Changes in eating habits and food traditions of Indo-Mauritians

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Over the past two decades, there has been a shift towards consumption of energy-dense, imported processed foods and fast foods accompanied by a neglect of the traditional diets in many developing countries. A neglect of traditional food (TF) systems is related to nutrition transition marked by an increased consumption of unhealthy processed foods and significant lifestyle changes such as inadequate time for meal preparation. This nutrition transition (NT) has also resulted in a rise in diet-related chronic conditions. The current review aims to discuss the importance of TF and diets of Indo-Mauritians who constitute the majority of the general population in Mauritius as well as outline drivers behind the present NT. Understanding the functional properties of traditional foods is important in developing interventions to reduce the rising prevalence of chronic conditions such as obesity in Mauritius. A priority in view of the prevailing chronic disease burden could be to revive the use of neglected TF with high nutritive benefits through local nutrition education programs targeting the general population and in addition, to improve awareness of the high nutritive values of local TF in the education system as well as encouraging food companies to market these foods in an edible manner.

Keywords: Food traditions, Eating habits, Indo-Mauritians

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Located on the South-East coast of the African continent, Mauritius is a small island which has a population of about 1.3 million inhabitants. Being a multi-ethnic society, Mauritians whose ancestors come from India, also known as Indo-Mauritians, make up the majority (68%) of the entire population. More specifically, the Mauritian population is composed of Hindus (51.2%), Muslims (17.1%), Creole (30.2%), Chinese (0.7%) and others (0.8%)1. In addition, the Hindus can be further categorized into Biharis/North Indians–40%, Tamils–7%, Telegus–3% and Marathi–2%. After having undergone through major economic changes in the late 1970s and the 1980s2 and originally, having a low-income and agriculture-based economy, Mauritius is currently classified as an upper-middle income nation with a Gross National Income of US$ 9, 227 in 20133. Mauritius is now a diversified economy with growing industrial, financial, Information and Communication Technologies, sea-hub and tourist sectors4. Consequently, broader economic growth and urbanisation, coupled with globalisation, have led to a decline in food prices and improved access to cheaper and more food5.

From a nutrition perspective, there has been a shift from low-caloric and nutrient-rich foods to energy-dense foods, a greater consumption of fats and oils, processed foods and a higher intake of animal-based foodstuffs, especially protein and fats5. Combined with lack of exercise, a transition from labour-intensive work to sedentary jobs and the adoption of the Western culture and lifestyle, chronic conditions such as obesity are on the rise among Mauritians of different age groups, whether it be older individuals, middle-aged adults or adolescents6,7,8. For instance, the current prevalence of overweight and obesity (2011-2014) among Mauritian adults is 35.7%9. The adult prevalence rate has clearly increased since it was reported to be 34.9% in 2009, compared to 30.5% in 1987 when the first Non-Communicable Disease Survey had been carried out10,11.

Traditional foods commonly eaten among Indo-Mauritians have been neglected over time, making way to increased consumption of refined processed ones, convenience foods and fatty meat consumption. Indeed, foods such as plantains or raw bananas, tapioca, jackfruit, cassava, boiled vegetables and seafood, which were long considered as the main staples of the traditional Indo-Mauritian diet and

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having a high nutritive value, are now only occasionally eaten among the younger generations. Similar trends have been reported among other populations of Indian origin whereby traditional wild fruits are being less consumed although these traditional foods have a higher protein, iron, mineral and vitamin content\(^2\). Moreover, today food is more often consumed for pleasure and not solely to appease hunger and to meet bodily energy demands as it was the case for many Mauritian families decades ago. Along with that, it has been reported that Mauritian families prefer eating saltier and fattier fast foods with homemade meals becoming a rare practice among Mauritian families\(^3\).

In particular, traditional cereal and root staples in many economically developing countries such as in Mauritius have been replaced by ready-to-eat bread which requires less time and effort for preparation before eating\(^12\). Moreover, the types of staple consumed often determine the types of condiments with which they are eaten. As in the case of Mauritian food systems, root staples and tubers such as breadfruit, ‘patate’ (sweet potato) and cassava were often consumed with chutneys (plant-based products) and sauces which are much less fatty and salty than cheeses, processed meat, meat products and fat spreads that are now commonly eaten with bread. In addition, there has been an increased tendency among Mauritian families to eat away from home. Consumption of street foods and eating in fast-food restaurants are more frequent due to the shift in work environment\(^4\). Other factors include the mushrooming of food outlets and convenience stores, more active social life, higher income and increased advertisements aiming to promote westernized diets.

