SHEFS

Future Food in India

Health and Environmental Impacts

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1. What is SHEFS?

SHEFS (Sustainable and Healthy Food Systems) is a global research programme using novel techniques to generate and synthesise evidence, and to help decision-makers create policies that deliver nutritious and healthy diets in an environmentally sustainable and socially equitable manner.

CONTENTS

2. Introduction

This brief provides an overview of the latest evidence from SHEFS, linking dietary patterns in India to their impact on population health and the environment.

SUMMARY: **Key findings**

- SHEFS research suggests that diets in India can be broadly categorised into five patterns that are either *rice-based* (most likely to be eaten in the South) or *wheat-based* (most likely to be eaten in the North).

- Underweight is more prevalent in the areas consuming *wheat-based* diets, and overweight is more prevalent in areas consuming *rice-based* diets.

- *Rice-based* diets have the highest greenhouse gas emissions and *wheat-based* diets use the most surface and groundwater in their production.

- Making small changes such as consuming less dairy and more fruits and vegetables could make diets healthier; reduce their environmental footprints and help India's food system become more sustainable; as well as helping to feed future generations.
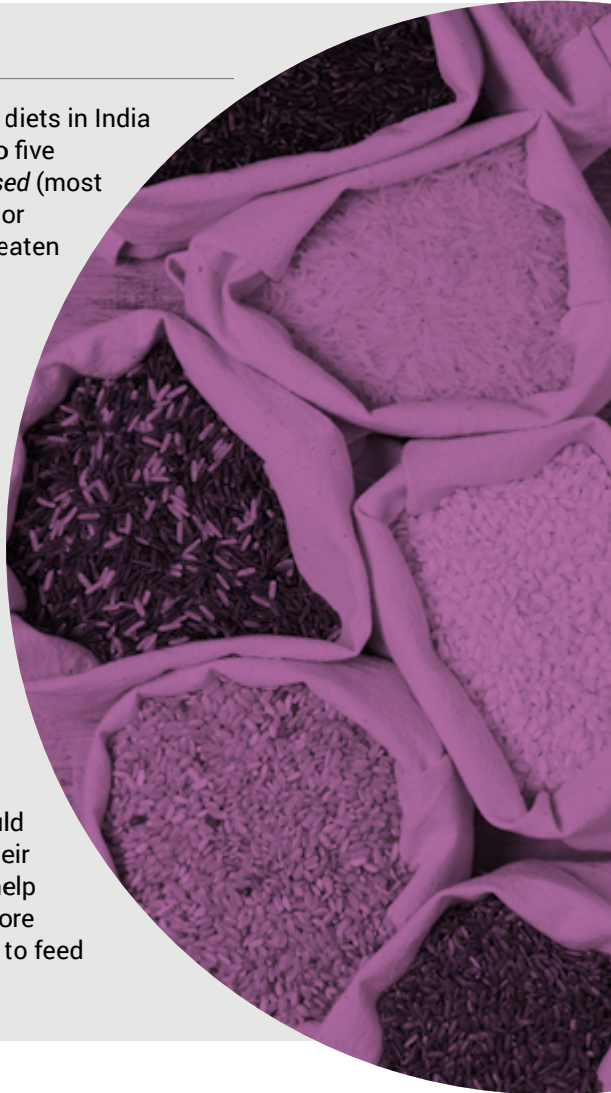
3. Indian Diets Today

Dietary patterns vary greatly across India, and their health and environmental impacts also vary significantly between regions. Diets in India can be broadly categorised into five different dietary patterns (*Figure 1*) related to where people live, their age, their gender and their education (based on data from 2005)[1]. The main differences between the dietary patterns are that some are based on *rice* and others are based on *wheat*. People in the South are more likely to eat *rice-based* diets, and people in the North are more likely to consume *wheat-based* diets. Within each broad dietary pattern there are differences between social strata. Better educated people in the South are more likely to eat a diet with rice and fruit, while better educated people in the North are more likely to eat a diet that contains both rice and wheat and which is rich in oil. This suggests that diets will change as populations become wealthier, and in most cases these new diets will also have higher environmental footprints. One dietary pattern also contains more meat than others, and this is consumed mainly in urban areas. Most diets are low in fruit and vegetables and contain too much salt.

