INITIATIVE ON Sustainable Healthy Diets

SHiFT PROJECT NOTE JUNE 2024

Socio-economic, environmental and health impacts of dietary transformation in Bangladesh

A scenario simulation study for the period 2022-2040

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Introduction

Recently, in many low- and middle-income countries, a rise in income, urbanization and a change in lifestyles have resulted in a shift in dietary patterns from mainly staple crops, such as rice, wheat and maize, towards a diet characterized by higher intake of meat, sugar and processed foods. This so-called nutrition transition has led to a situation in many countries that is referred to as the double burden of malnutrition, which is defined as the simultaneous observation of both undernutrition and overweight, obesity, and diet-related non-communicable diseases (Popkin et al., 2020). The change in diets, and in particular the worldwide rise in the consumption of animal protein, also has had a strong negative impact on the environment, including loss in biodiversity, water resource depletion, deforestation, and an increase in greenhouse gas (GHG) emissions (Willett et al., 2019).

There is consensus that the transformation towards sustainable healthy diets is regarded as a key strategy to improve human nutrition and health, combat poverty and promote environmental sustainability (GLOPAN, 2020). *Sustainable healthy diets* are defined by the Food and Agriculture Organization of the United Nations (FAO) as “a dietary pattern that promotes all dimensions of individuals’ health and wellbeing; has low environmental pressure and impact; is accessible, affordable, safe and equitable; and is culturally acceptable” (FAO & WHO, 2019).

Several studies show that adoption of diets which are characterized by low-meat content or are completely plant-based, result in improved health outcomes but might lead to an increase in cropland, freshwater and fertilizer use in several low-income countries (Springmann et al., 2018). This suggests that there might be unintended consequences and trade-offs that need to be addressed by decisionmakers when promoting the uptake of healthy diets.

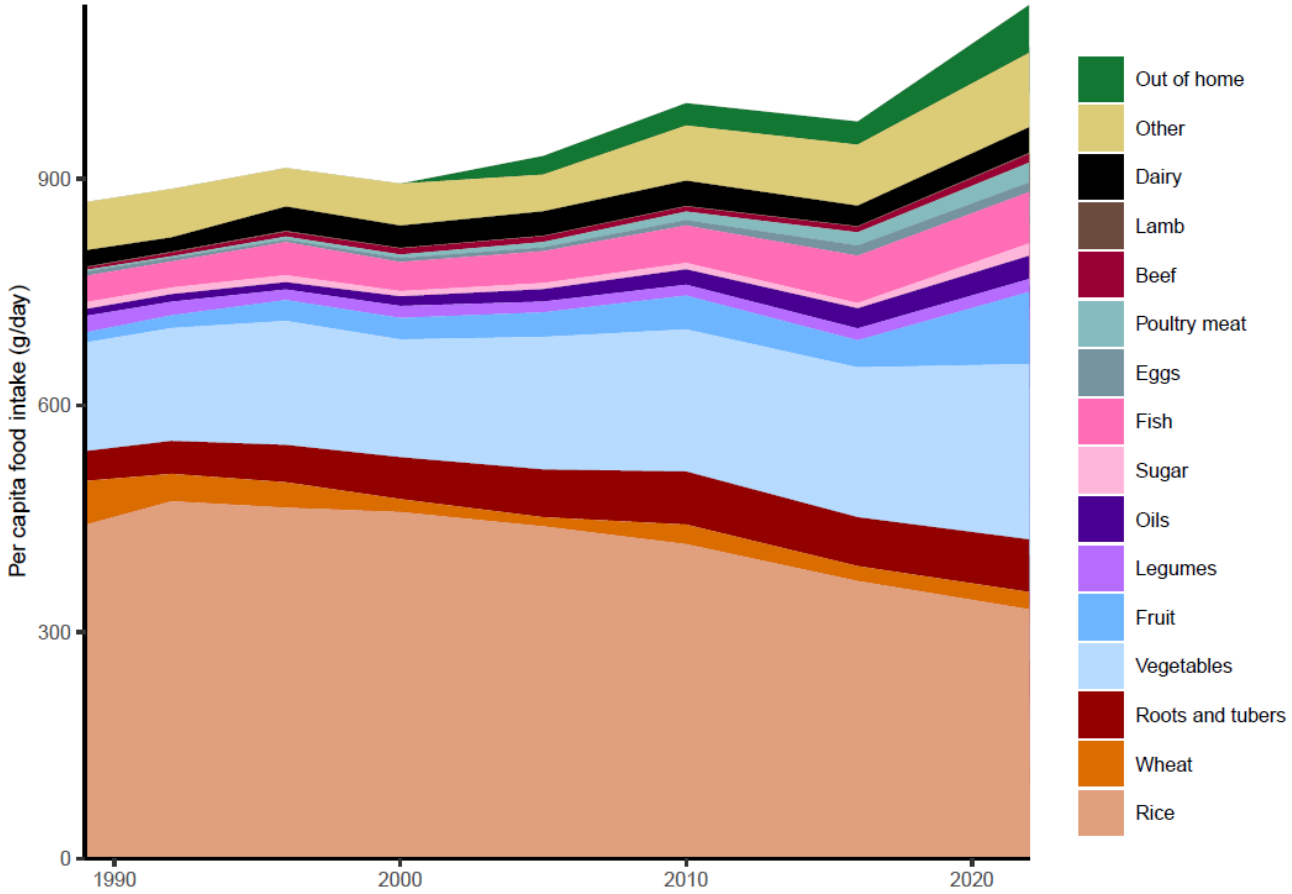
The aim of this study is to assess the potential trade-offs between socio-economic, health and environmental impacts associated with a transition towards healthier diets in Bangladesh for the period 2022-