Consequently, though some studies have reported a link between current eating habits of Mauritian families and an increased risk of obesity or other chronic diseases, little data is available on the decline in the consumption of traditional foods, the nutritional benefits of these traditional meals and their dietary components along with the evolution of the current dietary practices of Indo-Mauritians. To the authors’ knowledge, this is the first study to explore the changes in traditional food practices which have occurred in Mauritius. The main objectives of this review are to:

1. Discuss the importance of traditional dietary practices of Indo-Mauritians.
2. Outline the factors that trigger nutritional transitions in Mauritius.

**Methods**

Using PubMed, Google Scholar and Science Direct, we searched the English-language literature that documented changes in traditional food systems in populations of Indian origin, including Mauritius. The following words “traditional foods”, “Indian”, “changes”, “importance” and “Mauritius” were used in the initial search step. As a result, 45 journal papers, reports and data sheets were included in the present study.

**Traditional food systems and their nutritional benefits**

Traditional foods (TF) can be defined as those foods which originate from local plant or animal resources through gathering and harvesting, and these foods also bear cultural meaning\(^15\). Before the advent of industrialisation and economic changes in Mauritius, traditional foods of Indo-Mauritians consisted mainly of wild grown vegetables also known as ‘brèdes’ (leafy vegetables), root staples like cassava, tapioca, cassava, sweet potato, grains such as corn, beans, fresh milk obtained through rearing of animals like goat and cows, and marine sources of animal protein through fishing. Given the very physical demands in fishing, rearing of animals, gathering and harvesting along with travelling long distances on foot, energy spent in obtaining food was very significant. Similar trends of obtaining food and which required physical exertion have been reported likewise among other populations such as Indian American and aboriginal communities\(^1,16\). Most often, energy expenditure was quite high due to labour-intensive work such as farming-related occupations and less use of transport vehicles coupled with significantly little time spent in watching the television.

**Composition of traditional foods**

Surprisingly, cassava, breadfruit and sweet potato were the preferred staples of the Mauritian diet instead of rice since during World War II, rice became scarce and had to be rationed\(^13\). Root vegetables were easily available and could be grown in one’s backyard. Further, wild leafy vegetables, known as “brèdes” in Mauritius, were often collected in different seasons, cooked and eaten with staple foods like rice\(^17\). Consequently, rice became a precious commodity during the 1970s and only people, who could afford it, would buy good quality rice while rationed rice was of poor quality. Through
testimonies of elderly people, it has been known that a small amount of rice, when eaten, was boiled with leafy vegetables and was prepared similarly to a soup consistency and then, eaten with chutneys, sauces or pickles.

There was no or little addition of cooking oil and salt was used sparingly since both items were not affordable to everyone. Once a week, fish was eaten and which was the preferred source of animal protein among Indo-Mauritians because of its easy availability and it was cheaper compared to other types of meat. Similarly, during the 1970s in India, instead of meat and meat products, whole grain cereals, pulses, fruits and vegetables were more often consumed. Hence, it can be inferred that similar meat and fish consumption patterns were followed among Indo-Mauritians during the 1970s to 1980s. As for grains and beans, varieties of dried beans such as ‘dholl’ and lentils were cooked together with rice and served while sometimes, seven varieties of dried beans and grains were ground, roasted together with salt or sugar and made into small balls. This was a very popular item known as ‘satwa’ which means the mixing of 7 beans or ingredients in one food only. Most importantly, ‘satwa’ was and is still viewed as extremely nourishing by elderly Indo-Mauritians and in particular, it was commonly consumed during and post pregnancy or during times of illness. Similar practices have been documented in areas of India such as in Himachal Pradesh where cereals and legume based foods are the common staples, and beans are often accompanied by rice or cooked flour dough known as ‘roties’. Like in other similar cultures, wild grown fruits such as guavas were often eaten while green banana, when cooked, was consumed and accompanied with chutney or chilies’ pickle. Popular snack items were maize pudding and steamed rice cakes, which is known as ‘poutou’ till today. Among the beverages, water and tea with milk were most commonly consumed. Soft drinks along with sweetened beverages were not common since they were not easily affordable.

