Exploration of Using Salt as Vehicle for Iron and Other Nutrients

Jonathan Gorstein, Executive Director IGN

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Overview

- Building on success of salt iodization
- Rationale for salt as a vehicle for food fortification
- Importance of anemia
- Experience with double fortification
- Next steps – global technical consultation to develop clear program guidance

Building on the success of salt iodization programs

- Public-private partnership has led to exceptional global progress in salt iodization
- Access to iodized salt has increased from <20% in 1990 to 86 % of households in 2018.
- Large populations are no longer iodine deficient, though progress is still required to reach all segments of populations and sustain achievements

Salt as an effective vehicle for fortification

- Salt is a commonly consumed commodity worldwide
- It is consumed in relatively uniform amounts, about 10 grams/person/day
- Fortification of salt with iodine does not require sophisticated technology
- Salt industry structure conducive to fortification, although some challenges persist where there are many small-scale producers
- Salt iodization at scale has been achieved in many countries

Salt as an effective vehicle for fortification

- Based on success of salt iodization, there is interest to expand the scope of salt fortification to add other nutrients other than iodine
- Most work has been done with fortification of salt with both iodine and iron (referred to as double fortified salt; DFS).
- Sub-optimal iron intake is associated with a number of serious human diseases, including anaemia

Micronutrient Malnutrition Unit
Nutrition for Health and Development

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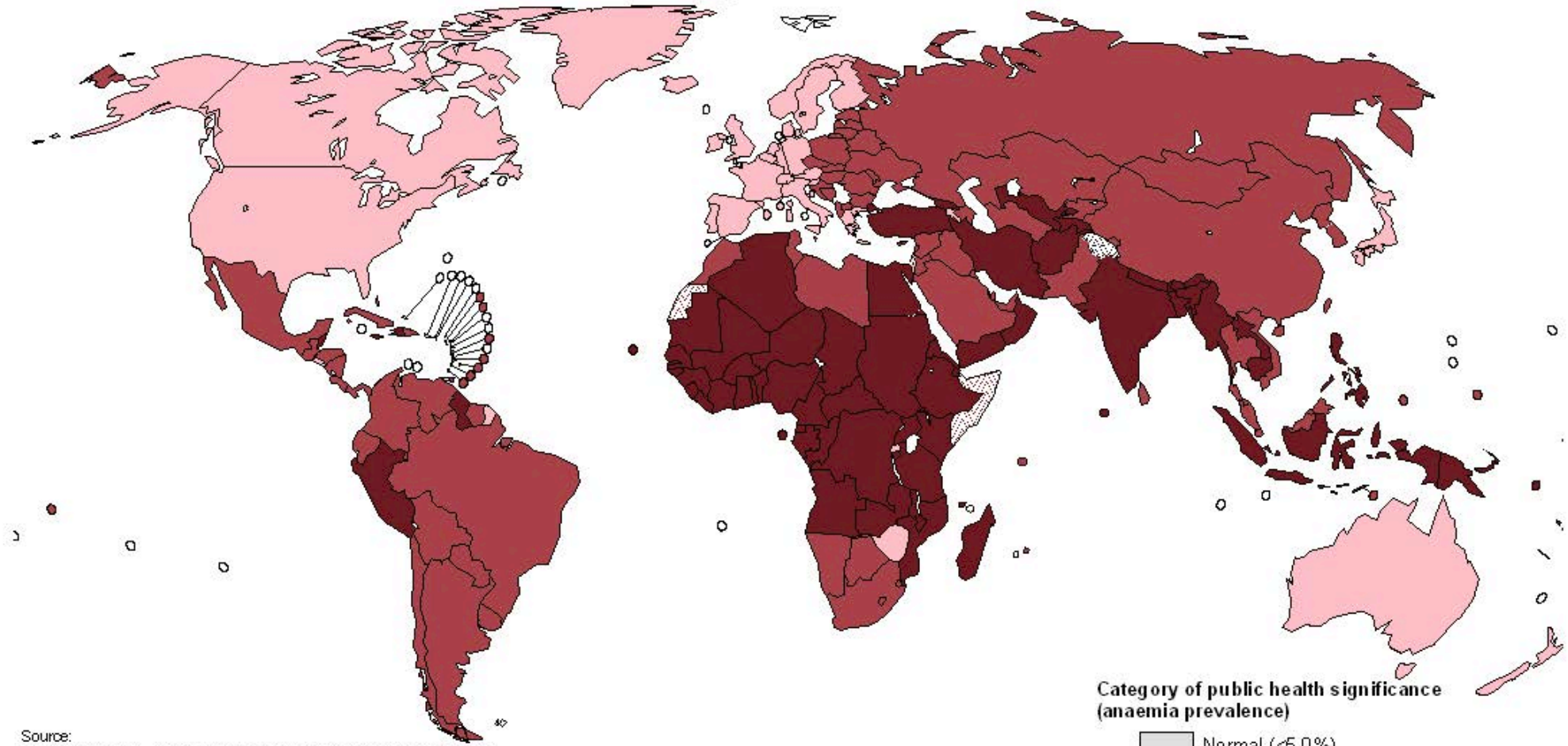
Anaemia as a public health problem by country:
Pregnant women



