Rapid Assessment Digitization of Oil Fortification Quality Check Processes







Introduction

Globally, women and children bear the brunt of increasing malnutrition. Vitamin A deficiency (VAD) affects 250 million preschool-age children, and 20 million pregnant women worldwide. In Pakistan, the 2018 National Nutrition Survey (NNS) revealed that 27.3% women of reproductive age are vitamin A deficient and 80% are vitamin D deficient. Similarly, 51.5% children under the age of five suffer from vitamin A deficiency and 63% are vitamin D deficient. Vitamin A deficiency is a leading cause of increased risk and severity of infectious diseases and morbidity, possibly by weakening the immune system and is also the number one cause of preventable blindness. Vitamin D deficiency causes rickets, leading to soft bones and skeletal deformities and is the single largest cause of osteoporosis.

Fortification of staples and condiments is a proven, cost-effective strategy for bridging the dietary gaps in vitamin and mineral deficiencies¹. The Government of Pakistan mandated fortification of edible oil in 1965, however, the coverage and adequacy of oil fortification remained limited due to weak implementation and enforcement by food regulatory bodies.

In 2017, Nutrition International started supporting the government and the private sector to revitalize efforts in improving implementation and enforcement of edible oil fortification and worked with through National Fortification Alliance (NFA) in Pakistan to review, revise and harmonize

¹ Keats et al., Improved micronutrient status and health outcomes in low- and middle- income countries following large-scale fortification: Evidence from a systematic review and meta-analysis, Am J Clin Nutr 2019;00:1–13.

standards for oil fortification. The revision includes addition of vitamin D to mandatory fortification of oil. The oil millers are required to meet following government standards for oil fortification:

- Vitamin A min 33,000 to max 45,000 IU/Kg of Oil
- Vitamin D min 3,000 to max 4,500 IU/Kg of Oil

We anticipate that the revised levels will assist in increasing the population's intake of these vitamins and help in reducing micronutrient deficiencies rampant in vulnerable population.

Monitoring the quality of fortified foods is an important consideration for success of food fortification interventions. For edible oil fortification, there are several methods for quantitative testing of added vitamins in oil - including testing it through High-Performance Liquid Chromatography (HPLC) and Spectrophotometer. Vitamin D is not tested in samples. Vitamin A is used as proxy to determine fortification level of vitamin D, as oil fortification premix comes in a blended form containing predefined quantities of both vitamins A&D. The levels of vitamin D are considered to be the same as the levels of vitamin A found in test results. Though testing of samples using HPLC is a gold standard and the most accurate for quantification of vitamin A, this method is time consuming, expensive, and requires trained human expertise and high-end laboratory equipment. The provincial food authorities and millers prefer rapid testing quantitative methods for quality assurance and quality control purposes². The iCheck Chroma 3 is a portable photometric device used for quantitative assessment of vitamin A level in refined edible oils³, which produced by BioAnalyt and used by large number of fortification programs globally.



Previously with support from the UK Aid, Nutrition International (NI) supported the industry and government partners in improving quality assurance and quality control processes for oil fortification in Pakistan and provided iCheck Chroma 3 devices to select cluster labs over the last few years. Currently,

Aim and Objectives

This study aimed at measuring the potential of upscaling iCheck Chroma 3 at cluster labs and acceptance by the government food authorities for quantitative testing of vitamin A in fortified oils to improve and strengthen internal and external quality assurance and quality control. The key objectives of the study were to:

- Assess usage, coverage, workload, successes, issues, challenges and opportunities to scale use of iCheck Chroma 3 at cluster labs for quantitative testing of vitamin A in fortified oil at mills.
- Conduct a rapid assessment of the iCheck cluster labs to inform placement of additional iCheck devices at other mills that presently do not have one.
- Review cost implications of iCheck Chroma 3 utilization for millers and make necessary recommendations to ensure iChecks and vial remain accessible beyond project life.
- Determine readiness of government food authorities to use iCheck Chroma 3 as a device for quality control and identify the best placement of such devices in different government departments at provincial and divisional levels.
- Understand millers and government authorities' perceptions about the use of iCheck connect to digitize quality data and in scaling up the use of iChecks or other testing equipment for improved quality assurance/control.

with support from Bill and Melinda Gates Foundation (BMGF), Nutrition International is supporting digitization of Pakistan's vitamin A/oil program to drive sustainability. In this regard, Nutrition International conducted a study to assess the utilization and potential for scale up of iCheck Chroma 3.

