

## ABSTRACT

Iodine Deficiency Disorders (IDD) have been a major public health problem in Pakistan as reported by around 36 studies of different scale since 1994 and some of those reporting  $\geq 70\%$  of goiter/iodine deficiency prevalence. Statistics show that approximately 1.7 million newborns are at risk of mental impairment due to the poor iodine status of their pregnant mothers. Universal salt iodization (USI) is the solution recommended by WHO to address IDD. Pakistan had some of the lowest rates of consumption of iodized salt, estimated at just 17% in 2001. A national IDD Control Program was initially launched by the government in 1994, however, the program was unable to achieve a significant increase in salt iodization levels. USI program was revitalized in 2005 in Pakistan by Nutrition International (NI) to improve results with the funding from Canadian Government in coordination with other key stakeholders. The USI program is implemented in 110 out of 146 districts of Pakistan covering a population of 174 million. Independent assessments were conducted to assess the progress and status of adequately iodized salt production and household consumption. This article aims to describe Public Health Impact of the USI program in Pakistan during 2005 through 2013. Study involved retrospective review of key documents and the data which includes USI program reports, evaluation reports, and national nutrition survey report.

The evaluation of household consumption of adequately iodized salt in 2008-09 in a selected province revealed an increase to 54% compared to 25% in 2001-2. Another assessment in 2010-11 revealed that 99% of salt produced is being iodized to some degree showing salt industry's motivation towards salt iodization. The National Nutrition Survey of 2011 showed an increase in household utilization of iodized salt from 17% to 69% resulting in decrease in severe iodine deficiency among mothers from 37% to 3% and among school children from 23% to 2%. The increase in iodized salt consumption from 2006 to 2013 has protected 13 million newborns from IDD and may have averted 250,000 severe mental impairments.

Strong government ownership and commitment, coupled with effective monitoring and supervision, have been key success factors. Ongoing quality control measures, stringent regulatory and enforcement mechanisms, availability of fortificants in the open market and demand generation are the necessary requirements for the program's sustainability.

## Introduction:

Iodine-deficiency disorders (IDD) have multiple adverse effects on growth and development in humans. IDD include goiter, endemic cretinism, deaf-mutism, stillbirth, congenital anomalies, perinatal and infant mortality. Such disorders can be prevented at low cost intervention like iodized salt. It is a universal foodstuff, intake is seasonally consistent, costs are relatively small, and it is easily distributed (M.B., 2012)<sup>1</sup>.

IDD have been a major public health problem in Pakistan as reported by around 36 studies of different scale since 1994 and some of those reporting  $\geq 70\%$ , of goiter/iodine deficiency prevalence (Khatak, R.M. et. al (2007). WHO recommended Salt iodization as a preferred strategy to control iodine

deficiency disorders and this strategy is implemented across more than 120 countries (WHO, 2014)<sup>2</sup>. Iodized salt consumption in Pakistan came out to be at one of the lowest rates in the world, estimated at just 17% in 2001 (Pakistan National Nutrition Survey, 2001). Solution to this problem was sought when government initiated a national IDD Control Program, however, the program was unable to achieve a significant increase in salt iodization levels. In 2005, Nutrition International (NI) and Government of Pakistan have taken a step forward with to improve the situation with support from Canadian Government and World Food Program (WFP) in coordination with other key stakeholders.

The following USI program's components made the program successful in Pakistan:

- 1) Technical and operational support to salt processors  
It includes modification/ addition of equipment for large and medium scale salt processors for uniform mixing of potassium iodate, quality assurance, training of SPs, supportive supervision and monitoring of the iodization process;
- 2) Support to the government for program monitoring and quality control that includes: support in monitoring and supervision by MI field staff; training and capacity building of staff from provincial and district Departments of Health; establishment and strengthening of the Quality Control Lab (QCL) at district and sub-district levels; regular monitoring of laboratories through the MI Field Officers, for laboratory quality assurance; program review and planning meetings; training sessions for Sanitary Inspectors to support the quality control component.
- 3) Advocacy meetings with government departments and stakeholders for promulgation of provincial legislation on mandatory edible salt iodization; and Quarterly Provincial IDD Control Committee Meetings for advocacy and positioning of MI at the provincial level.
- 4) Supporting the operationalization of a revolving fund established for supply of potassium iodate to salt processors on cost to cost basis, ensuring uninterrupted supply.
- 5) Supporting the uninterrupted supply of iodization equipments (drip feeds & drip sets) to salt processors on cost to cost basis through revolving fund established for supply of potassium iodate.

The USI program is implemented in 110 out of 146 districts of Pakistan covering a population of 174 million. Conduction of independent assessments played a vital role in assessing the progress and status of adequately iodized salt production and household consumption.

The study aims to describe Public Health Impact of the USI program in Pakistan during 2005 - 2013. Results of National Nutrition Survey 2001 and 2011 results are also presented in this paper in order to assess urinary iodine concentrations (UIC) among mothers and schools children. Status of iodized salt production is inferred from third party evaluation and reports of Global Affairs Canada.

