

**Republic of Mauritius**

# **Wheat Flour Fortification Landscape Analysis**



## **Final Report**

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## List of Abbreviations

CDC	Centre for Disease Control
FFI	Food Fortification Initiative
GAD	Government Analyst Department
HPLC	High-Performance Liquid Chromatography
IDA	Iron Deficiency Anemia
LMLC	Les Moulins de la Concorde
MoHW	Ministry of Health and Wellness
MSB	Mauritius Standards Bureau
QA/QC	Quality Assurance/Quality Control
SADC	Southern Africa Development Community
STC	State Trading Company
VAD	Vitamin A Deficiency

## Executive Summary

Mauritius is located in the Indian Ocean, off the south east coast of the Africa continent, about 900 kilometers east of Madagascar. The territory of Mauritius includes the island of Rodrigues situated 560 kilometers to the north east of Mauritius. In addition, there are four small Islands, namely, the Agalega, the St Brandon, the Chagos Archipelago and the Tromelin that rely on Mauritius. In July 2021, the population of the Republic of Mauritius was estimated to be 1,263,888, with 624,820 being males and 639,068 females.

The country has steadily moved from a low-income agricultural-based economy to a diversified upper middle-income economy. As at 1<sup>st</sup> July 2020, the World Bank classified Mauritius as a high income country with a Gross National Income per capita of Rs 509,600 (US \$ 12,740).

The consumption of wheat and rice in 2020/2021 were 220g/c/d and 127g/c/d respectively. The trend is that consumption of wheat is reducing while that of rice is steadily increasing. This reduction has been attributed to covid-19 impact. It is expected that this will increase in the coming years. Whereas over 99% of wheat flour is obtained locally, all the rice is imported. Wheat flour and products are consumed by over 80% of the population.

Mauritius does not grow wheat. All the wheat milled in the country of which 85% is for domestic consumption is imported by the only local miller Les Moulins de la Concorde. Major country of origin includes France, Germany and Australia. In 2021, the country imported about 138,000MT of wheat grain.

The grain storage capacity at the mill is 40,000MT in 16 silos, while holding storage for flour is 3000MT, which are adequate since procurement take place four times in a year and the turnover of the flour is high.

Domestic flour production in 2021 stood at 107,250MT with 85% supplied to State Trading Company (STC) distribution system under government subsidy, 4.7% goes through the open market system, and 10.3% is exported. An unknown but very small proportion of flour for special uses is imported by the private sector.

There is only one domestic wheat flour mill with installed capacity of 570MT of grain per day, operating at 88% capacity. There are two production lines of 400MT per day and 170MT per day. The milling diagrams were supplied by Buhler. One of the lines uses a batch mixing system with 1,000MT's holding bin ahead of the mixer and can produce 20MT of flour per hour. The other

line has 14MT per hour continuous screw conveyor system. The mill has micro-feeders for improvers and enzymes. For flour fortification, each production line will require an additional micro-feeder for dosing micronutrient premixes.

### **Recommendations**

- (i) The FFI consultants are to draft a national strategy for wheat flour fortification incorporating a number of the findings with clear monitoring and evaluation framework. This will support the different sectors mentioned and involved to plan and budget very well to avoid duplication of resources and efforts.
- (ii) Mauritius Standards Bureau (MSB) will start the process of developing a national wheat flour fortification standard and the Ministry of Health and Wellness (MoHW) to request the standard in writing. The FFI consultants shall lend technical assistance support during the process, which is expected to take a maximum of 6 months including gazette of the standards. When ready, STC shall use the standard (specifications) as a requirement for procurement.
- (iii) Both the MSB and Government Analyst Division Laboratory (GADL) should budget to address equipment gaps to be prepared to analyze folic acid and iron in flour among other nutrients. There is need for GAD and MSB to invest in acquiring additional High-Performance Liquid Chromatography (HPLC) equipment for micronutrient analysis and train lab personnel on the use of the HPLC equipment for vitamin& mineral analysis
- (iv) In order to integrate fortification in the production system, the existing production and quality assurance department at the mill will require training/orientation<sup>1</sup> in addition to procurement of micro feeders premix. Access to quality premix is key. The mill needs to be linked to the premix suppliers some of which are already suppliers of their ingredients.
- (v) The mill should undertake baking trials and organoleptic studies to ascertain whether fortification affects color, texture, smell and taste, although we know from several studies, it does not.
- (vi) Organoleptic test (baking trials) of fortified wheat flour using the Mauritius standards is a good practice to ensure local ownership of the standard by stakeholders. The Food and Agricultural Extension Institute (FAREI), under the Ministry of Agriculture and the miller is one of the companies which is well placed to undertake such trials.
- (vii) Apart from the nutrition surveys which come in 5 years' interval, annual compliance monitoring survey should be pursued as well. University of Mauritius and other research agencies need to collaborate with government.

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<sup>1</sup>Some staff have experience of fortification elsewhere before they joined the mill

## **1. INTRODUCTION**

### **1.1 Background**

In the Budget Speech 2019-2020, the Prime Minister announced that Mauritius will encourage supply of wheat flour with Iron and Folic Acid to address problem of high incidence of anaemia among women and reduce the prevalence of neural tube defects in newborns. One of the objectives of Mauritius National Action Plan for Nutrition (2016-2020) was to reduce nutritional anemia in female adolescents 12-19 years to 10%. Furthermore, a 50% reduction in anaemia is to be achieved in reproductive-age-women by 2025 in order to meet the global nutrition targets. In order to address the above, Mauritius will have to embark on a Food Fortification Programme as soon as possible.

In this regards, Ministry of Health and Wellness (MoHW) approached Southern African Development Community (SADC) to provide Technical Assistance (TA) to initiate national food fortification to roll out the SADC regional minimum fortification standards. Food Fortification Initiative (FFI) was requested to provide the required TA with support from Food and Agriculture Organization (FAO) grant. This landscape analysis report is an important part of the milestones in the technical support FFI is providing to Mauritius under this arrangement

### **1.2 Country overview**

Mauritius is located in the Indian Ocean, off the south east coast of the Africa continent, about 900 kilometers east of Madagascar. The territory of Mauritius includes the island of Rodrigues situated 560 kilometers to the north east of Mauritius. In addition, there are four small Islands, namely, the Agalega, the St Brandon, the Chagos Archipelago and the Tromelin that rely on Mauritius. In July 2021, the population of the Republic of Mauritius was estimated to be 1,263,888, with 624,820 being males and 639,068 females.

