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REPORT

on sentinel assessment conducted in Akhal, Balkan and Mary velayats (provinces) and Ashgabat City within the framework of the Iodine Deficiency Elimination program through Universal Salt Iodization in Turkmenistan

Ashgabat 2006

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ABSTRACT

Results of the survey conducted in selected sentinel sites in 3 provinces and capital city of Turkmenistan confirm adequate and sustained level of iodine nutrition and elimination of iodine deficiency in this county. Almost 100% of all salt on household level is iodized. Results of urinary iodine assessment (both by laboratory of the Research and Clinical Center for Mother and Child Health Protection and reference laboratory in Russia) show adequate level of iodine supply to population. After almost 8 years of universal salt iodization, this prevention program led to virtual elimination of iodine deficiency disorders. Results of ultrasonography evaluation of thyroid glands in schoolchildren and pregnant women showed only sporadic (2.4%) prevalence of thyroid enlargement (goiter). This is direct evidence that endemic goiter in Turkmenistan has been virtually eliminated. Assessment of sentinel sites piloted in this survey showed reliability and validity of such approach. In future, it is recommended to conduct similar assessment of urinary iodine and iodine in salt at the same sites on the annual basis.
Urgent measures should be taken to improve quality of iodine assessment in the laboratory of the Research and Clinical Center for Mother and Child Health Protection. For this, senior laboratory analyst should attend training on urinary iodine determination in Tashkent in April, 2007 and, if needed, also get additional training in reference iodine laboratories in Almaty or in Moscow. Turkmenistan laboratory should also join EQUIP program provided by CDC to check quality of UI assessment on a regular basis. To improve quality of iodine assays in salt by laboratories of the Sanitary Epidemiological Inspections, external quality control study should be conducted with support of qualified laboratory in some neighboring country. UNICEF Office could provide necessary assistance to such external control. After introduction of measures for the improvement of laboratory methods of iodine testing in salt and urine, new round of sentinel studies should be conducted in the second part of 2007 to get updated results on level of iodine nutrition in Turkmenistan.

This report has been prepared by the staff of Research and Clinical Center for Mother's and Child's Health (MCH Center) named after Gurbansolan-edghe (Director – Ch. Nazarov) and State Sanitary Epidemiological Inspection of the Ministry of Health (Head – A. Orazov) with support of UNICEF consultant – Prof. G. Gerasimov (Russia).

Financial and organizational support for this survey was provided by UNICEF Office in Turkmenistan.

1. INTRODUCTION

Iodine Deficiency Disorders (IDD) pose a serious threat to health and development of population in many countries of the world. Universal salt iodization (USI) is the most cost-effective, safe and reliable method of iodine prevention, meaning that more than 90% of population should use adequately iodized salt.

IDD elimination program in Turkmenistan started from the early 1990-s. First modern epidemiological assessment was conducted in 1994 and showed existence of iodine deficiency among the population. Goiter prevalence in Ashgabat was 20% and in Dashgowuz – 64%. Based on these results, president's decree on USI was adopted in Turkmenistan.

In January-March 2004 a national epidemiological representative 30 cluster, school-based survey of 879 schoolchildren aged 8-10 was carried out covering all administrative districts of the country (velajat). The survey was performed based on UNICEF. WHO, ICCIDD guidelines: "Assessment of iodine deficiency disorders and monitoring their elimination" (2001). Results of this survey confirmed adequate level of iodine nutrition of Turkmenistan population on the entire territory of the country. This was achieved by universal availability of quality iodized salt that was found in 100% of the surveyed households. Median urinary iodine level (170 mcg/l) for the national sample was in the safe range (100-300 mcg/l) recommended by WHO, UNICEF and ICCIDD, and proportion of samples with iodine levels below 100 and 50 mcg/l were significantly below recommended thresholds. Based on results of this survey in 2004 Turkmenistan was proclaimed by UNICEF, WHO and ICCIDD as the country that eliminated iodine deficiency.

However, the 2004 survey did not include assessment of most common clinical feature of iodine deficiency – prevalence of goiter among schoolchildren and pregnant women. Goiter prevalence reflects not only level of iodine nutrition but overall efficiency of IDD elimination program. In situation of adequate iodine nutrition goiter prevalence in children should be below 5%. At the same time, decrease of goiter prevalence in the course of IDD elimination program is rather slow process and goiter prevalence could be still elevated even in situation of normal iodine supply.