FIGURE 1: Current dietary patterns in India *¹

JAMMU & KASHMIR

HIMACHAL PRADESH

PUNJAB

CHANDIGARH

UTTARAKHAND

HARYANA

NEW DELHI

ARUNACHAL PRADESH

RAJASTHAN

UTTAR PRADESH

SIKKIM

ASSAM

NAGALAND

MEGHALAYA

MANIPUR

BIHAR

GUJARAT

MADHYA PRADESH

JHARKHAND

WEST BENGAL

TRIPURA

MIZORAM

CHHATTISGARH

DAMAN & DIU

ODISHA

DADRA & NAGAR HAVELI

MAHARASHTRA

ANDHRA PRADESH

GOA

KARNATAKA

PUDUCHERRY

ANDAMAN & NICOBAR ISLANDS

LAKSHADWEEP

TAMIL NADU

KERALA

The rice and meat diet is also consumed in the blue and yellow states, but mainly in urban areas

KEY

■ **Purple** wheat, rice and oils
■ **Yellow** rice and fruit
■ **Blue** rice and low diversity

■ **Green** wheat and pulses
□ **White** indicates data unavailable
▲ States have small data samples

*¹ Map represents state lines at time of data collection (2005)

4. Human Health Impact

Consumers of each dietary pattern vary in their nutrition and health status. Although consumers of the *rice and fruit* pattern are the most likely to be obese, they have a lower risk of having high blood pressure. Consumers of the *wheat and pulses* and *rice and meat* patterns are the most likely to have a high waist-hip ratio which is associated with increased risk of Type 2 diabetes.

Consumers of the *wheat-based* diets are the least likely to be obese and the most likely to be underweight[1]. Regional differences in health (*Figure 2*) correlate with the dietary patterns in that the *wheat-based* patterns are more prevalent in areas with greater levels of undernutrition, while the *rice-based* patterns tend to be more prevalent in areas with greater levels of obesity.

> ❝ *Regional differences in health correlate with the dietary patterns in that the wheat-based patterns are more prevalent in areas with greater levels of undernutrition, while the rice-based patterns tend to be more prevalent in areas with greater levels of obesity*

Map of India showing obesity rates by state:

- JAMMU & KASHMIR
- HIMACHAL PRADESH
- PUNJAB
- UTTARAKHAND
- HARYANA
- NEW DELHI
- RAJASTHAN
- UTTAR PRADESH
- ARUNACHAL PRADESH
- SIKKIM
- ASSAM
- NAGALAND
- MANIPUR
- BIHAR
- MEGHALAYA
- JHARKHAND
- WEST BENGAL
- GUJARAT
- MADHYA PRADESH
- TRIPURA
- MIZORAM
- DAMAN & DIU
- CHHATTISGARH
- ODISHA
- DADRA & NAGAR HAVELI
- MAHARASHTRA
- TELANGANA
- GOA
- ANDHRA PRADESH
- KARNATAKA
- PUDUCHERRY
- TAMIL NADU
- ANDAMAN & NICOBAR ISLANDS
- LAKSHADWEEP
- KERALA

KEY

- ■ **Green** indicates below national average
- ■ **Purple** indicates above national average
- ☐ **White** indicates data unavailable
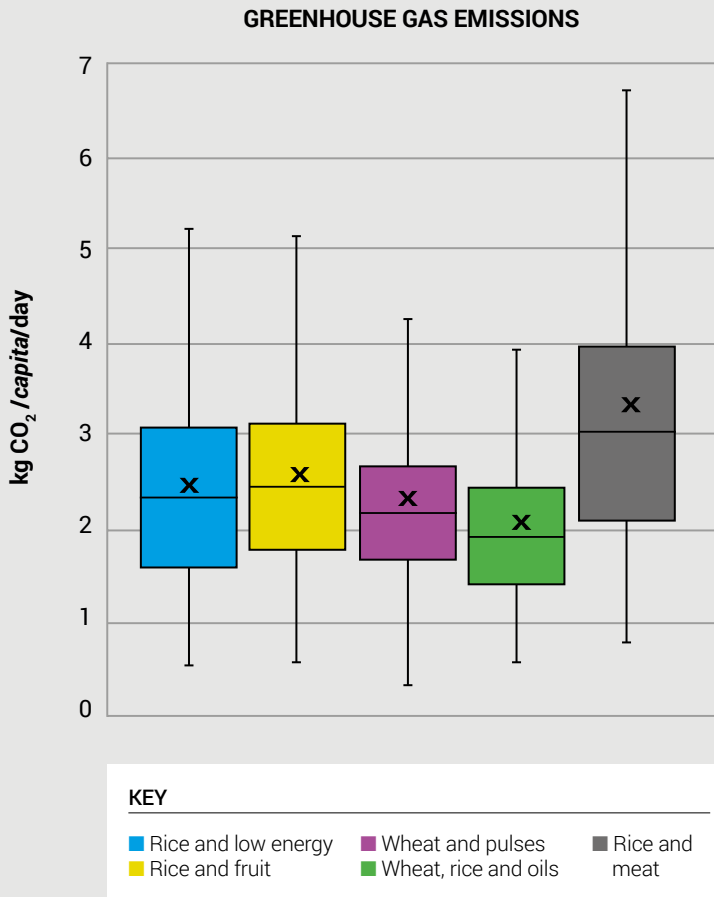
5. Greenhouse Gas Emissions and Land Use

The food system is a major contributor to India's greenhouse gas emissions. However, the typical Indian dietary patterns have different environmental implications.