Mauritius has steadily moved from a low-income agricultural-based economy to a diversified upper middle-income economy. On 1st July 2020, the World Bank declared Mauritius as a high income country with a Gross National Income per capita of US \$ 12,740. It reached this milestone in one of the worst years in its history due to the global COVID-19 pandemic, which has wreaked havoc on its economy. The effects of COVID-19 have reversed recent gains in poverty reduction and female labor force participation.

**Figure 1: Administrative Map of Mauritius**



Source: Mauritius Maps & Facts - World Atlas

However, the country faced a steep recession towards the end of 2020. Gradual recovery was expected for 2021, but remained subject to significant downside risks, including a prolonged pandemic or failure to address longstanding structural constraints to investment, competitiveness, and skills development. The fiscal outlook depends heavily on a timely unwinding of COVID-19-support measures and a reform of the public pension system.

### **1.3 The objectives of the landscape analysis**

The landscape analysis was aimed at providing a comprehensive perspective on the need for and feasibility of wheat flour fortification. The landscape focused on situational analysis, wheat flour supply chain diagnostics, and readiness of the government and industry to implement mandatory wheat flour fortification. The situational analysis looked at the trends in malnutrition, micronutrient deficiencies and consumption patterns of wheat flour that hold the potential as a food vehicle for micronutrients. The wheat flour supply chain analysis, government and industry readiness to plan, implement and monitor mass fortification was assessed.

### **1.4 Methodology**

Both desk review and primary sources of information were used. A review of the existing information on micronutrient deficiencies, consumption patterns of wheat flour and government policies and intervention to address malnutrition was done. Information on stakeholder mapping was also obtained during desk review. Most of the documents were accessed from internet sources and literature requested from contacts in country. These included reports from nutrition surveys, annual health statistics reports, policies documents and annual reports from the milling industry. This was a continuous process which started in August 2021.

The gaps in the literature review were filled through key informant interviews, focus group discussions and observation. The two consultants from FFI made a one week (13-20 February 2022) visit to Mauritius to interface with the stakeholders. The team met representatives from relevant government ministries, departments and agencies, the private sector, industry, research institutions, and development partners in the country. Apart from assessing the situation, the discussions also focused on what the roles the different stakeholders will play in the implementation of a food fortification program.

## **2. GRAIN CONSUMPTION AND FOOD FORTIFICATION STATUS**

Wheat flour is the main staple in Mauritius. It means the Mauritian population is dependent on wheat for their caloric intake. The per capita consumption of wheat stands at 220g/c/d in 2019; it's a staple consumed by over 80% of population- all ages and has opportunity for large scale fortification during milling process since 100% of wheat grain is imported and 100% industrially milled locally.



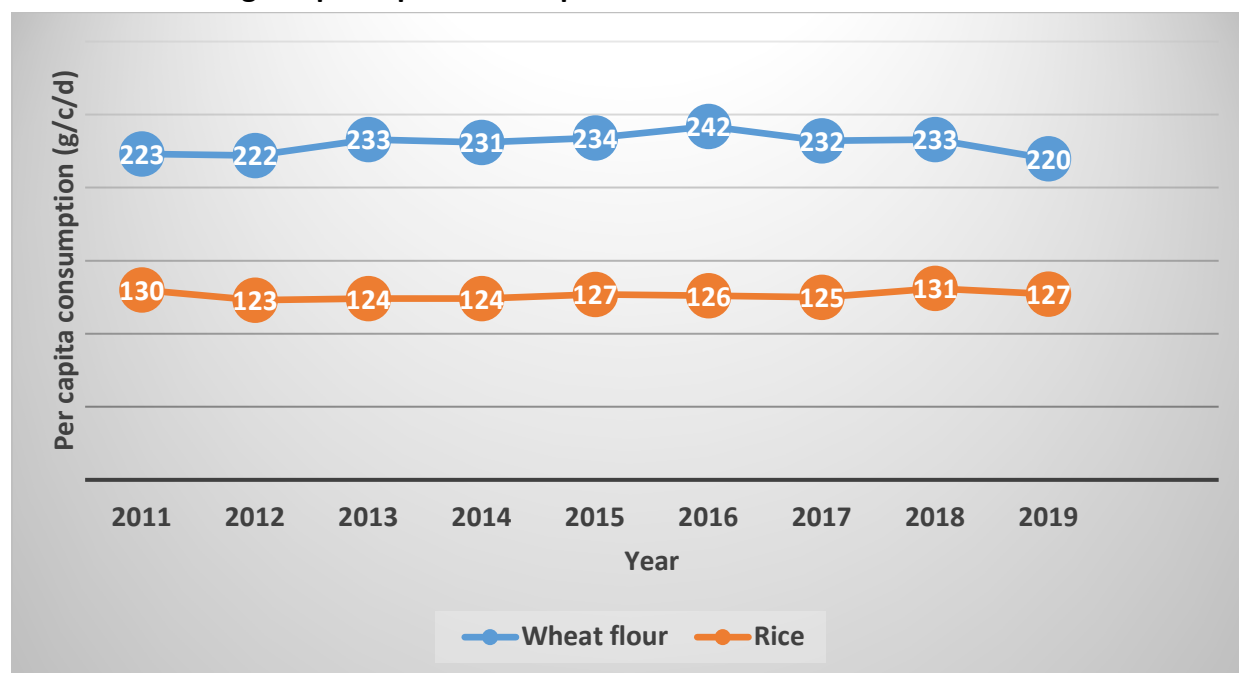
**Table 1: Grain consumption and food fortification status in Mauritius**

Food	Consumption/availability (g/c/d), 2016 <sup>2</sup>	Consumption/availability (g/c/d), 2019 <sup>3</sup>	% Industrially milled <sup>4</sup>	Fortification status, 2020	Nutrients in standard
Wheat	242	220	100	No fortification	N/A
Rice	126	127	100	No fortification	N/A

Source: Statistics Mauritius (2020)-Digest of Agricultural Statistics (2018, 2020)

The above table clearly indicates that, consumption of wheat is still high despite the decrease in the population and per capita consumption over time. This trend for nine years is shown in the Table 1 below.