Thus, the objective of 2006 assessment was to provide data in support of IDD elimination in Turkmenistan as results of effective USI program in place for more than 7 years. Another objective was to pilot more effective and less costly sentinel method for site selection for monitoring of IDD control program through USI.

2. MATERIAL AND METHODS

The Sentinel Study was conducted by research team of Research and Clinical Center for Mother and Child Health Protection (RCC MCHP) with UNICEF support in Akhal, Balkan, Mary velayats and Ashgabat City in September 2006. Sites for the assessment were randomly selected among clusters (schoola) pre-selected for 2004 survey. School children aged 8-10 years and pregnant women (living in the same towns or villages as schoolchildren) were assessed in local health centers.

Totally 253 persons were surveyed: 126 schoolchildren and 117 pregnant women, residing both in urban and rural settings (Table 1).

Table 1. Number of surveyed schoolchildren and pregnant women in velayats and Ashgabat City

#	Velayat	Number of the assessed persons (number of collected urine samples)	
		Number of school children	Number of pregnant women
1	**Akhal**	33 (30)	41 (34)
2	**Balkan**	30 (32)	27 (26)
3	**Mary**	32 (29)	32 (30)
4	**Ashgabat City**	31 (30)	27 (27)
5	**Total**	**126 (121)**	**127 (117)**

Goiter prevalence was assessed by thyroid ulstrasonography (US) using portable US scanner Philips SDR 1200 with 5.0 mHz transducer. Thyroid volume was calculated by Brunn et al. (1993) formula. Reference thyroid volumes (P97) recommended by F.Delange et al (1997) were used for calculation of goiter rate. For adult pregnant women 18 ml was used as a cut-off for normal thyroid volume. All thyroid studies were conducted by UNICEF consultant, Prof. G.Gerasimov (Russia).

Iodine was assayed in spot urine samples using method described by J.Dunn et al. (1993) after wet digestion with ammonium persulfate. Spectrophotometric manual method had the following analytical parameters: – threshold of sensitivity - 5 mcg/l, accuracy – coefficient of variation, CV – 13.6%, analytical recovery – 80 – 104%. For the purpose of internal quality control pooled urine sample with mean concentration 148 mcg/l was used for each batch of analytical analysis. Salt samples were tested directly in field for iodine content using spot express kits. All salt samples were subsequently assayed for iodine quantity by titration in the laboratory of Sanitary Epidemiological Inspection. Data on amount of laboratory tests are presented in Table 2.

Table 2. Amount of Laboratory Tests

Velayat	Number of urine samples tested for iodine content	Number of salt samples tested by rapid test and titration
Akhal	64	74
Balkan	58	58
Mary	59	58
Ashgabat City	57	57
Total	238	247

For external quality control of urinary iodine (UI) assays 30% of urinary samples were also tested for UI content in the reference laboratory based in the Endocrinology Research Center (Moscow, Russia). This laboratory stands among most qualified reference laboratories within the Network of Reference Urinary Iodine Laboratories that is supervised by Centers for Disease Control and Prevention (CDC, Atlanta, USA).

Results of external evaluation showed that the Turkmenistan lab has a very high bias with little to no correlation to the Moscow laboratory results. This reflects rather low quality of UI assays. More detailed opinion of CDC experts is presented in Annex 2.

3. RESULTS AND THEIR DISCUSSION

The following indicators were used for the assessment of efficiency of IDD prevention program and iodine nutrition in Turkmenistan:

- Content of iodine in salt (qualitative and quantitative methods)
- Content of iodine in spot urine samples (schoolchildren and pregnant women)
- Goiter prevalence in schoolchildren and pregnant women by ulatrasonography method

Salt Iodization

Totally 247 salt samples were collected during the survey and tested for iodine (by qualitative rapid test) directly in the field and by laboratory of Sanitary Epidemiological Inspections (SEI) of the Ministry of Health (quantitative method). Official results of this testing are presented in Table 3.