### **Methodology:**

Literature review of key documents, for instance, articles and national nutrition survey reports conducted in 2001 and 2011 respectively, is done to analyze the situation completely. Urinary Iodine Excretion among children 6-12 years and mothers along with the coverage of households reflect the impact of USI program in Pakistan.

### **Results:**

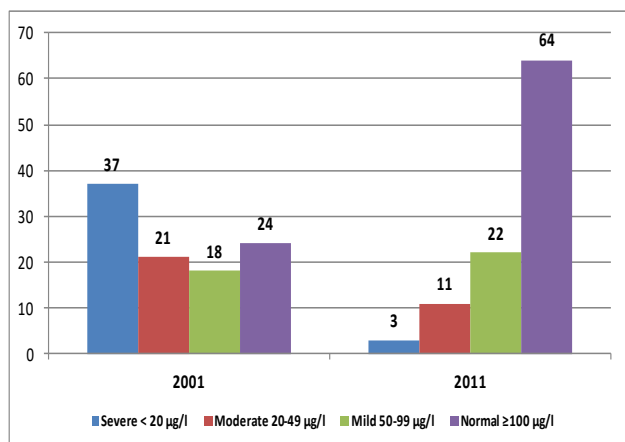
#### **Goiter prevalence**

Prevalence of visible goiter among mothers decreased from 12.2 percent in 2001-02 to 3 percent in 2011. The national nutrition survey 2001-02 survey showed the prevalence of visible goiter was high among young mothers aged below 20 years

#### **Urinary iodine concentration**

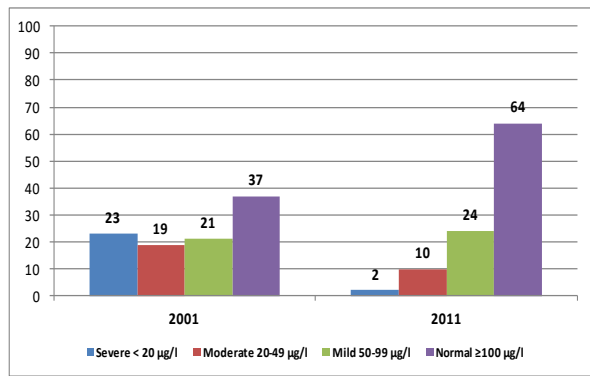
The National Nutrition Survey of Pakistan (2011) highlighted the USI program impact with considerable improvements in iodine deficiency rates among mothers and children of Pakistan. The results of the survey, based on urinary iodine excretion, revealed reduction in iodine deficiency among women from 76.3 percent in 2001-02 to 35.9 percent while severe iodine deficiency reduced from 36.7 percent to 3.1 percent during the same period as reflected in figure 1.

**Figure 1:- Comparison of Urinary Iodine Excretion among Mothers between NNS 2001 and 2011**



Reduction in iodine deficiency among school aged children (SAC) went from 63.7 percent (NNS-2001-02) to 37.1 percent while reduction in severe iodine deficiency for this same group went from 23.4 percent to only 2.1 percent during the same period (fig-4).

**Figure: Comparison of Urinary Iodine Excretion among School aged Children between NNS 2001 and 2011**



### Availability of iodized salt

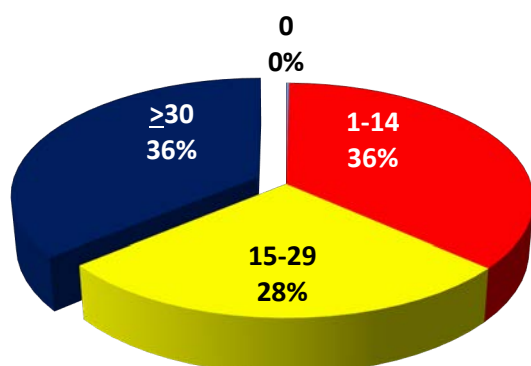
According to the national nutrition survey 2001, the consumption of iodized salt at household level was 17% despite the fact that the 56.4% respondents were aware of the benefits of iodized salt. The survey also highlighted that the use of adequately iodized salt at household level increased from 17 percent (NNS-2001-02) to 69 percent in 2011. The change came due to the rigorous monitoring of the government officials; uninterrupted supply of potassium iodate;

regular technical assistance to the Salt Processors.

The first third party evaluation of household utilization of adequately iodized salt was done during 2008-09 at the end of the phase 1 of USI program. The evaluation revealed that household consumption of adequately iodized salt had increased from a baseline of 25 percent for the region (NNS 2001-2) to 54 percent at the end of year 2008 (WFP evaluation report 2008). This evaluation was carried out only in the areas of Khyber Pakhtunkhwa, Azad Jammu & Kashmir and Gilgit Baltistan.