In addition, particular attention should also be paid to the cooking methods of these TF. Similarly to other native Indian cultures, boiling was the most common cooking method among Indo-Mauritians simply because it was a cheaper and quicker way of preparing meals. An earth oven, which was usually constructed outside of home and made of wooden sticks and brick units, was used to prepare both animal and plant-based foods. Aside from boiling, broiling, roasting and heat or steamed methods of cooking food were common. Smoking and drying were often preferred methods of preserving and cooking meat or fish. In particular, fish products have been traditionally preserved by fermentation, salting, drying and smoking in the Northeast and South East parts of India, and these preserved fish products are consumed as a side dish with cooked rice.

Benefits of traditional foods

Although infectious diseases and infant mortality were the most urgent health problems among our ancestors, the traditional diets and consumption patterns among Indo-Mauritians provided many nutritional benefits along with advantages beyond nutrition. For instance, growing, gathering, harvesting and fishing activities related to TF systems confer health benefits through increased physical activity and it has been reported that some communities like the Innu people used to expend as much as 50 mega Joules of energy daily.

The nutritional benefits can be attributed to the following main factors:

(i) **The nutritional composition of TF**: Traditional wild plants are well known to be rich sources of essential micronutrients worldwide. For instance, *Artocarpus altilis*, commonly known as breadfruit, is a rich source of starch, carotenoids, vitamin A and has been traditionally used in the treatment of high blood pressure, urinary infections, meningitis, diarrhoea, dysentery, stomach aches, skin ailments, fungal infections. This brings up the fact that increasing research is being done on the therapeutic and pharmacologic effects of TF and their bioactive components. Further, wild traditional fruits such as jackfruit, papaya, guava among others, although not as tasty and desirable like the current popular ones, have been reported to have a higher protein, iron, sodium, potassium content and other nutrients.

While it is beyond the scope of this review to detail the therapeutic or medicinal effects, a cogent link between food and medicine is definite.

(ii) **Cooking methods**: Boiling, broiling, roasting and steaming being the main cooking methods among Indo-Mauritians required little or no use of cooking oil. Hence, the amount of fat
consumed suggests better blood lipid profiles and a reduced risk to chronic conditions such as cardiovascular problems and obesity. For instance, non-communicable diseases surveys between 1987 and 1998 depict an increase of as much as 60% for diabetes in Mauritius\textsuperscript{10}.

(iii) Low salt content: Most meals and TF, when consumed, had a low sodium intake and numerous studies have reported a significant association between low salt consumption and reduced risk of hypertension and chronic kidney disease\textsuperscript{23, 24}.

(iv) Vegetarian practices: Those who followed the traditional Indian diet, practiced vegetarianism and avoided meat or fish products\textsuperscript{25}. Vegetarian diets, which provide adequate levels of vegetables, fruits and fibre-rich grains, have been associated with a reduced risk of oral, oesophageal, and breast cancers\textsuperscript{26}. Although carbohydrate content of traditional diets was higher among Indo-Mauritians, meals consisted of little fat and physical activity level was higher in terms of labour-intensive and manual work.

(v) Use of spices and herbs: Spices and aromatic vegetable products, such as certain parts of herbs (seeds, leaves, barks, roots) were used to enhance taste and flavour in traditional diets\textsuperscript{26}. While these spices such as ginger, turmeric, clove, cardamom, cumin seeds among others have been known as home remedies for improving digestion, diarrhoea, sinus and colds, they are currently reported as chemo preventive agents having significant anti-oxidant and anti-inflammatory activities\textsuperscript{26, 27}.

**Evolution of traditional diets and current dietary practices**

The last three decades have witnessed a fundamental transformation of diets among essentially all ethnic groups in Mauritius. At the beginning of this transformation was the agro-industrial revolution in developing countries which enabled people to produce and to consume increasingly sophisticated food products\textsuperscript{5}. Over the years, although Mauritius has succeeded in achieving a certain measure of agricultural diversification in terms of crops like beans, peas, potato, maize, tomato, onion, cabbage, cauliflower, brinjal, ginger, garlic, ladies finger, carrot among others, a majority of foods including staples such as rice and cereals are still being imported\textsuperscript{5}. In particular, the import bill has more than doubled from 2001 to 2007 mainly due to the drastic increase in the import of processed food items\textsuperscript{28}. The food habits of Mauritian consumers, including those of Indo-Mauritians, have shifted towards processed and convenience foods, with an emphasis on quality, food safety and brands. These data demonstrate a shift in food habits among Mauritians, with changes in food availability and receding famine, increases in chronic diseases, and shifts to decreasing physical activity and increasing use of processed food high in starch, fat and sugar\textsuperscript{29}.