Table 3. Official data on iodine content in salt from households in Turkmenistan

Velajats	Number of salt samples tested by rapid field tests	Among them positive	Number of salt samples tested by titration	Among them conform to requirements of GOST 630-2003
Ashgabat city	57	57	57	57
Akhal	74	74	74	74
Balkan	58	58	58	58
Mary	58	58	58	58
Total	247	247	247	247

Thus, based on the official data, all samples were adequately iodized, i.e. conformed to requirement of national standard for salt (GOST 630-2003). However, by observation of UNICEF consultant G.Gerasimov, several samples of salt collected in Akhal velajat did not contain iodine. This observation is not reflected in the official report. It is also reasonably doubtful that 100% samples of salt from households had iodine within the margin if 25 to 55 mg/kg. Most likely, there is a need to conduct external control of quality of iodine determination in salt in SEI laboratories.

Urinary Iodine Levels

Results of the assessment proved adequate and sustainable level of iodine nutrition of Turkmenistan population. Median UI level for the whole assessed group of schoolchildren and pregnant women was 188 mcg/l; only 16% of samples had UI below 100 mcg/l and only 4% - below 50 mcg/l (Table 4, Fig. 1).

Table 4. Urinary iodine content in school children and pregnant women in Akhal, Balkan, Mary velayats, Ashgabat City and on the national level.

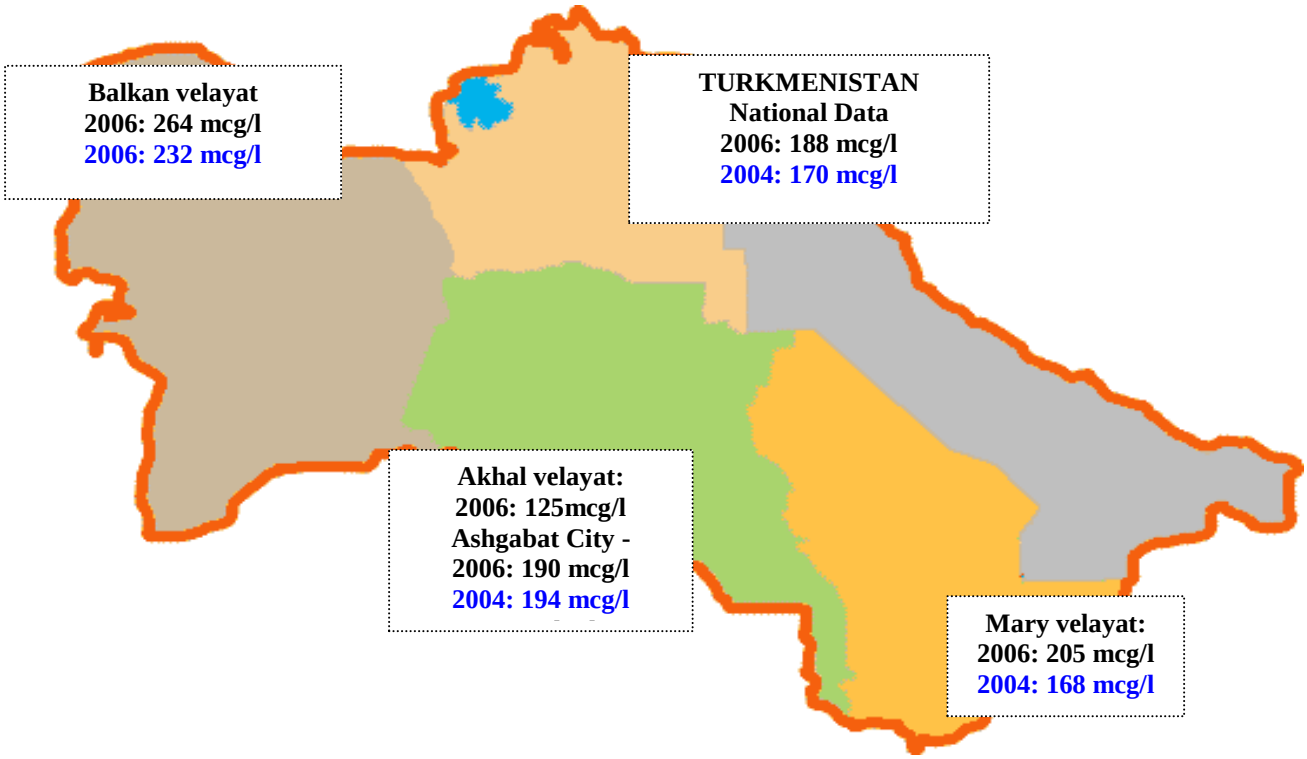
Velayat	Number of urine samples tested for iodine content	Median of urinary iodine level	Minimum value of iodine content	Maximum value of iodine content
Akhal	64	**125**	5	329
Balkan	58	**264**	52	500
Mary	59	**205**	32	510
Ashgabat City	57	**190**	42	377
Total	**238**	**188**	**5**	**510**