The *rice-based* diets have the highest greenhouse gas emissions (*Figure 3*) because irrigated rice produces methane (a very potent greenhouse gas). The *rice and meat* diet eaten more in urban areas[3] has the most emissions overall because in addition to the rice, ruminant animals such as mutton produce methane and nitrous oxide. The *rice and meat* diet also uses the most land to produce the food eaten[4]. However, in comparison to other countries such as the USA and the UK, per-capita greenhouse gas emissions from Indian diets remain low.

GREENHOUSE GAS EMISSIONS

KEY

■ Rice and low energy   ■ Wheat and pulses   ■ Rice and
■ Rice and fruit   ■ Wheat, rice and oils   meat

> 66 **The food system is a major contributor to India's greenhouse gas emissions.**

* The **x** represents the mean, the line through the middle of the box is the median, the outside of each box is the 1st and 3rd quartiles, and the distance between the two whiskers is the range.
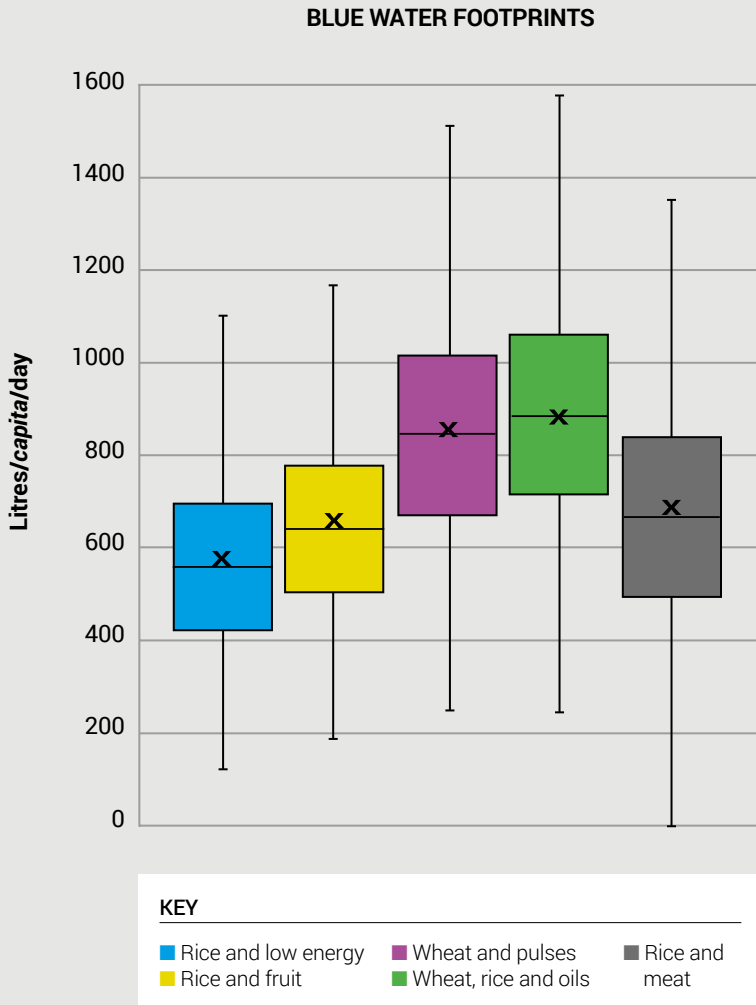
6. Water Use

Blue water is fresh surface and groundwater – in other words, the water in lakes, rivers and bodies of rock holding water below the earth's surface. This water is used for irrigation when there is insufficient rainfall – during the dry Rabi season, for example. Green water (rainfall) is also used, and is abundant during the monsoon or Kharif season. Because the monsoon rains are becoming less reliable, blue water is increasingly being used to irrigate India's food production. This is a potential problem as some water reserves are finite and already scarce in certain areas.

Rice-based diets require the most water to be produced, but this comes from both blue and green water resources. *Wheat-based* diets are more dependent on blue water and are therefore reliant on depleting resources (*Figure 4*)[3]. Blue water usage by the food system is the most concerning because many parts of India are experiencing groundwater depletion[5]. Current Indian diets use more blue water than average global diets, and small dietary changes can make a large difference at a population level. For example, shifts away from wheat to increased sorghum and millet consumption would reduce blue water use[6].

> **Blue water usage by the food system is the most concerning because many parts of India are experiencing groundwater depletion**

FIGURE 4: Blue water footprints of the five dietary patterns. The blue water footprint provides a measure of the volume of irrigation water used in the production of diets*

BLUE WATER FOOTPRINTS

KEY

- Rice and low energy
- Rice and fruit
- Wheat and pulses
- Wheat, rice and oils
- Rice and meat

* The **x** represents the mean, the line through the middle of the box is the median, the outside of each box is the 1st and 3rd quartiles, and the distance between the two whiskers is the range.