**Table 2: Trend in grain per capita consumption in Mauritius**



Source: Statistics Mauritius-Digest of Agricultural Statistics (2018, 2020)

### 3. WHEAT FLOUR CONSUMPTION PATTERNS AND PREFERENCES

Nearly 70% of the flour goes for scheduled bread. The Mauritian population consume different types of bread. The scheduled bread produced in Mauritius is made of wheat flour, water, yeast,

<sup>2</sup>Mauritius Statistic-Digest of Agricultural Statistics (2018)

<sup>3</sup>Mauritius Statistic-Digest of Agricultural Statistics (2020)

<sup>4</sup>Interview with stakeholders in Mauritius

improver and salt. It has a baking formula attached to the flour specifications produced by STC. The scheduled bread category mostly includes Round bread (Pain Maison), ‘Baguette’ and ‘Pain Moule’ with or without score, and having a crispy crust. The rest of the flour is for flat bread like chapattis & rotis, pastries, cakes and noodles. With increasing habit of eating out, there are mushrooming food courts around the cities where Mauritians like enjoying these products. The prospects of targeting the population with fortified flour will go a long way to secure their intake of the required amounts of micronutrients and reduce the micronutrient deficiency burdens on the population and the economy.

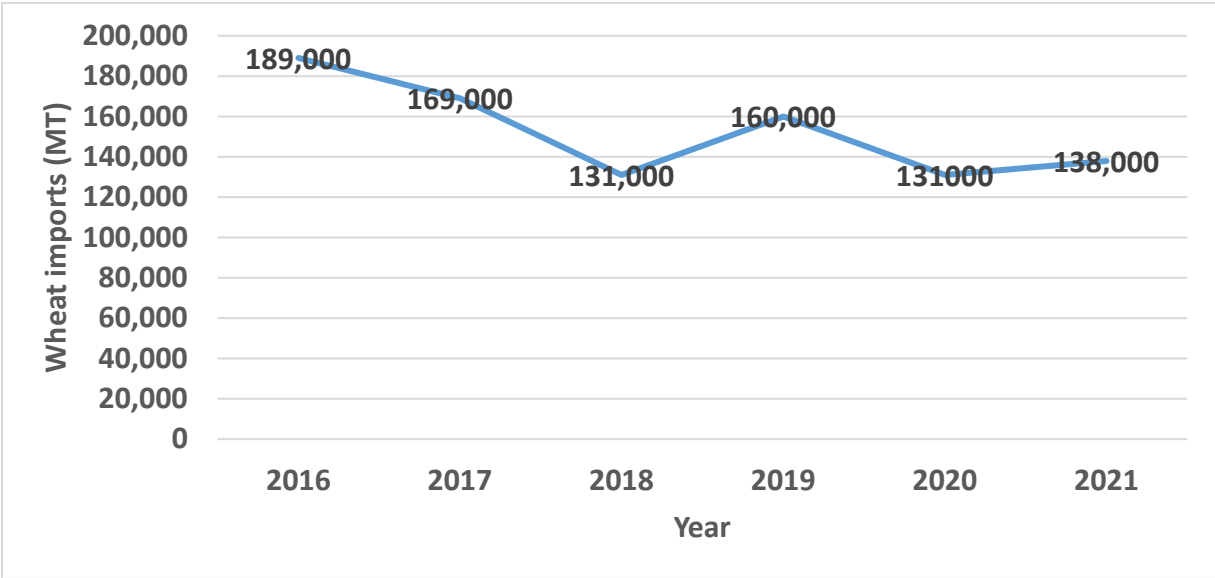
**4. WHEAT GRAIN PRODUCTION, IMPORTS AND EXPORTS**

There is no domestic production of wheat grains in Mauritius. The country is a net wheat grain importer and does not re-export. Les Moulins de la Concorde (LMLC) is a sole importer of wheat grain and the only local producer of wheat flour.

**4.1 Wheat grain imports**

The company imports wheat largely from France, Germany and Australia, using international specifications, as the country does not have specifications for wheat grain. In 2021, the Mill imported about 138,000 metric tons of wheat grain valued at \$32 million. The trend of imports is presented in Graph 1 below. The decline in 2020 and 2021 imports has been attributed to the disruptions caused by covid-19. The trend is expected to rise as restrictions continue to ease and economies rebound.

**Graph 3: Wheat grain import trends**



Source: FAO (2021): Cereal supply and demand balances for sub-Saharan African Countries Situation as of November 2021/Mauritius Country Commercial Guide (2020).

The location of the industry at the sea Port of the city of Port Louis is very strategic. The wheat is shipped direct to the reception site of the factory where it is offloaded and conveyed to the silos directly. This makes it cost effective logistically.

## **4.2 Wheat Storage capacity**

The countries wheat storage capacity is mainly with Les Moulins de la Concorde, which owns sixteen silos, with a total capacity of 40,000MT of wheat. This makes it possible to store the raw material in optimal conditions for several months and thus ensure the continuity of the supply of freshly ground flour to the country. Freshness is an aspect particularly illustrated by the uninterrupted supply of flour during the sanitary confinements of 2020 and 2021.

## **5. MILLING INDUSTRY STRUCTURE**

### **5.1 National Milling Capacity**

Les Moulins de la Concorde (LMLC) is the only mill that produces wheat flour in Mauritius, largely consumed in the country with a very small proportion for exports. Mill was established in 1989 with full capacity of 400MT/day of wheat grain. Another line of 170MT/day was added in the year 1995. Total installed capacity stands at 570MT/day as of Feb 2022. The mill is the sole provider of wheat flour for the government subsidy program operated by STC.

