BioAnalyt

Rapid Measurement of Iron and Iodine in Double Fortified Salt with iCheck

July 2019

Double **Fortified** Salt

An estimated 1 billion people, including 35 million babies, do not consume sufficient amounts of iodine. Almost 18 million of these babies are mentally impaired as a consequence.

Nearly 2 billion people suffer from anemia, over half of which is due to iron deficiency. Anemia is a condition that can cause complications in pregnancy, low birth weight, and infant and maternal deaths.

Table salt is a universal condiment, present in the diets of nearly every population. Therefore, addition of essential micronutrients to salt is an effective way to reduce micronutrient deficiencies. Salt iodization is considered one of the most successful health interventions of the 20th century, reaching 86% of all households globally. However, ensuring sufficient levels of iodine in salt, and thus adequate iodine consumption, remains a challenge. Recently, technology to include iron in salt has been developed by Nutrition International and the University of Toronto.

Double Fortified Salt (DFS) contains both iodine as potassium iodate, and iron as ferrous fumarate, compounds that were found to be most suitable for this application in terms of nutrient stability and product taste. The interaction between iron and iodine is reduced or eliminated through encapsulation of the iron.

Iodized salt with added encapsulated iron (circled) as ferrous fumarate.

Mixing is critical to ensure quality and compliance of DFS. Although iodine is typically applied to salt using a spray drying technique, which facilitates a relatively homogenous distribution in salt, encapsulated iron is added by dry mixing, which results in a heterogeneous distribution. The photo here shows the variability of iron found in DFS samples.

Preliminary studies also indicate cost-effectiveness of this intervention at scale. Production of DFS is estimated to cost US $0.18 – 0.20 per person, per year[1], with a benefit-to-cost ratio calculation for anemia reduction around 2.4 to 1 or better.

1. Horton S. Double-fortified salt reduces anemia, benefit:cost ratio is modestly favorable. Food Policy. Vol. 36 (5), 2011.

How it works

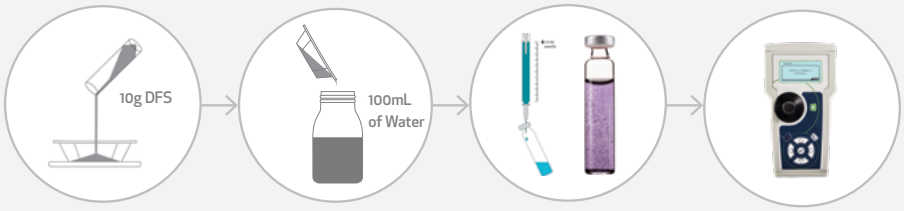
Measuring Iron and Iodine in DFS with iChecks

To facilitate the implementation of DFS, BioAnalyt developed a sample preparation protocol to enable reliable measurement of the concentrations of both iron and iodine in a single salt sample.

iCheck Iodine and iCheck Iron are both portable single-wavelength photometers, pre-calibrated for quantitative measurement of iodine in salt and iron in multiple food matrices, respectively. iCheck Iodine was already developed to specifically measure iodine in table salt as potassium iodate. iCheck Iron has the capability to measure intrinsic iron and added iron as ferrous fumarate, ferrous sulfate, NaFeEDTA, and ferric pyrophosphate in many food matrices.

To ensure reliable results with iCheck Iron, DFS samples require a customized sample preparation protocol*. Samples should be diluted in a hydrochloric acid solution to facilitate solubilization of the ferrous fumarate. Then, samples are heated to facilitate the release of the iron compound from its stearin encapsulation.

IODINE MEASUREMENT



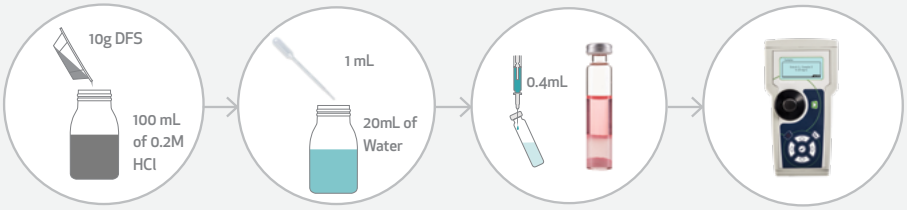
Weigh 10 grams of DFS.

Transfer 10 grams of DFS to a flask and dilute to 100 mL with water.

Proceed with measurement following the iCheck Iodine User Manual.

Multiply the result displayed by 10 (per dilution) to get the concentration of iodine in DFS in mg/kg.

IRON MEASUREMENT



Mix 10 grams of DFS with 100 mL of 0.2M HCl solution. Heat it to 80°C for 15 minutes.

Take up 1 mL of the DFS and acid solution after heating and dilute to 20 mL with 0.2M HCl solution.

Proceed with measurement following the iCheck Iron User Manual.

Multiply the result displayed with 200 (per dilution) to get the concentration of iron in DFS in mg/kg.

*Contact us to get **detailed protocol and training**:

Email: support@bioanalyt.com
WhatsApp: +49 1573 1111234

Method Comparison

Results with iChecks are Comparable to those with Reference Methods

All iCheck devices are compared to traditional laboratory methodologies to ensure reliability and accuracy of measurements. For DFS, iCheck methods were compared to mass spectrometry methods (ICP-MS). DFS standard samples were sourced from Canada and India and iron and iodine levels were measured using both methods.

The results are listed in the table below together with specifications provided by manufacturers. Based on these samples, iCheck results are comparable to those of ICP-MS and correlate well with the standard specifications.

Sample	Analyte	Specifications , mg/kg	Measured Concentration, mg/kg	
			ICP-MS[2] ± SD	iCheck ± SD
DFS sample 1	Iodine	50	50 ± 5	45 ± 0.9
DFS sample 1	Iron	1000	707 ± 71	973 ± 24
DFS sample 2	Iodine	39	42 ± 4	40 ± 0.1
DFS sample 2	Iron	970	863 ± 86	952 ± 57

iCheck analysis was performed in-house at BioAnalyt, Germany, ICP were performed in accredited lab in Germany. Extended measurement uncertainty (MU) for iron and iodine and with ICP -MS is 10%. ICP-MS method for iodine was according to VDLUFA III 11.7.15 and the method for iron was according to EN 15763 mod.; DIN EN ISO 17294-2. iCheck results are reported with standard deviation of triplicate measurement.

Benefits of iCheck

- **Speed:** Results in 5 to 60 minutes.
- **Economy:** Cost is only 10% of conventional lab methods.
- **Easy implementation:** Only 1 day of training is required.
- **Scalability:** Portable, with no set-up calibration required.
- **Accuracy:** Performance is comparable to reference lab methods.

iChecks are manufactured in Germany, used in over 80 countries and validated against standard laboratory methods. Learn more at www.bioanalyt.com/products.