7. Future Diets: Population projections and implications for national food production

Predicted future diets in India are expected to contain more fruit, vegetables, potatoes and dairy products. Consumption levels of cereals are expected to stay the same, and meat consumption is expected to stay low[3].

If each dietary pattern was made healthier (i.e. meeting WHO nutritional guidelines)[7] this could reduce the amount of water used in Indian agriculture by 30% (*Figure 5*). This would be enough to provide the growing population up to 2050 with healthy diets without using more water in Indian agriculture. The main changes would be to eat less wheat and dairy, and to eat more fruit and vegetables[8]. This would also reduce greenhouse gas emissions from diets and the healthier diet would reduce deaths from non-communicable diseases.

FIGURE 5: Change in environmental impact that could be seen by 2050 if optimised dietary patterns were adopted

KEY
- Blue Water Footprint
- Greenhouse Gas Emissions
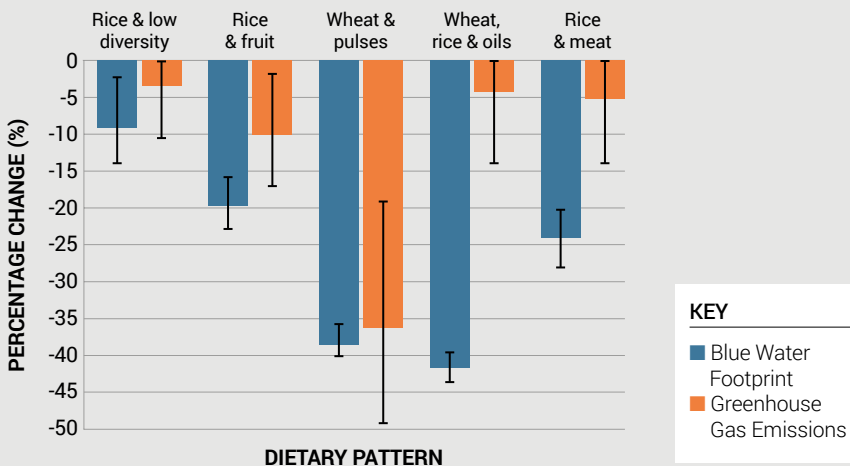
Future Diets

Although these changes could have huge importance, there is still a need to produce more food in India to feed a growing population. In the last decade, cereal production in India has increased by 26%[6]. This increase resulted from improvements in agricultural production that increased yields, rather than more land or water being used. Whether this trend can continue in an environmentally sustainable manner is uncertain. For example, increasingly extreme weather in the monsoon seasons means there is a growing dependency on cereal production in the dry season, and as a result more of the finite blue water reserves are being used. Improvements in agricultural production must therefore also continue to ensure that increasing food production in India also supports a healthy environment.

> **Improvements in agricultural production must therefore also continue to ensure that increasing food production in India also supports a healthy environment**

8. Conclusion

This brief summarises evidence generated by SHEFS on the health and environmental impacts of dietary patterns in India. This evidence is provided to help policy makers understand the complex interaction between diets, environment and health in India and the implications for the future. Further SHEFS research will aim to provide the basis for specific policy recommendations to shape a food system in India that delivers healthy, sustainable and socially equitable diets.
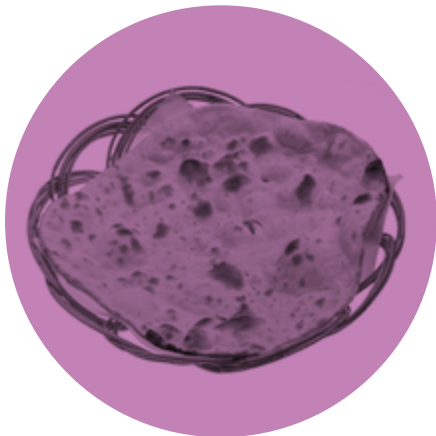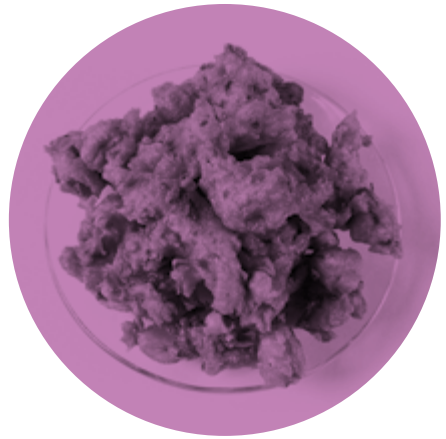
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