The mill operates at 88% of its installed capacity in 24 hours per day and 30 days per month. It is usually shut down for maintenance for a few days. One of the lines uses batch mixture with 1,000MT holding capacity and can produce 20MT of flour per hour. The other line has 14MT per hour which uses continuous screw conveyor system.

LMLC is an active participant in the wheat flour supply chain, from grain imports, storage, local milling, distribution and after sales services and bakery training. This is a crucial role in the country's food security. The mill largely supplies the country, through STC, with fresh flour of four main types. (i) White wheat flour type A and (ii) brown wheat flour type A with coarse bran. Type A flours contain enzymes and antioxidant and use to make mostly Baguette (French type), round bread (pain maison) made in traditional and industrial bakeries. These constitute 68% of the flour consumed in the country. (iii) White wheat flour, type B and (iv) Brown wheat flour, type B with fine bran. There are no improvers and enzymes added in type B flours. They are largely used to

make flat bread like chapattis & rotis, pastries, cakes and noodles. These constitute approximately 32% of the flour supplied in Mauritian markets. The production of brown bread wheat flour has recently been introduced as a dietary measure to address increasing prevalence of the Non Communicable Diseases in the country and constitutes only 2% of the total flour in the market. However, the Mauritian population is not used to brown bread, thus demand for brown bread flour is very low.

Derived from refining, the bran is composed of dietary fiber and contains many nutritional elements, vitamins and minerals. The bran, essential to the local livestock sector, is integrated into the feed by industrialists, or used as such. <sup>5</sup>Les Moulins de La Concorde sell bran intended exclusively for animal feed in bulk or compacted (pellets), in 25 and 50 kg containers. This type of product is only available on order.

## **5.2 Wheat flour Production and Distribution**

An estimated 107,250MT's of flour was produced by LMLC in Mauritius in 2021. This was distributed through three main channels: State Trading Company; private contracts and direct local market supply and for export. The details are as follows:

### **(i) State Trading Company (STC)**

The Government subsidizes the white wheat flour and brown wheat flour so as to make it affordable for all income groups of the Mauritian population. The subsidy is applicable on basic types of bread for which the retail prices are fixed by the Government (regulated bread) as per the Consumer Protection (Control of Manufacture and Sale of Bread) Act. STC is mandated to procure and distribute the subsidized bread flour. This is done through a competitive international bidding process. It has its own specifications for the wheat flour they procure for the Mauritian population. Over the years, the Les Moulins de la Concorde has been winning the tenders for the supply of wheat flour to be distributed by the STC. Data from STC in Table 2 below indicates that, LMLC supplied 91,551MT's, equivalent of 85.4%, of the total production to STC under international bidding contract.

STC subsidizes the price of this flour by nearly more than a half. This is meant to ensure food security for all, as wheat is the main staple of the population. STC has a number of distribution channels for the wheat flour to be accessed by the consumers. These include; wholesalers,

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<sup>5</sup> Les Moulin de la Concorde website: <https://www.lmlc.mu/nos-produits/alimentation-animale#Produits%20pour%20animaux>; accessed on 17<sup>th</sup> Jan 2022

bakers, packers, food manufacturers and others. The number and quantities they traded in 2021 are presented in the Table 2 below. About 2.5% of STC flour is sent to the Island of Rodrigues.

**Table 2: Distribution Channels of STC**

Category of customer registered at STC	Sales 2021 (Metric Tons)	Number of customers registered STC 2021	Remarks
Wholesalers	36,984	58	Distribute in bags of 25kg to bakers, retailers and others
Bakers	24,218	80	Used mainly for bread and also pastries
Packer/Distributor	7,500	5	Pack and distribute in small packaging of 2.5kg/1kg to retailers
	12,271		Distribute in bags of 25kg to bakers, retailers
Noodle manufacturer	6,774	3	Used for making of noodles
Biscuit manufacturer	568	1	Used for making of biscuit
Others	25	2	-
Transfer to Rodrigues	2,260	-	Is sold to bakeries and to the population in Rodrigues
<b>TOTAL</b>	<b>90,600</b>	<b>149</b>	

Source: Mauritius State Trading Company (2022)

Important to note is that, the packers procure from STC in 25kg bags but sell in 2.5kg packets. How and where the re-packaging is done needs to be known and regulated to ensure the quality and safety of the flour is maintained along the supply chain. Besides, there is the extra cost involved in this repackaging.

**(ii) Directly to local market**

LMLC’s annual report for 2021 indicates that, 5,126MT of wheat flour was supplied to the local market under private contract. Two local food chains have special contracts with the mill to produce special flour for their industry according to their own specifications.

It is important to note that the industry also offers after sales services. There are about 212 bakeries operating in Mauritius and Rodrigues. The team of bakery specialists visit these bakeries regularly to listen to their feedback of the performance of the flour. These visits were, however, interrupted by covid-19 restrictions but have since resumed after 90% of vaccination coverage and had immunity.

### (iii) Exports

In 2021, about 11,148MT of flour was exported to the neighboring islands of Madagascar, Comoros and Seychelles. This is important to note, as the country develops the fortification program. The program could benefit the population in the export islands as well.