2040. The forward-looking approach, which compares two healthy diet scenarios with a business-as-usual future in which the diets follow a pattern consistent with the widely observed nutrition transition, will be useful to inform long-run national strategies such as Vision-2041, Bangladesh's long-run plan to achieve high-income status and eradicate poverty by 2041, as well as the national food system transformation pathway that has been developed with support from the 2021 United Nations Food Systems Summit (UNFSS) initiative.

Dietary change is happening in Bangladesh

Over the last decades, Bangladesh has experienced strong economic growth and impressive poverty reduction. As a result, the country has made major progress in reducing malnutrition (Nguyen et al., 2022). The increase in household income, combined with rapid urbanization, have resulted in an improvement in diet quality characterized by a substantial decrease in rice consumption and an increase in the demand for under-consumed food groups like poultry and fruits. At the same time, the consumption of sugar and oils has considerably expanded (Figure 1). Like other low- and middle-income countries, Bangladesh is also plagued by the double burden of malnutrition. According to a recent study, between 2004 and 2018, overweight/obesity increased substantially (17% to 49% for women and 21% to 34% for men), resulting in a rise in the incidence of non-communicable diseases like hypertension and diabetes (Nguyen et al., 2022).

Figure 1: Daily per capita food intake (grams/cap/day), 1989-2022



Note: Food purchase values were converted to food intake levels by adjusting for household waste and edible fraction. Source: Bangladesh Bureau of Statistics (1997, 2023).

Despite recent improvements, the prevalence of underweight in both women (12%) and men (18%) is still high. The change in food consumption patterns, combined with population growth have put substantial pressure on the environment, with detrimental effects on soil and water resources, thereby threatening ecosystems and biodiversity (Hasnat et al., 2018).

Dietary scenarios

For this foresight exercise, we compared three dietary scenarios: business as usual (BAU), the EAT-Lancet, and the national Food Based Dietary Guidelines (FBDG).