Median UI level within the range of 100-300 mcg/l is considered to be the most optimal from the point of view of adequate iodine nutrition. Median UI for the whole population is 188 mcg/l. This indicates that the rate of iodine provision with nutrition is adequate in Turkmenistan.

Table 5. Frequency Distribution of Iodine Concentration in Urine

Velayat	Iodine concentration in urine (mcg/l)									
	< 20		**20 –49,9**		**50 – 99,9**		**100 - 299**		**> 300**	
	n	%	n	%	n	%	n	%	N	%
Akhal	5	8	7	11	14	22	36	56	2	3
Balkan	-	-	-	-	3	5	30	53	24	42
Mary	-	-	1	2	5	8	44	75	9	15
Ashgabat City	-	-	1	2	6	10	42	74	8	14
Total	5	2	9	4	28	12	152	64	43	18

Figure 1. Median UI levels in Turkmenistan (by velajats): 2006 and 2004 data.



As it was mentioned before, quality of UI assays in the laboratory of the Research and Clinical Center for Mother and Child Health Protection (RCC MCHP) remained at rather low level and needs urgent improvement. However, this does not put in question the fact that level of iodine nutrition of Turkmenistan population is on adequate level. This was confirmed by results of UI assay by independent reference laboratory in Russia.

Totally 70 urine samples were tested by the same method in reference laboratory in Russia: 20 from Mary, 20 from Balkan, 10 from Akhal and 20 from Ashgabat city. Median urinary iodine level for the whole Turkmenistan was **139.1 mcg/l**. Only 1% of samples had UI level below 20 mcg/l, 6% - from 20 to 49 mcg/l, 27% - from 50 to 99 mcg/l, and 66% of samples were above 100 mcg/l.

Based on results of reference lab assessment, UI levels were adequate in all velajats – 138.5 mcg/l in Balkan, 139 mcg/l in Mary and 148.5 mcg/l in Ashgabat (data was insufficient for calculation of median for Akhal velajat). In general, results of UI testing in the reference lab were 25% lower that in RCC MCHP lab. However, results from both labs confirm adequate level of iodine nutrition in Turkmenistan.

Goiter prevalence in schoolchildren and pregnant women

Goiter is the most typical clinical feature of iodine deficiency. Goiter may be visible (larger size) or palpable. However, most reliable method for goiter detection is ultrasonography evaluation of the thyroid gland: three dimension of each lobe of the gland are measured and thyroid volume is calculated. Reference data from iodine sufficient countries are used as cut off limits for detection of thyroid enlargement in children. For pregnant women > 18 year old 18 ml was used as upper limit of normal thyroid volume.

Table 6. Goiter prevalence in school children and pregnant women in Turkmenistan

Velajats	Number of surveyed pregnant women **(with thyroid enlargement)**	Number of surveyed school children **(with thyroid enlargement)**
Akhal	41 **(3)**	33
Balkan	27	30 **(2)**
Mary	32	32
Ashgabat city	27	31 **(1)**
Total	127 **(3)**	126 **(3)**

These new data (Table 6) confirm that goiter in Turkmenistan exists only at sporadic level (2.4%) both in school children and pregnant women. Sporadic goiter, versus to endemic, is not related to iodine deficiency.