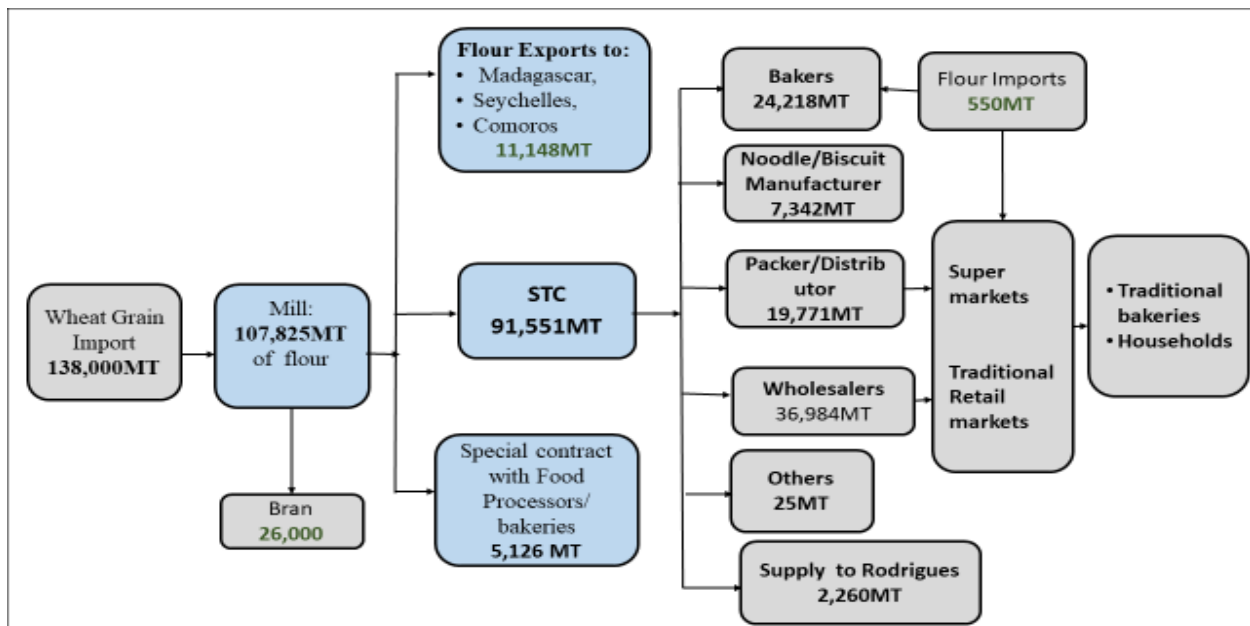
### (iv) Import of flour

STC reported to have imported flour in the past. But since 2010, STC has imported wheat flour at only three intervals in 2011, 2012 and 2014. An average of around 13,000 MT were imported by STC annually. Currently, some few private companies import 550MT of special types of wheat flour.

## 6. SUPPLY CHAIN DIAGRAM

The supply chain analysis diagram cohesively ties together the entire wheat flour distribution to visually depict the flow of wheat from imports, milling and flour distribution as discussed above.

Figure 2: Mauritius Wheat flour supply chain diagram for 2021



Source: Author's construction

## 7. WHEAT FLOUR FORTIFICATION READINESS

Mauritius does not have mandatory fortification program for any food vehicle. However, the country is in the process of programming mandatory fortification of wheat flour with iron, folic acid, zinc and vitamin B<sub>12</sub>. Wheat and wheat products are widely consumed by a large proportion of the Mauritian population, the only mill is centrally located, and it is cost effective. More

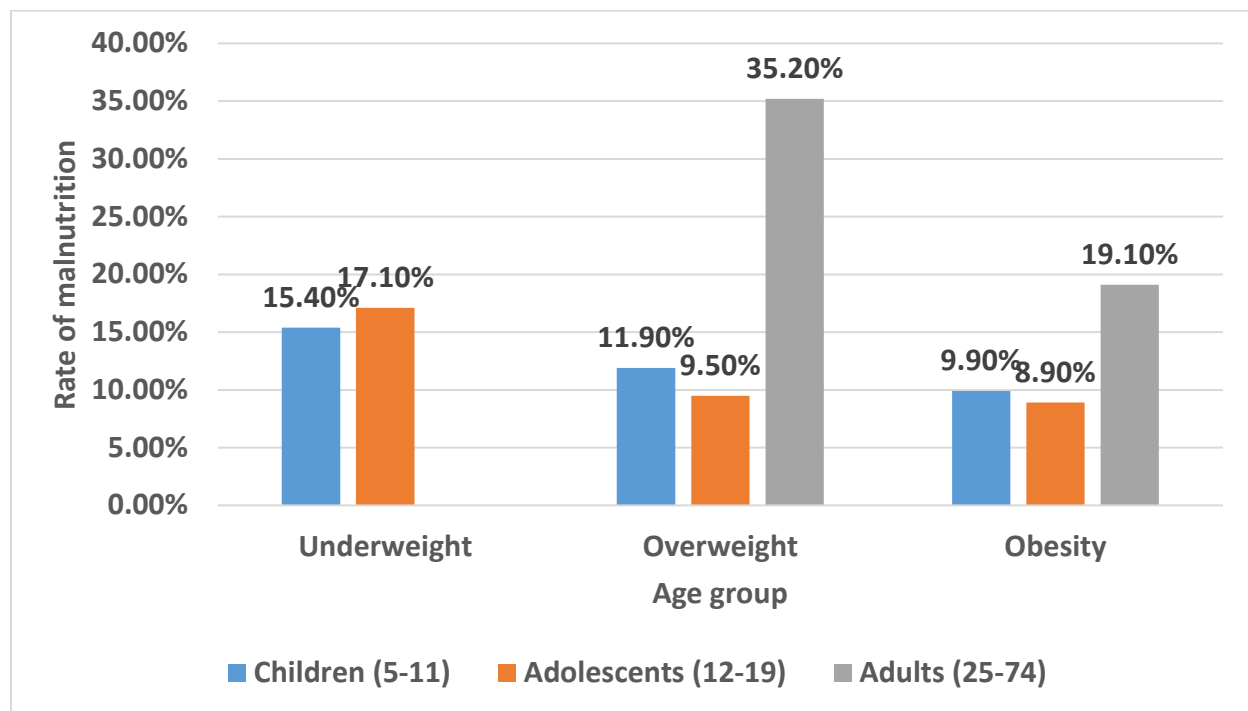
importantly the regional body SADC has developed a minimum standard for fortification. As Mauritius is a member of SADC this provides the impetus to move faster.

## 7.1 Nutrition and micronutrient status

### Underweight, overweight and obesity in Mauritius

Despite the improved economic status of Mauritius, nutrition indicators are still performing some-what poorly. The country suffers from double burden of malnutrition micronutrient deficiencies: high prevalence of underweight alongside increasing rate of overweight and obesity as shown in the Graph 1 below.