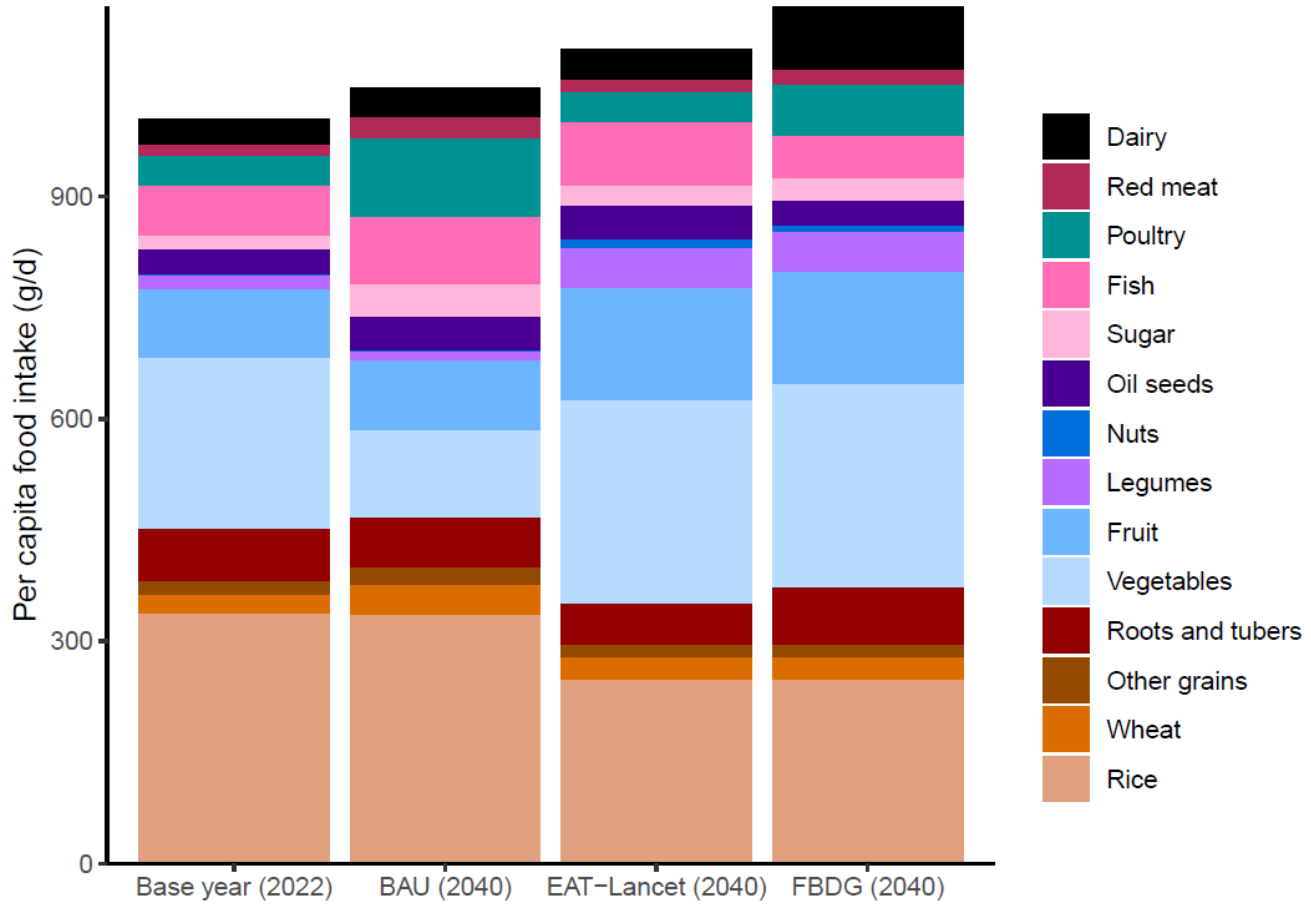
The BAU assumes that dietary change will follow a pattern that is consistent with the nutrition transition that has been observed in many countries. It is based on detailed long run national food demand projections based on historical trends (Bodirsky et al., 2020). The increase in household income in combination with demographic change and urbanization is expected to result in increasing consumption of oils (+43%), sugar (+136%), poultry (+166%) and wheat (+60%), while the intake of vegetables (-49%) and legumes (-33%) is expected to decrease (Figure 2). As a result, total energy intake will increase from 2,199 kcal/cap/day in 2022 to 2,547 kcal/cap/day in 2040.