It should be mentioned, that goiter prevalence in 1994 (assessed by the same person using the same ultrasonography scanner) was 20% in Ashgabat and 64% in Tashauz. While these prevalence figures were calculated using another reference levels for thyroid volume in children, it is quite clear that after more than 7 years of constant iodine prevention **endemic goiter in Turkmenistan has been eliminated**.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Results of this survey confirm adequate and sustained level of iodine nutrition and elimination of iodine deficiency in Turkmenistan. Almost 100% of all salt on household level is iodized. Results of urinary iodine assessment (both by laboratory of the Research and Clinical Center for Mother and Child Health Protection and reference laboratory in Russia) show adequate level of iodine supply to population.
4.2. As a long term result (after almost 8 years of universal salt iodization) this prevention program led to virtual elimination of iodine deficiency disorders. Results of ultrasonography evaluation of thyroid glands showed only sporadic (2.4%) prevalence of thyroid enlargement (goiter). This is direct evidence that endemic goiter in Turkmenistan has been eliminated.
4.3. Assessment of sentinel sites piloted in this survey showed its reliability and validity. In future, it is recommended to conduct similar assessment of urinary iodine and iodine in salt at the same sites on the annual basis. Assessment of sentinel sites is easier and cheaper than the full-scale 30 cluster surveys but yield quite reliable results. Such assessment could be conducted on more frequent basis.
4.4. Urgent measures should be taken to improve quality of iodine assessment in the laboratory of the Research and Clinical Center for Mother and Child Health Protection. For this, senior laboratory analyst should attend training on urinary iodine determination in Tashkent in April, 2007 and, if needed, also should be trained in reference iodine laboratories in Almaty or in Moscow. Turkmenistan laboratory should also join EQUIP program provided by CDC to check quality of UI assessment on a regular basis.
4.5. To improve quality of iodine assays in salt by laboratories of Sanitary Epidemiological Inspections, external quality control of salt should be conducted with support of qualified laboratory in the neighboring country. UNICEF Office could provide necessary assistance to organize such external control.
4.6. After introduction of measures for the improvement of laboratory methods of iodine testing in salt and urine, new round of sentinel studies should be conducted in the second part of 2007 to get updated results on level of iodine nutrition in Turkmenistan.

4.7. Combined data of recent assessment in relation to reference levels are presented in Table 7.

Table 7. Combined results of 2006 sentinel IDD assessment in Turkmenistan in relation to reference indicators of IDD control and elimination.

Indicator	Goal	Final results	
		RCC MCHP	Reference Laboratory
Iodine levels in urine:			
• Median (mcg/l)	100-300	188	139.1
• Proportion of samples with UI levels below 100 mcg/l	< 50 %	16 %	34%
• Proportion of samples with UI levels below 50 mcg/l	< 20 %	4 %	7%
Goiter prevalence in schoolchildren	<5%	2.4%	
Salt iodization:			
• proportion of households consuming quality iodized salt	> 90 %	100 %	

Annex 1

RECOMMENDED REGISTRATION FORM FOR CLUSTER SURVEY

Velayat and etrap _____
Population point _____
School Number_____ Cluster Code (number) _____
Total number of surveyed children _____

#	Child's First Name and Family Name	Age (years)	sex: 1- male 2- female	Salt*: 1 - iodine 2 - no	Iodine content in urine	Other
1.						
2.						
3.						
4.						
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Annex 2

Message from CDC Reference laboratory

The data looks like the Turkmenistan lab has a very high bias with little to no correlation to the Moscow laboratory results. Briefly we looked at the four datasets independently. The Balkan Velajat data has an intercept of 56 ug/L with outliers at both the low and high end of the dataset-and only one point negatively biased. If you look at the associated difference plot you have outliers as much as 153 ug/L greater than the Moscow results. 1/5th of the data shows differences of greater than 100 ug/L, this is really unacceptable in our opinion. The Ashgabat data looks dismal; with a correlation coefficient of 0.17-there is basically no correlation. The only real notable trend is a relatively consistent high bias with the Turkmenistan lab and notable also is that the range of the differences spans almost 300 ug/L and above about 180 ug/L the trend seems to go negative. The Mary Velajat data continues with the extremely high bias in the Turkmenistan lab data. The regression intercept is 144 ug/L! That really sums up this labs performance, but further analysis shows a mean bias of over100 ug/L. Again, all of the data is positively biased with the exception of one point. The upper end of the bias exceeds 300 ug/L-again unacceptable in our opinion. The Akhal data still shows a consistent positive bias but not as pronounced. The difference plot shows a mean difference of about 16 ug/L this is better, and only you can decide the error or bias you are willing to accept. The positive bias in this data spans the entire range of the data strangely enough seemingly worse in the mid range of the data set with less difference at the high and low ends of the data.

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January 30, 2007