**Graph 1: Prevalence of underweight, overweight and obesity in Mauritius**

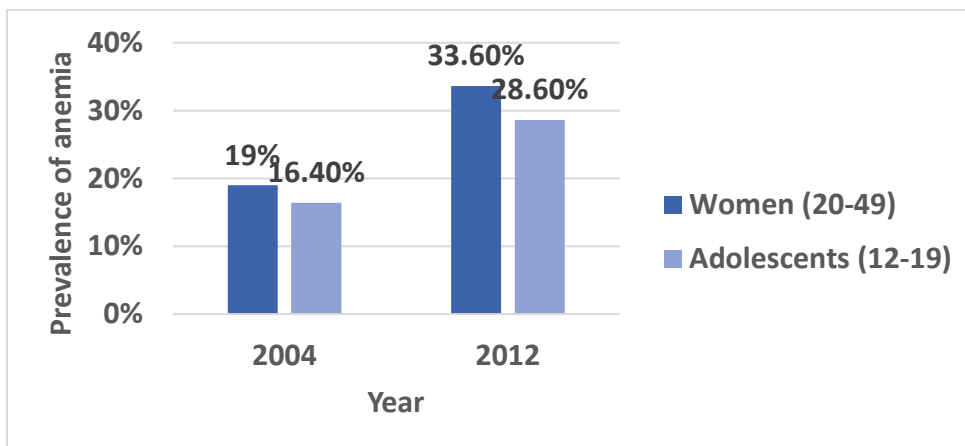


Source: Health Report 2020

### Prevalence of anaemia

Nutrition surveys conducted in Mauritius have shown high micronutrient deficiency in the form of anaemia, which is constantly on the rise. The highest prevalence of anemia is among females in the age group 20 to 49 years which increased from 19% in 2004 to 33.6% in 2012, followed by girls aged between 12 to 19 years, where it increased from 16.4% in 2004 to 28.5 % in 2012 as shown in the Graph 2 below.

**Graph 2: Anemia prevalence in Mauritius**

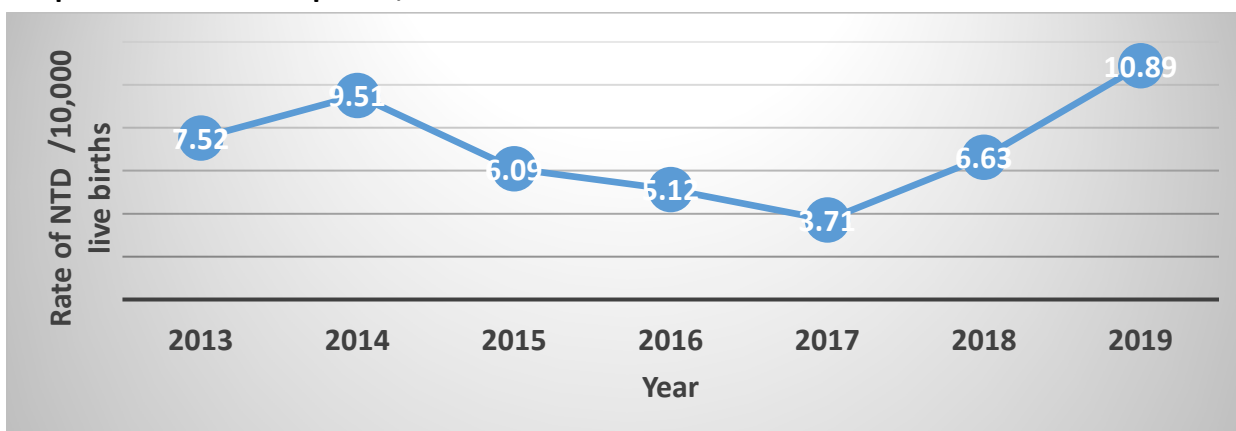


Source of data: National Nutrition Surveys (2004 and 2012)

### **Prevalence of Neural Tube Defects**

The Birth Defects Registry of Mauritius Institution of Health (MIH) shows NTD prevalence of 8.3 (2017), 5.0 (2018) and 10.8 (2019) per 10,000 births. These are reported cases. There could be unreported cases that are not included here. Many of the private health facilities where the mothers sometimes deliver, even though government facilities are free of charge, do not have the capacity to detect and thus report these cases in time.

**Graph 3: Trend of NTD per 10,000 live birth**



Source: Mauritius Institute of Health (2022)

### **Importance of fortification**

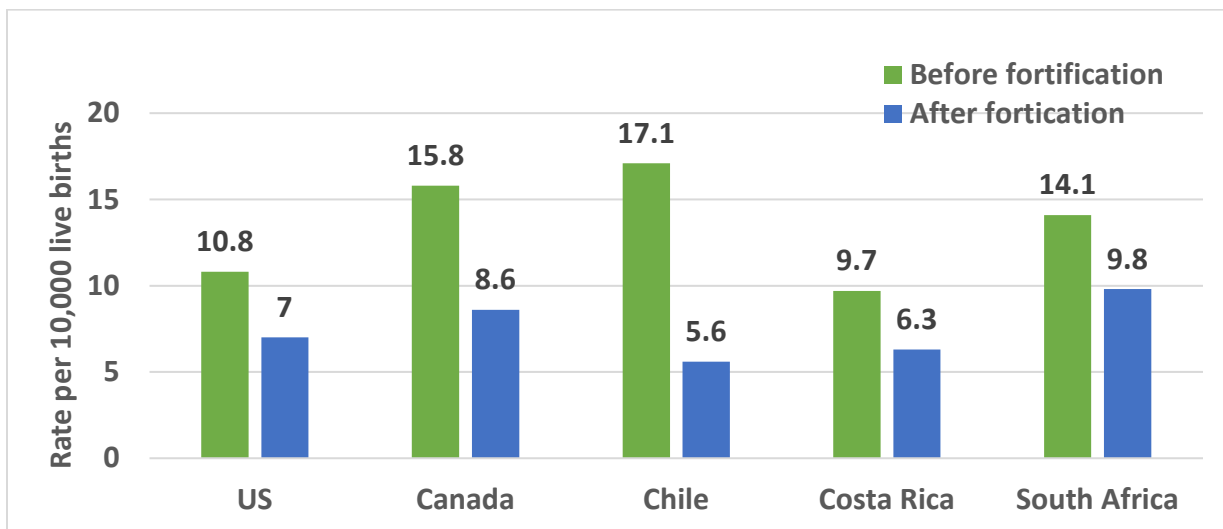
Fortifying commonly-eaten grains such as wheat flour, maize flour and rice is among the easiest and least expensive ways to prevent malnutrition, strengthen immune systems and nurture a healthy and productive next generation. When women in a population are getting enough folic acid before and during early pregnancy, the prevalence of neural tube defects is about 6 per