Similar trends have been reported in developing countries such as Malaysia as well. Changes in dietary patterns have been characterised by a decline in the consumption of traditional staple foods and crops, alongside there is an increase of preference for animal protein\textsuperscript{30}. Following economic growth among low income countries, an increase in the Gross Domestic Product (GDP) is accompanied by changes in food consumption patterns\textsuperscript{31}. And such patterns include a rise in the consumption of food items, derived from animal sources, such as milk, cheese, animal fats, meat and meat products. Hence, it can be inferred that a similar scenario has occurred in Mauritius, following an increase in GDP as from the mid-1980s and onwards. Even the staples eaten during breakfast, lunch and dinner have also considerably changed over the past 10-15 yrs among Mauritians. Consumption of bread, rice, ‘roti’ made with flour is decreasing while there is a high preference of highly processed foods, such as burgers, pizzas, French fries, chips, cakes, biscuits and sweetened breakfast cereals. Such shifts in dietary habits are notable not only among Indo-Mauritians but as well as among South Asians immigrants in Europe, such as those coming from India, Pakistan, Bangladesh and Sri Lanka\textsuperscript{32}.

In comparison to decades ago, homemade food has now become a rare commodity not only in Indo-Mauritian families, but among other ethnic groups as well\textsuperscript{1}. There has been a metamorphosis of the eating practices among Mauritians, irrespective of age, gender, ethnicity or social class. This is mainly due to urbanisation which creates new and improved marketing food strategies, attracts supermarkets and improves access to foreign suppliers in the overall food supply\textsuperscript{5}. Consequently, there has been an increased reliance on fast foods due to busy work schedules of many Mauritians and less time for meal preparations. In addition, this has led to more frequent snacking in
between meals. Although the literacy of the Mauritian population has improved significantly over the years and many people are health-conscious, the majority of places selling fast foods are usually overcrowded. Interestingly, taking the example of India, eating out is becoming more pervasive since eating out is a feature not just of the urban living, but also of slums and rural areas. While long ago, Mauritian school children and adolescents used to return home during lunch time to consume homemade meals consisting of rice, pulses or grain with vegetables, nowadays, most children bring energy-dense packed lunches to school. A study conducted among Mauritian school children aged between 8-12 yrs old reported that most packed lunches consisted of bread, eggs, sausages, red meat, poultry, burgers, ham and canned fish and with popular snacks being salty corn-based ones, chocolates and sweets. Similar trends have been observed in Kerala (India) and in Nairobi (Kenya), respectively whereby children spend more time watching television and reported increased caloric intake from fat, high sugar and refined cereal foods.

The last 20 yrs have also witnessed a rise in the number of women in the Mauritian workforce due to the industrial revolution and emergence of the manufacturing sector. The low percentage of women in the workforce in the late 1960s in Mauritius is consistent with the idea that the predominant role of women was that of a housewife and this occupation was typically characterised by cooking, housecleaning, and childcare. With the advent of the Export Processing Zone in Mauritius in 1970s-1980s, there has been a surge in the number of women in the Mauritian workforce and this implies that the role of the homemaker, especially healthy meal preparation, has gradually decreased and nowadays, is very scarce. Along with that, technological advances in food preparation and the advent of electronic appliances such as microwave ovens and refrigerators might have revolutionised meal preparation, resulting in an increase in the consumption of ready to eat and fast food which require minimal preparation at home. Indeed, there have been notable changes in the way food is cooked and stored, making preparation of meals more convenient and less time consuming, consequently reducing the workload of the working woman.

Health consequences of current dietary practices in Mauritius

Due to rapid industrialisation and significant improvements in living standards over the past decades, Mauritius has gone through an epidemiological transition in the profile of diseases. Maternal and child health problems have markedly declined and are controlled more effectively than decades back due to better healthcare programmes pertaining to immunization, ante and postnatal care. However at present, non-communicable diseases (NCDs) such as type 2 diabetes, obesity, high blood pressure, overweight and high blood lipid profile account for almost 85% of disease burden in the age group 25 - 74 yrs. In the past two generations, chronic conditions like obesity have become a major health problem and are believed to be associated with the easy availability of energy-dense foods and the rapid change from active to sedentary lifestyles. In this section, trends in obesity condition will be discussed only as it is beyond the scope of this review to cover all the other NCDs’ pattern in relation to diet and lifestyle.

