5).
4. Iron, Ca and Vitamin "D" deficiencies (laboratory testing) were studded in children 12-23 months of age visiting sentinel site for immunization (Table 3,6,7). Also identifying of rickets signs and receiving of vitamin D were notified in children U2 (12-23 months of age) (Table 8 and 9).
5. Anthropometric measurement was used for children 12-23 months of age/data was extracted from sentinels' medical records (Table 10).
6. Detailed Stat. analyses (Table 11)

Years	12-23 moths age children	anemia Hb<110 g/L	Severe anemia Hb <70 g/L
2018	303	35.6%	0.0%

Table 1: Hemoglobin (anemia) - 2018.

Region	12-23 moths age children	anemia Hb<110 g/L
Tbilisi	75	37.3%
Kakheti	75	38.6%
Achara	76	47.8%
Samegrelo	77	20.8%
Total	303	35.6%

Table 2: Hemoglobin (anemia)- 2018, by Region Sentinels.

Region	2018	
	12-23 moths age children	Ferritin <12.0 μg/L
Tbilisi	75	70.2%
Kakheti	76	71.0%
Achara	75	80.0%
Samegrelo	77	69.2%
Total	303	74%

Table 3: /Children/ Ferritin (Iron Deficiency) 2018, by Region Sentinels.

Region	2018	
	pregnant (1st trimester)	(Folate deficiency) serum folate <3.0 ng/mL
Tbilisi	60	20.0%
Kakheti	60	26.7%
Achara	60	31.7%
Samegrelo	60	43.3 %
Total	240	30%

Table 4: Folate deficiency 2018, by Region Sentinels.

Sentinels	Live-births		Still-births		NTDs (Neural tube defects) (diagnosed by ultrasound)			Abortion		Continued pregnancy with NTDs	NTDs per 1000 live-birth
	total	With NTDs	total	With NTDs	Total	Spina Bifida	Anencephaly	Total	With NTDs		
Tbilisi	2233	2	4	0	10	8	2	677	6	2	
Kakheti	230	0	1	0	2	1	1	95	2	0	
Achara	226	0	1	0	5	3	2	354	5	0	
Samegrelo	173	0	1	0	1	0	1	21	1	0	
Total	2862	2	7	0	18	12	6	1147	14	2	6.28

Table 5: NTDs prevalence 2018 (total-6 months)/data is obtained only from sentinels.

Region	# of children	Deficiency	Inadequacy	Sufficient	More than sufficient
		25(OH) D < 12 ng/ml	25(OH) D 12 - 20 ng/mL	25(OH) D 20-30 ng/mL	25(OH) D 30+ ng/mL
Tbilisi	75	2.7%	6.7%	32.0%	58.6%
Kakheti	76	9.2%	26.3%	22.4%	42.1%
Achara	75	6.7%	17.3%	25.3%	50.7%
Samegrelo	77	3.9%	13.0%	26.0%	57.1%
Total	303	4.4%	15.3%	26.7%	53.6%

Table 6: Vitamin "D" - 2018/ 12-23 months age children/ total - 303 children/ by Region Sentinels.

Region	2018	
	# 12-23 months age children	Calcium < 2.20 mmol/L
Tbilisi	75	9.3%
Kakheti	76	15.8%
Achara	75	10.7%
Samegrelo	77	9.1%
Total	303	10.2%

Table 7: Ca - 2018/ 12-23 months age children/ total -303 children/ by Region Sentinels.

	With rickets signs	Without rickets signs	Total
# Children	125	224	349
%	35.8%	64.2%	100%

Table 8: Rickets in Children (12-23 months).

	Received	Not received	Total
# Children	305	44	349
%	87.4%	12.6%	100%

Table 9: Receiving of vitamin "D" before visiting Sentinel / Children (12-23).

#	Target group	Percentage of children with**					
	# Children (12-23 months)	Stunting Height-for-age	Wasting Weight-for-height		Underweight Weight-for-age		Overweight Weight-for-height
		< -2 Z-scores*	< -3 Z-scores	< -2 Z-scores*	< -3 Z-scores	< -2 Z-scores*	> +2 Z-scores
1	349	14.2	0.9	1.5	0.1	1.7	23

Table 10

* Category <-2 Z-scores includes <-3 Z-scores.