Source:
de Benoist B et al., eds. Worldwide prevalence of anaemia 1993-2005.
WHO Global Database on Anaemia. Geneva, World Health Organization, 2008

Anemia as a major public health problem

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Key consequences:

- Loss of energy
- Reduced work capacity
- Reduced disease resistance
- Increased maternal mortality
- Impaired individual mental development
- Reduced productivity and economic development at population level

How to prevent anemia?

- Anemia is caused by many factors, including a **lack of iron in the diet**
- Supplementation programs have had mixed results
- Providing additional iron through fortification has been recommended as a strategy to reach large segments of the population, as long as conditions are appropriate

Consideration of salt as a vehicle for delivery of iron

- Double fortified salt was first conceived of in 1969
- Many studies undertaken to assess potential impact
- Recent systematic review of DFS efficacy reported:
  - Increase Hb concentrations by 3.74 g/L
  - Reduced risk of anemia by 41%
  - Reduced risk of iron deficiency anemia by 63%

Consideration of salt as a vehicle for delivery of iron

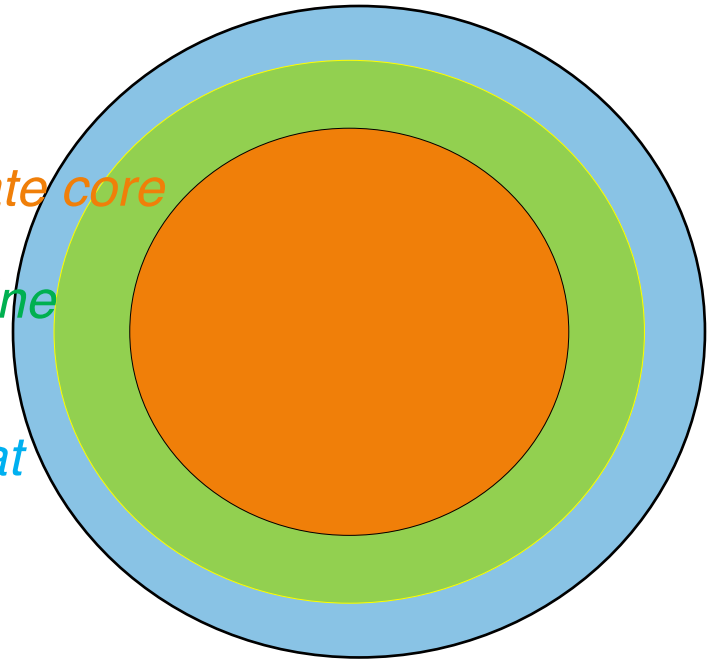
- Stable technology for DFS took decades to develop due to challenge of combining two nutrients
- Iron-iodine interactions may result in the loss of iodine and decreased iron bioavailability
- Many formulations tested
- Microencapsulation technology has been developed to reduce the interaction
- Beyond premix characteristics, stability depends on raw salt quality, storage conditions, and packaging material