10,000 births. However, in approximately 80% of countries that reported an estimated prevalence for neural tube defects, the rate was higher than 6 per 10,000 births. According to a study<sup>6</sup> by America Center for Disease Control (CDC), those countries with rates higher than 6 per 10,000 births are considered to have a high prevalence. Unfortunately, Mauritius falls into this bracket.

The Graph 4 below, demonstrates the efficacy of mandatory fortification of staples with folic acid. It shows changes in Neural Tube defect prevalence before and after fortification around the world.

**Graph 4: Neural Tube defects prevalence changes before and after fortification**



Source: CDC (2016)<sup>7</sup>

A remarkable change has been realized in Chile and Canada. While changes in South Africa and Costa Rica are slow. The South African experience is probably due to large population consuming maize flour from the thousands of small and micro hummer millers across the country, which fortification is technologically challenging. With 100% of commercial milled flour, the rate of change can be faster.

<sup>6</sup>Key Findings: Global Burden of Neural Tube Defects <https://www.cdc.gov/ncbddd/birthdefectscount/features/kf-neutral-tube-defects-burden.html>

<sup>7</sup>CDC (2016) Folic Acid & Neural Tube Defects: Data & Statistics <https://www.cdc.gov/ncbddd/birthdefectscount/data.html>

## **7.2 Country Initiatives and Readiness for Mandatory Fortification**

### **Introduction**

Mauritius embarked on a path towards mandatory fortification. So far, a multi-sectoral committee including food producers and food processors, as well as consumer protection department, knowledge institutions civil society organization has been formed. The first committee meeting chaired by the Honorable Minister of Health and Wellness was conducted in August 2021. A national workplan and budget was prepared and agreed on with SADC to request FFI to provide technical assistance in formulation, implementation and monitoring of national fortification program. This plan was disrupted by covid-19. With the development and approval of SADC minimum regional standards for fortification, and FAO financial assistance, the time is ripe to move forwards. However, certain prerequisites such as mandatory law, national standards, Industry and government readiness are important and their status is discussed in the following sections.

### **Mandatory law**

Mauritius has no legislation for mandatory food fortification. Neither is there voluntary fortification going on in the country. The good news is that there is opportunity to insert a clause on mandatory food fortification in the Food Act which is being reviewed. The Minister of Health and Wellness is committed to ensure fortification is included in the revised Food Act soon to be tabled for discussions. However, since the review of the Food Act has to be passed by parliament, it may take long to be approved. An opportunity at hand is the review of the Food Regulations which can also provide for fortification of wheat flour with vitamins and minerals. Since reviewing the regulation is within the mandate of the Minister of Health and Wellness, it takes lesser time, so should be considered as the first priority. The inclusion of fortification regulation should cover both locally and imported wheat flour. It should also put in place monitoring guideline/protocols for effective monitoring for food at the production, markets and ports of entry.

### **National fortification standard**

The country has no national standard and specification for wheat grain and wheat flour. Wheat is imported by the private sector using international standards and ensures that the grain will enable it to meet flour specifications set by the STC and some of the private corporations. STC issues specification for the flour which MSB monitors for compliance. In the past, attempts to put in place standards for both grain and flour by MSB was not concluded.

In order to develop national fortification program, MSB will develop national standard for wheat flour, either by adopting or adapting the SADC regional approved minimum

standards within the next six months. STC which procures wheat flour under the government subsidy and distributes to consumers across the country, is committed to working with MSB to incorporate national standard in their specifications for procurement.

### **Industry readiness to fortify**

The mill has no experience in flour fortification. However, some of the milling staff had had experience in food fortification in their prior works stations elsewhere. The mill had in past made attempts to fortify flour and undertake baking trials with fortified flour, but could not complete the process due to no absence of technical guidance. The mill has four micro feeders dedicated for improvers and enzymes for the two production lines. The mill requires 4 micro-feeders for premix addition on the two production lines.

The mill has internal systems for QA/QC from raw materials to the final product. There are tests they run in the mill such as moisture, protein, minerals, falling numbers test etc. In addition, it has its own bakery where baking trials are conducted in the lab. According to the manager, the mill will require one additional staff in the quality assurance department dedicated to QA/QC of fortification. In terms of readiness for fortification, the mill has technical capacity for qualitative analysis, but lack the required equipment and technical capacity to undertake quantitative analysis, although arrangements can be made to fill this gap.

Government has frequent visits to mill to undertake compliance monitoring against STC specifications. This is done twice a year but with impromptu visits in between. The mill does internal marketing campaigns for their products.

### **Government capacity to monitor for compliance**

External monitoring is vital for compliance of the fortifying industry, although the industry has a robust internal monitoring system for self-regulation. As per the Food Act, the public health inspectors collect samples routinely for analysis (either at the point of entry or from the market). The system is functioning well and the technical capacity is adequate. Fortification monitoring will simply be integrated in the current system thus making it less costly. The analysis of samples collected from production sites, markets and ports of entry is undertaken by two accredited laboratories, namely Mauritius Standards Bureau (MSB) and the Government Analyst Division Lab.