Children						
Descriptive						
		Hb	Fe	Vit D	Ca
Mean		113.70	11.7227	34.5013	2.3165
95% Confidence Interval for Mean	Lower Bound	112.67	10.8682	32.5810	2.3049
	Upper Bound	114.73	12.5771	36.4216	2.3281
5% Trimmed Mean		113.72	10.8607	33.3815	2.3212
Median		114.00	9.5200	31.5000	2.3200
Std. Deviation		9.150	7.55794	16.98642	.10261
Minimum		87	3.74	5.17	1.75
Maximum		144	45.00	92.00	2.61
Range		57	41.26	86.83	.86
Interquartile Range		12	7.29	19.80	.12
Children					

Percentiles								
Hemoglobin		Percentiles						
		5	10	25	50	75	90	95
Weighted Average(Definition)	Hb	99.20	103.00	108.00	114.00	120.00	124.00	129.80
Tukey's Hinges	Hb			108.00	114.00	120.00		
Children								
Percentiles								
Ferritin		Percentiles						
		5	10	25	50	75	90	95
Weighted Average(Definition)	Fer	4.4220	5.1620	6.7100	9.5200	14.0000	21.9200	28.0800
Tukey's Hinges	Fer			6.7150	9.5200	13.7500		
Children								
Percentiles								
Ca		Percentiles						
		5	10	25	50	75	90	95
Weighted Average(Definition)	Ca	2.1700	2.2040	2.2700	2.3200	2.3900	2.4200	2.4480
Tukey's Hinges	Ca			2.2700	2.3200	2.3850		
Children								
Percentiles								
Vit "D"		Percentiles						
		5	10	25	50	75	90	95
Weighted Average(Definition)	D	12.7200	15.0400	23.2000	31.5000	43.0000	59.4400	67.7800
Tukey's Hinges	D			23.3500	31.5000	42.5000		

Table 11: Stat. Analyses.

Anthropometric measurements/Prevalence of other forms of malnutrition (2017-2018)

Table (349 children's extracted data).

Discussion

According to WHO/CDC guidelines (ref), the prevalence of anemia in children population is classified as a ''moderate'' public health threat (by the public health significance of deficiency). In terms of the folate deficiency, prevalence is high in pregnant women (30%).

Due to the project design, we could not define clearly the real reasons of deficiency which require further investigation to determine proper intervention strategy.

Due to similar studies in similar context, we can assume that above mentioned deficiencies are caused due to possible reasons: a) Poor nutrition of Georgian population. b) Georgian foods do not contain sufficient amount of micronutrients. c) ''Formula'' for toddlers' nutrition does not contain the needed micronutrients that should meet physiological requirements of children after breastfeeding.

Conclusion

Georgia does have problems with iron deficiency in children and folate deficiency in pregnant women, and problems with NTDs prevalence, which means that additional nutritional intervention is necessary to combat the deficiency.

Limitations

This study has one main limitation: We defined the prevalence of micronutrients Deficiency, but could not investigate the reasons of the deficiency because, the study project did not include personal interviews on dietary habits.

Recommendations

- Need to advocate for nutrition interventions regarding food fortification (with iron and folic acid) strategy.
- Should implement one additional project for studying the dietary habits of population using standard questionnaires.
- Promote the main principle of healthy eating.
- In toddlers, special nutrition powder can be used to supplement feeding menus.

Acknowledgements

This research study was funded by the United States Centers for Disease Control and Prevention (Strengthening micronutrients deficiency surveillance in Georgia- grant # 5U2GGH001658). The research team/NCDC acknowledges with gratitude the commitment of the Centers for Disease Control and Prevention to the research efforts.

Staff of sentinel sites (Health Facilities) and Laboratories involved in the project.

Thank to Dorothy L. Southern for providing scientific writing advice and critically reviewing the manuscript.

Bibliography

1. Pena-Rosas JP., *et al*. "Monitoring and Evaluation in Flour Fortification Programs: Considerations for the Design and Implementation of Feasible and Effective Systems". *Nutrition Reviews* 66 (2008): 148-162.

2. Brian McCarthy. "Former Director of the WHO Collaborating Center". Division of Reproductive Health, CDC. Personal communication.

Volume 3 Issue 5 May 2019