Current iron formulation in DFS premix (India)

Agglomerate ferrous fumarate with flour

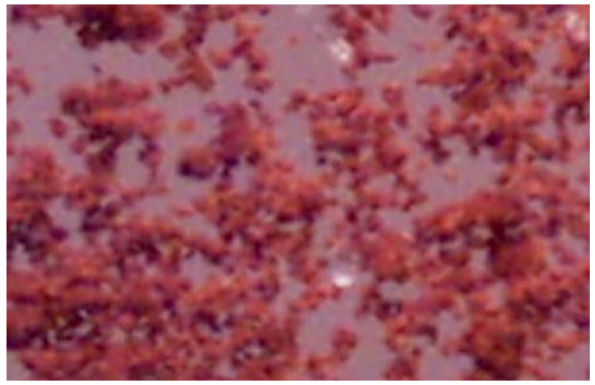
Coat with titanium dioxide in stearine

Overcoat with stearine



Y.O. Li. J Microencapsul.(2011) 28(7):639-49

Physical characteristics of encapsulated iron



FeFum Powder

Extruded agglomerate

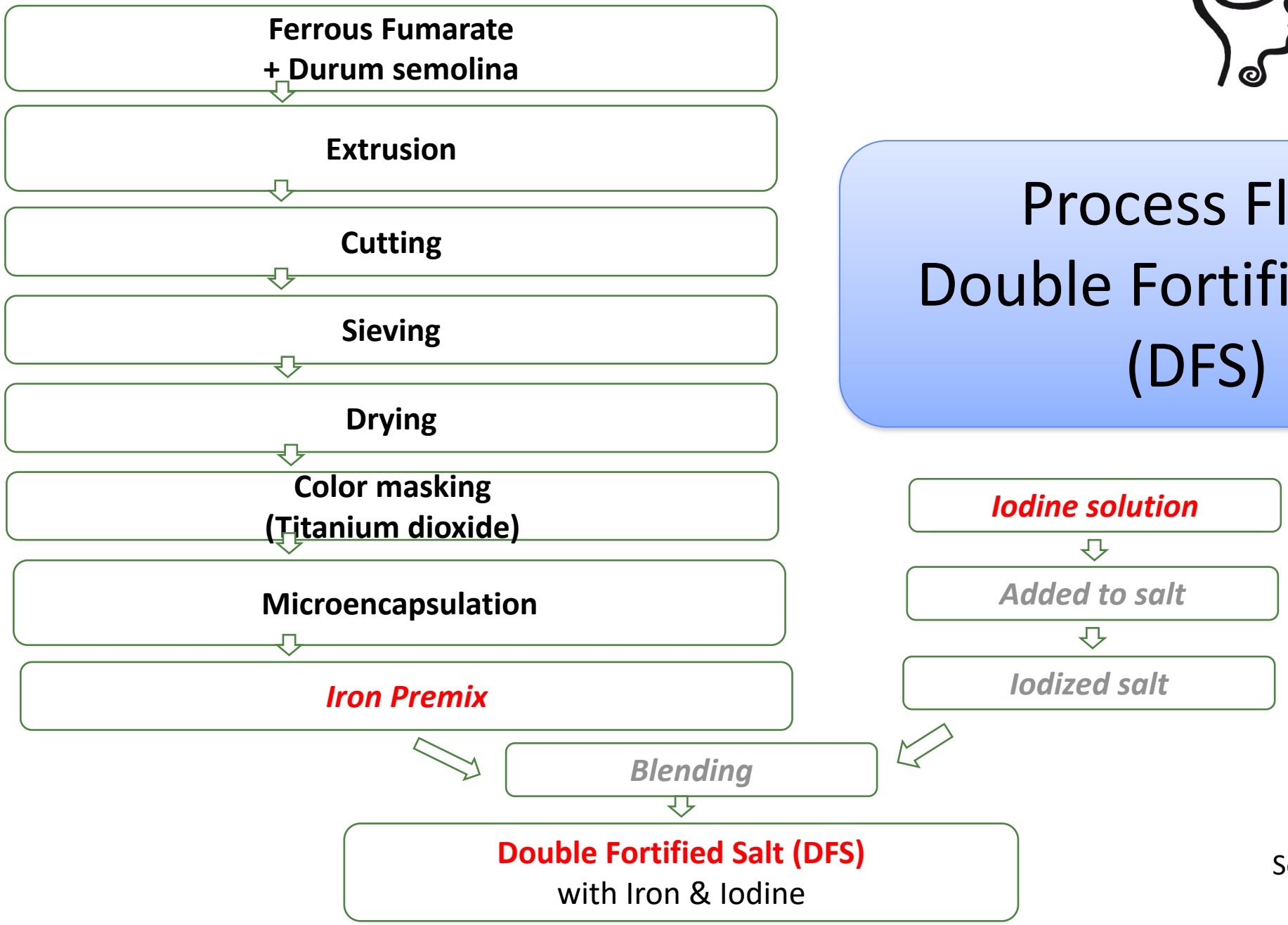
TiO_2 colour-masked

Encapsulated premix

Fortified salt(DFS)

Source: Tata Trusts, India

Process Flow Double Fortified Salt (DFS)



Source: Tata Trusts, India

Salt refining and DFS production

Source: Tata Trusts, India

Rationale for DFS in India

- In India, anemia affects 53% of women 14-49 years of age and 58.4% of children 6-59 months old (NFHS-4, 2015-2016).
- Assumption that iron deficiency is a major contributor – studies in Uttar Pradesh (UP) show that two-thirds of anemia is associated with iron deficiency
- Public distribution systems reach large segments of marginal population with basic commodities, including iodized salt
- Therefore, salt as a fortification vehicle beyond just iodine has been particularly interesting in India.

Experience to date in India

- Independent efficacy study on school age children in Bangalore reported anemia rates dropped 34% within 8 months of consumption of food cooked with DFS
- State of Tamil Nadu has been providing lunches prepared with DFS for 3.4 million school children for nearly 10 years
- States of Uttar Pradesh, Madhya Pradesh and Jharkland currently distributing DFS to over 66 million beneficiaries at subsidized price
- Initial experience through public sector promising, yet clear operational challenges need to be addressed

Scaling up options for DFS in India