Mauritius Standards Bureau (MSB), does quality tests on wheat flour procured by STC against STC specifications. MSB is the national standards body, operating under the supervision of the

Ministry of Industrial Developments, Small and Medium Enterprises and Cooperatives. However, MSB reported that, for rheology analysis, samples are sent to South African Grain Laboratory (SAGL) in South Africa. Qualities from Bakeries are also monitored. There are three types of bakeries where the bulk of flour goes, the STC subsidized and non-subsidized open market flours. These are traditional bakeries in the village, hi-tech bakeries in the cities and supper market/malls bakeries.

Another body responsible for micronutrient analysis will be the Government Analyst Division Laboratory (GADL). The GADL is a government Laboratory established under the Food Regulation Act. The department has five (5) sections of laboratories for different analysis such as food control, toxicological analysis, occupational health, hermitical quality control and nutrition analysis. On average 200 samples of different food are analyzed per month in the laboratory. In the nutrition lab, GAD has equipment and staff to analyze micronutrients in food, such as iron and zinc. They department is in process of running trials test analysis for folic acid. The lab has high turn-around period of 3 to 8 weeks for any sample analyzed. There are efforts being put to reduce this turn-around time. However, no lab has the dedicated equipment to analyze vitamins in food in the country apart from GADL.

### **Impact assessment**

Tracking impact of fortification is important in order to ascertain whether the micronutrient deficiencies are indeed being addressed. The department of Nutritional Sciences from the University of Mauritius has the capacity to undertake research pertaining to the impact assessment.

Currently the country is planning to undertake national nutrition survey. This is an opportunity to integrate micronutrient biomarker indicators to obtain baseline data on anemia (Iron deficiency anemia), Vitamin A deficiency (VAD), folate deficiency, iodine deficiency, as we formulate fortification program. However, Iodine deficiency components are missing among the key biomarker indicators due to lack of lab capacity to analyse them and financial challenges.

### **Advocacy on benefits of fortification**

Consumer education and advocacy on the benefits of consuming fortified foods is key for the success of fortification program. The Nutrition Unit and the Health Information and Education (HIEC) Unit of the MoHW will be responsible for fortification advocacy.

## 8. RECOMMENDATIONS

The following are the recommendations to address the weaknesses and take advantage of the opportunities for wheat flour fortification.

- The FFI consultants will draft a national food fortification strategy, incorporating a number of the findings with clear monitoring and evaluation framework. This will support the different sectors mentioned for proper planning and budgeting so as to avoid duplication of resources and efforts.
- MoHW was tasked to fast track the inclusion of a clause in amendment of the food regulation so that within the next six months, the revised regulation is in place for the industry and other stakeholder to prepare to start the fortification program by beginning 2023.
- Mauritius Standards Bureau (MSB) is to start the process of developing a national wheat flour fortification standard and the MoHW to request the standard in writing. The FFI consultants shall lend technical support during the process, which is expected to take a maximum of 6 months including gazette of the standards. When ready, STC shall use the standard (specifications) as a requirement for procurement.
- Both the MSB and GADL should budget to address equipment gaps to be prepared to analyze folic acid and Iron in flour besides other nutrients. There is need for GAD and MSB to invest in acquiring additional HPLC equipment for micronutrient analysis of vitamins and train lab personnel on the use of the HPLC equipment for vitamin analysis.
- In order to integrate fortification in the production system, the mill will require one additional staff, a maximum of 4 micro feeders and procurement of premix. Access to quality premix is key. The mill needs to be linked to the premix suppliers of which some of their ingredient suppliers are premix suppliers.
- The mill should continue to undertake baking trials and organoleptic studies to ascertain whether wheat flour fortification with vitamin and minerals affects color, texture, smell and taste, although we know from several studies, it does not. Organoleptic test (baking trials) of fortified wheat flour using the Mauritius standards is a good practice to ensure local ownership of the standard by stakeholder. The Food and Agricultural Extension Institute (FAREI), under the Ministry of Agriculture and the miller are well placed to undertake such trials.

- Apart from the nutrition surveys which come in 5 years' interval, annual compliance monitoring survey of sentinel type should be pursued as well. University of Mauritius and other research agencies need to collaborate with government.

## 9. Annex: Concorde Brands

Specialties	Use
Extra	bread making.
High Protein	pancakes, pies, quiches, cookies and pastries.
Premium	pastries and pastries.
Great	various uses
Self-Raising	Flour recommended for cakes, yeast cakes and donuts.
Semolina	biscuits, cakes, oriental delicacies, halwas, pudding and pasta.
Cake	bread, pastries and pastries
Pasta	Farathas, brioche, puff pastry, pizzas, pasta, noodles, milk bread, burgers, coconut macarons, sandwich bread.
Tradition	traditional breads.
Low Carb	bread with reduced glycemic value
Farathas	Farathas, unleavened bread, sandwich bread

### Alize Flour brand

The Farine des Alizés range has been designed to meet local demand as well as that of neighboring islands. The flours are specially adapted for making traditional French breads. These products are sold in 25 kg paper bags:

Specialties	Use
Extra	bread in the direct method or in controlled proofing
Oatmeal	Viennese pastries and pastries
Mi-Crème	bread with a cream crumb

### DoMix brand

products are baking mixes containing mixtures of wheat flour and baking ingredients. They are used in addition to white flour to make special breads. These products are sold in 10 kg paper bags.

Specialties	Use
Multigrain	specialty breads and cookies.
Campaign	special campaign-type breads
Nordic	Nordic-style special breads
Rye	special rye breads.

**Optimal brand**

Les Moulins de La Concorde offers bakers its Optimal improver, available in 10 kg sachets. It improves dough tolerance, prolongs fermentation and increases volumes.

**Individual uses**

LMLC provides two brands of wheat flour for all private uses. These are Bledor and Les Moulin. These are largely for household use which includes for local recipes. Bledor is suited to basic doughs, breads, pastries. It is packaged in 1kg sachets and cover all family uses. Les Moulin comes in 2kgs and 5kgs sachets and offers white and brown flour. LMLC sells bran to the animal food industry in bulk in the form of 25 and 50kgs. It is only available on order.