The EAT-Lancet diet, which is regarded as the standard reference for a global sustainable and healthy diet, is taken from Willett et al. (2019). In the EAT-Lancet scenario, the intake of rice is expected to decrease sharply (-26%), whereas the consumption of oils (+43%), nuts (+316%), fruit (+62%), vegetables (+19%) and legumes (+202%) rises. Total energy intake (2,278 kcal/cap/day) is comparable to current levels, but the composition of the diet differs.

The FBDG scenario is based on Bangladesh's national Food Based Dietary Guidelines (Ministry of Food, 2021), which serves as a national policy reference for a healthy diet. The total recommended energy intake in the FBDG diet (2,238 kcal/cap/day) is similar to the EAT-Lancet diet but there are differences at food group level. The main difference is the higher recommended intake of red meat, poultry and dairy while the recommendations for nuts, oil seeds and fish are lower.

Transformation of diets is a long-run complex process, which might take years or even decades. Future dietary composition and total consumption levels, as well as their impact on socio-economic conditions, health and the environment, strongly depend on major drivers, in particular change in income and population growth. In our scenario and modelling design, we assumed that the change in diets from the current level to the BAU, EAT-Lancet and FBDG targets will take approximately 30 years. To maintain consistency with Vision-2041, Bangladesh' key long-term strategy, all assumptions and outcomes are presented for the year 2040. In line with the historical trends, we expect gross domestic product (GDP) per capita to increase with around 5% on average while the population will increase from 171 million in 2022 to 193 million in 2040, consistent with the UN medium population projections (see methods).

Figure 2: Daily per capita food intake for the base year and business as usual (BAU), EAT-Lancet and Food Based Dietary Guidelines (FBDG) scenarios



Note: It is assumed that Bangladesh will gradually reach the BAU, EAT-Lancet and FBDG targets by 2050. The figure shows 2040 intake targets. Source**:** For base year (2022), Bangladesh Household Income and Expenditure Survey 2022; for BAU (2040), model simulation based on Bodirsky et al., 2020; for EAT-Lancet (2040), Willett et al., 2019; and for FBDG (2040), Ministry of Food, 2021.

Impacts of dietary transformation

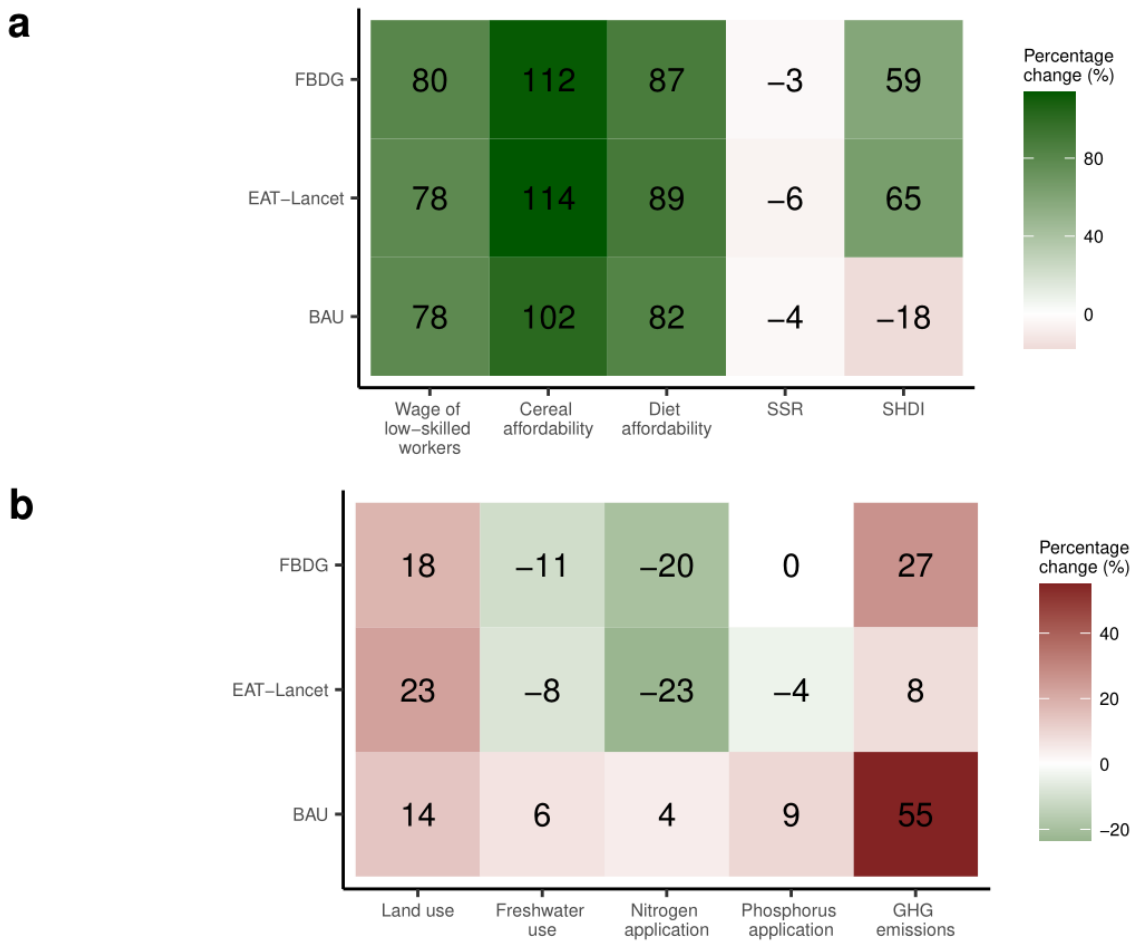
Figure 3 summarizes the projected change for ten socio-economic, health and environmental indicators across the three dietary scenarios between 2022 and 2040. The figure shows that none of the three diets performed the best on all indicators.