Key Descriptions

Cluster Lab

A cluster lab refers to a centrally located mill in an identified cluster of 5-6 mills. Cluster labs have an adequately equipped laboratory and dedicated human resource. A total of 26 such labs were provided with iCheck Chroma 3 devices by Nutrition International over the last few years to be used by mills in the respective cluster to test fortified oil samples. Coded samples of cluster mills are taken by the zonal manager on fortnightly basis to get the samples checked using the iCheck Chroma 3 device in the cluster lab.

² Cécile R, Jacques B, Arnaud L, Sylvie A. Quantification of vitamin A in fortified rapeseed, groundnut and soya oils using a simple portable device: comparison to high performance liquid chromatography. Int J Vitam Nutr Res. 2013;83(2):122-8. doi: 10.1024/0300-9831/a000154

³ https://www.bioanalyt.com/wp-content/uploads/2019/05/iCheck-Chroma-3_product-information_EN_2019.pdf. Accessed on 24 December 2021



iCheck Connect

iCheck Connect is a web-based application for iCheck Chroma 3 devices, currently introduced by Nutrition International as part of the BMGF-supported digitization project. iCheck Connect enables wireless transfer of measurement results from an iCheck device to a tablet or computer. The app allows for a user-friendly way to categorize, visualize, and interpret transferred data making it actionable. Currently, a demo version is being tested and the data is being transferred to a BioAnalyt web. Training and pilot testing of iCheck Connect are underway. Once finalized, the data will be integrated with Fortification Information System (FortIS).

Methodology, Data Collection and Analysis

A rapid assessment based on qualitative research was conducted. Data was collected from Punjab, Sindh, Khyber Pakhtunkhwa (KP) and Islamabad from September 7 to October 18, 2021. A total of 41 interviews including that of 21 mill representatives from Punjab, Sindh, and Khyber Pakhtunkhwa (KP) provinces, representatives from National Fortification Alliance, Pakistan Standards and Quality Control Authority (PSQCA), Sindh Food Authority, KP Food Safety and Halal Food Authority (KPFSA), Pakistan Vanaspati Manufacturers Association (PVMA) and members from BioAnalyt and Nutrition International were conducted. Data analysis was carried out using NVivo software.

Key Observations

■ Food authorities across the provinces were found to be actively and regularly monitoring and testing the fortified oil samples. Quantitative testing has been a part of the national and provincial standards and regulations giving a range of 33,000 to 45000 IU/ Kg for vitamin A and 3,000 to 4,500 IU/Kg of vitamin D. Failure to achieve these standards results in hefty fines/penalty to the millers. Therefore, the millers are keen to fortify edible oil and get their samples tested before supplying their products to the market.

ICheck Chroma 3 provided by Nutrition International is considered a good and handy device for assessing vitamin A levels by the industry partners. All the mills were keen to have their own device and shared that even without Nutrition International support, they will be able to sustain the use of iCheck Chroma 3, provided that the testing reagents/vials are available locally as importing these items from their country of origin (Germany), is time consuming and cumbersome.

Based on the cluster labs readiness assessment, the labs were found ready to conduct testing relevant to oil fortification assessment. All cluster labs set up under the National Food Fortification Program (NFFP) had designated human resources, who are trained and experienced in performing such tests. While majority of the cluster labs were open five days a week for eight hours, a few cluster labs were also open 24/7. The iCheck Chroma 3 devices alongwith reagents were available at all the mills and were being used for testing of one sample from each mill on a fortnightly basis. The tests were performed in coordination with Nutrition International's zonal managers who are responsible for the supply of the reagents for testing edible oil samples. However, a temporary shortage of reagents was reported for two to three months across the provinces due to a delay in supply from Germany, owing to the COVID-19 pandemic related restrictions.