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Public Sector Approaches

- Public Distribution System (PDS), Integrated Child Development Scheme (ICDS) and Mid-Day Meals (MDM) can reach significant vulnerable populations
- Targeted beneficiaries using existing supply chains: FPS shops, Anganwadi centres and schools
- Needs strong monitoring
- State subsidies to act as incentives

Open Market Approaches

- Business case for salt producers
- Initial entry through higher grades gradually percolating to less expensive grades
- Government policy and regulation would help
- Demand creation through active campaigns by private sector

Source: Mannar. DFS in India. IJCH (2018) 30: 63-71.

Innovations in program design in India

Encapsulation plant established at JVS Foods Jaipur to manufacture premix to be blended with salt

Procurement of DFS and distribution through PDS and MDM

Demand creation through education and communication

Global Consultation Process

- **Need to review evidence:**
  - Efficacy and effectiveness on anemia, iron deficiency and iodine deficiency
  - Comparison of salt and other foods as a vehicle for fortification
  - Technical feasibility
  - Implications for salt industry
  - Economic considerations

Global Consultation Process

- **Convene and facilitate multi-partner workshops**
- **Outputs:**
  - State-of-the art publications presenting information to-date on DFS: scientific and programmatic
  - Evidence-based guidance for implementation of DFS by interested countries
    - Conditions which should be in place for DFS to be successful
    - Care to avoid where such conditions are not present

Web: http://www.ign.org
E-mail: info@ign.org
Twitter: @ign_iccidd

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