Obesity

According to the World Health Organisation, Mauritius is already at an advanced stage in its epidemiological transition whereby NCDs risk factors are on the rise, namely overweight/obesity (50.9%) due to urbanisation along with openness of the island to the external world which has impacted on the eating habits and overall lifestyle of Mauritians over time. Recent studies indicate clearly that obesity is on the rise among several target populations, namely, among middle-aged, post-menopausal women, adolescents and school children. Specifically, the consequences of overweight and obesity are significant among Indo-Mauritians and African origin as there is baseline evidence to suggest that as from childhood, people of these two ethnic groups are more insulin resistant than their white counterparts. Moreover, in 2012, Mauritius had one of the highest rates of type 2 diabetes and it is well-known that obesity is a major risk factor of impaired glucose tolerance. Similar findings of a high prevalence of obesity have been reported among distinct ethnic groups, namely in American Indians and in British South Asians. Although the aetiology of obesity is multi-factorial, factors such as genetics and environments are clearly determinants and can be explained as follows:

(i) Genetics: Historically, for many Indian tribes, as in the case of Indo-Mauritians, periods of plentiful food have been frequently alternated
with periods of famine and it has been hypothesised that obesity results from the introduction of a continuous and ample food supply to people who have developed, through evolution, the ability to store energy efficiently and to survive through decades of feast-famine cycles\(^4\). This is known as the “thrifty gene” hypothesis which relates obesity in certain ethnic groups to a thrifty metabolism.

(ii) \textbf{Environmental factors}: Behavioural and lifestyle factors related to diet and physical activity levels are the major factors related to the rise in NCDs and their risk factors in the Mauritian population. Indeed, statistics from successive National NCD Surveys at 5-6 yrs intervals showed a rising trend in the prevalence of diabetes mellitus and hypertension over the period 1998-2009\(^5\). This period corroborates with the point in history, namely post the 1970s, during which major macro-level drivers such as economic growth, market integration and foreign direct investment produced radical changes in diet and physical activity patterns. Contrarily to the past generations, the current one in Mauritius follows a western dietary pattern characterised by a higher consumption of palatable processed, high-sugar, high-salt foods, meat and fast foods\(^6\).

(iii) \textbf{Socio-economic factors}: In developing countries as in Mauritius, food choice is mainly dictated by its price. Globalisation of food markets, fast food chains, and the increasing availability of street vendors, offers food at very competitive values, increasing availability of street vendors, and the increasing availability of street vendors, offers food at very competitive values, influence the eating habits of low socio-economic status (SES) people\(^7\). Differences in diet quality arise as a result of higher SES individuals being able to purchase fresh, nutrient-dense and better quality produce such as fresh fruits, vegetables, lean animal protein sources such as fish which are sold at a higher price in grocery and convenience stores\(^8\). Additionally, in Mauritius, food choices among low SES individuals are influenced by the price per weight of food products\(^9\). Low fat protein items such as pulses, which cost less per weight, are the preferred choices of low-income people.

**Recommendations and conclusions**

Eating habits of Indo-Mauritians and that of the general Mauritian population have changed over the past 20 yrs. With regards to traditional staple foods, a decrease in intake has occurred alongside with higher consumption of refined carbohydrate-rich foods, animal protein, processed meat and products while fruits and vegetables are consumed in less varieties and to a lesser extent. Consequently, these changes have resulted in a higher intake of energy relative to need, less fibre and low intake of micronutrients, phytochemicals and anti-oxidants which were previously prominent in traditional food items. Other changes in food intake trends include increased intake of western franchised fast foods as well as local energy-dense foods and snacks.

The shift from traditional diets to the current westernised diet and lifestyle in Mauritius have brought about serious health concerns such as a rise in chronic conditions like obesity which are the main causes of mortality and morbidity among Mauritians. While there is unlikely one single solution to prevent and to decrease the risk of nutrition-related NCDs, there is an obvious need to identify strategies in order to promote healthier choices in the Mauritian community. Most importantly, nutrition education programs aiming to promote the traditional diets of Mauritians should be considered in light of the increasing scientific evidence available on the therapeutic and medicinal properties of traditional foods. Such an initiative has been fruitful in the Pohnpei Island whereby an intervention program resulted in a significant decrease in rice consumption, an increase in the consumption of local varieties of fruits and vegetables, and a positive attitude towards local foods\(^9\). Hence, similar strategies need to be implemented among Mauritians since reviving the interest in the Mauritian traditional diet might be one of the solutions to tackle the rise in NCDs in Mauritius?

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