■ The millers, food authorities and government partners also reported using other methods for assessing vitamin A levels in fortified edible oils. These included the use of Rapid Testing Kits (RTKs) for qualitative testing, using High-Performance Liquid Chromatography (HPLC) and Spectrophotometers for quantitative testing. Although, none of the government partners has their own iCheck Chroma 3, they reported to have attended the trainings arranged by Nutrition International where a demo on the iCheck Chroma 3 device was provided to them, making them aware of the usage of the device. Authorities in the Khyber Pukhtanwa and Sindh provinces were ready to use the devices for their mobile labs as well.

• The need for a local supplier of the device and reagents is beneficial for both the millers and the government authorities. They opined that such an arrangement shall reduce the cost and time of purchase as compared to making international

procurement. BioAnalyt is in the process of identifying a potential distributor in Pakistan and requires further assistance from the BMGF and Nutrition International in this regard.

Some of the mills, mainly from Sindh and Punjab provinces, reported that the method comparison of iCheck Chroma 3 results is not in total agreement with the HPLC results. They reported that the inaccuracy of results using iCheck Chroma 3 was 30%, which is higher than that of HPLC, that is 10%. However, those millers whose findings were coming within the given range and were able to repeatedly get the same results were satisfied with the device. The respondent from BioAnalyt shared that those results from iCheck Chroma 3 are comparable with that of HPLC and this measure of uncertainty can be reduced by repetition and calculating the standard deviation of the results. They further added that in future trainings, they will reinforce this point and train the millers accordingly.

■ All mills indicated willingness to have their own device from the program. In case all mills cannot get devices, a mechanism needs to be defined and put in place to continue the process of cluster labs receiving and assessing samples from other mills within their clusters. They also shared that it will be difficult for the mills without iCheck Chroma 3 devices to access the cluster labs on their own without the current support from Nutrition International's zonal managers due to difficulties in visiting competing mills.

QA/QC training conducted by Nutrition International was considered to be the most important component of support by all the relevant stakeholders. These trainings were attended by majority of the millers, and government partners. The stakeholders shared that these trainings should continue even after the project comes to an end.

All respondents shared that monitoring/ enforcement by the provincial food authorities and endorsement of standards by PSQCA has resulted in greater compliance to the mandatory standards for oil fortification by the industry.

• On the question about scaling up installation of iCheck Chroma 3 in oil producing mills, some respondents shared that an endorsement for use of iCheck Chroma 3 by the food authorities will help millers scale up more urgently. Otherwise, some millers will keep on relying on qualitative testing.

Regarding iCheck Connect, most of the stakeholders were unaware of the application. However, those who had already been oriented about it or were part of its Beta testing felt that the application will be helpful in improving oil fortification monitoring and reporting processes.

Recommendations

- Introduction of iCheck Chroma 3 is an effective intervention implemented to support and improve the quality of oil fortification.
- Currently, the demand for iCheck Chroma 3 devices by the millers and government stakeholders is high and it seems possible to further scale up the use of the devices. Compared to the HPLC method, it is a cost-effective intervention that can be sustained by the millers as well as by the government authorities. However, a local distributor in Pakistan is a pre-requisite for a scale-up. Otherwise, issues pertaining to shortage of reagents/vials, maintenance of devices and trainings may surface and could negatively affect the scale-up and utilization of the equipment for QA/QC.
- Nutrition International needs to advocate with the government authorities to use iChecks for assessing oil samples for fortification in the field as it is more cost-efficient and less time consuming. These devices can also be placed in mobile labs set up by provincial food authorities used for on-the-spot testing during monitoring visits to mills or markets. In case of inadequate fortification detected by the iCheck Chroma 3, further investigation could be undertaken using the HPLC laboratories operating at provincial levels. This will assist in reducing cost and time in terms of performing the quantitative tests at provincial level HPLC reference laboratories.
- An endorsement by the government food authorities, in the form of developing Standard Operating procedures (SOPs) for QA or issuance of directives may further increase the utilization of iCheck Chroma 3 by the millers for a robust QA regime, after the program phases out.
- Additionally, Nutrition International should continue advocating with government food regulatory bodies for their regular monitoring of mills and markets to ensure adequate fortification of oil. Similarly, a long-term plan should be devised with food authorities for QA/QC trainings, after the project's close out. Nutrition International should consider closing the project in a phased manner to ensure smooth takeover of the project interventions by the government for ownership and sustainability.