Another third party assessment of iodized salt production in Pakistan were conducted by RADS in 2010 revealed that 99% of salt produced was being iodized to some degree showing salt industry's motivation towards salt iodization. The study reflected there were more than 1172 salt processors in the country with varying salt processing capacity. The Punjab province has the largest number of salt processors i.e. 64 percent, Pakhtunkhwa 19 percent, Sindh 11 percent, FATA 3 percent, Balochistan 2 percent and AJK 1 percent of the total units. The country's production was estimated at 1.33 million tonnes, of which 953,917 tones (72%) was being used for human consumption. The remaining 28 percent is either used for industries or for livestock. A total of 185,390 tonnes of salt is iodized in the country which is 14 percent of the total salt and 20 percent of the edible salt processed in the country. The proportion of iodized salt varied among the provinces and regions in the country. The following figure shows iodine content of salt by level at salt processors level.

### **Iodine content of salt by Levels in ppm at Salt Processors level**



GAC 2015 reports reflects that 261,401 MT of additional adequately iodized salt ( $\geq 30$  ppm) produced by salt processors with support from NI. During the reporting period, 484,076 MT of edible salt was produced by MI-supported processors, of which 69% was adequately iodized ( $\geq 30$  ppm) against a plan of 65% and up from the baseline of 15%. This is a significant improvement compared to 2014 where only 61% of the salt was adequately iodized. 65 M people reached at a cost of \$0.01 per beneficiary. 1.3 M newborns protected from iodine deficiency disorders by improving the iodine status of mother.

### Discussions:

Iodine deficiency is the most common preventable cause of brain damage with more than 2 billion people from 130 countries at risk (Hetzel, 2012). USI program is being implemented in Pakistan since 2015 and have impressive results.

In NNS 2001-2, revealed 17 % hhs were using iodized salt which was improved upto 69%. RADS evaluation report also reflected 90% salt iodization happening at salt processor levels where GAC report 2015 shows 69% salt was adequately iodized at Salt Processors level. These studies reflect impressive improvements in terms of salt iodization.

Since Urinary iodine is a well-accepted, cost-efficient and easily obtainable indicator for iodine status that tells us the population vulnerable to iodine deficiency (WHO, 2008). While comparing the results of 2001 and 2011, we found significant improvement in terms of Urinary Iodine Excretion among mothers and school age children between 6-12 years of age.

The median urinary excretion of mothers indicates adequate iodine status at national level (105  $\mu\text{g/l}$ ). In 2001, median urinary excretion of mothers was 62.8  $\mu\text{g/l}$ .

The data also revealed that median urinary iodine excretion in children 6-12 years is 126  $\mu\text{g/l}$  which is quite encouraging which was 88.86  $\mu\text{g/l}$  in 2001.

Urinary iodine excretion improved among mother and children as percentage of coverage of iodized salt increased from 17% to 69% at hh level. If we compare production data from 2005 to 2015 it will also tell us the significant improvement in iodized salt production at salt processors level, as a result coverage at hh level improved which is directly associated with the production. The prevailing situation can be improved further through legislation/food fortification act that will impose ban for using non iodized salt for human and animal consumption. Consequently median urinary excretion of mothers and children will be improved further.

### Conclusion:

Pakistan moved from a situation where 17% hhs were covered with iodized salt to 69% after the successful implementation of USI program. Now most of the population is using iodized salt. Goiter prevalence reduced and iodine deficiency among school aged children and women were also reduced significantly.

In Pakistan, a number of factors have contributed in achieving significant strides towards USI and controlling IDD. First and the foremost is the strong ownership by the Government. This ownership was there at all levels, starting from federal to the provincial and district level. Similarly there was strong monitoring and supervision by the Department of Health (DoH) where focal persons have been deputed for USI at national, provincial and district levels which had a great impact on overall iodization. The phased expansion of the program with building on the lessons learnt and addressing shortcoming and bottlenecks revealed in the earlier phase was a sound strategy contributing to momentum of the program.

The focus on quality control and enforcement of standards required for adequate iodization contributed immensely to the improvement in salt iodization levels. The establishment and strengthening of quality control labs at the district level for analysis of iodine in edible salt samples played an important role in strengthening monitoring and enforcement.

In addition, regular reviews of the program have been another major development. These reviews are held at district level through District IDD Control Committee meetings; at provincial level through Provincial IDD Control Committee meetings and provincial IDD Control Program Reviews and at national level at USI partners meetings and USI Pakistan Program Reviews. These review meetings helped to revise the strategies adopted for program implementation and bridge the gaps where required.

Finally strong coordination and collaboration among the different partners and stakeholders involved has been a critical element of the USI program. Besides formulation of different committees and partner's forums at various levels helped in achieving the desired results. MI staff were stationed in the government departments at

provincial and zonal level to act as focal person.

### Key-words

Iodine deficiency disorders, goiter, urinary iodine, iodized salt

### Acknowledgments

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