Between 2022 and 2040, the wages of low-skilled workers are expected to improve in all three scenarios (+78% to +80%). This is not surprising as in all scenarios, GDP growth is high, resulting in high real wage growth rates. An expected increase in agricultural productivity leads to lower cereal prices, which, in combination with higher wages results in an increase in affordability of cereals (predominantly rice) in all three scenarios (+102% to +112%). For similar reasons, prices across almost all food groups decrease, which causes an improvement in the affordability of the total diet (+82% to +89%). The self-sufficiency ratio (SSR) in Bangladesh marginally decreases (-6% to -3%) in all three dietary scenarios, which can be explained by a net increase in calorie imports of mainly oil seeds in the BAU and EAT-Lancet scenarios, and nut imports in the EAT-Lancet and FBDG scenarios. The healthiness of the diet (SHDI), which is negatively associated with the risk of non-communicable disease (e.g. diabetes, hypertension and obesity), substantially improves in the EAT-Lancet (+65%) and FBDG (+59%) scenarios

due to an increase in consumption of fruits, vegetables, legumes, and whole grains, while it decreases in the BAU scenario (-18%) because of excessive consumption of poultry and red meat, and a decrease in vegetable consumption.

The differences between the three scenarios are larger for the health and the environmental indicators. Apart from land use, the BAU scenario has the most negative impact on the environment, while the environmental footprint for the FBDG and EAT-Lancet scenarios is comparable and largely positive. By far, the growth in GHG emissions is the highest in the BAU scenario (+55%) mainly caused by the increase in red meat consumption. Nonetheless, emissions are also expected to increase in the EAT-Lancet (+8%) and FBDG (+27%) scenarios, although much less in the former case. The BAU scenario also results in higher water (+6%), nitrogen (+4%) and phosphorus use (+9%), which contrasts with the other two dietary scenarios where application rates decrease (-23% to 0%). In all three scenarios the demand for land will rise (+14% to +18%) because of the increasing demand from a growing population. The growth in land use is the highest in the EAT-Lancet scenario because of the combined increase in legumes, oil seeds and nuts.

Figure 3: Multiple impacts for three dietary scenarios between 2022 and 2040 (percentage change), (a) socio-economic and health impacts and (b) environmental impacts

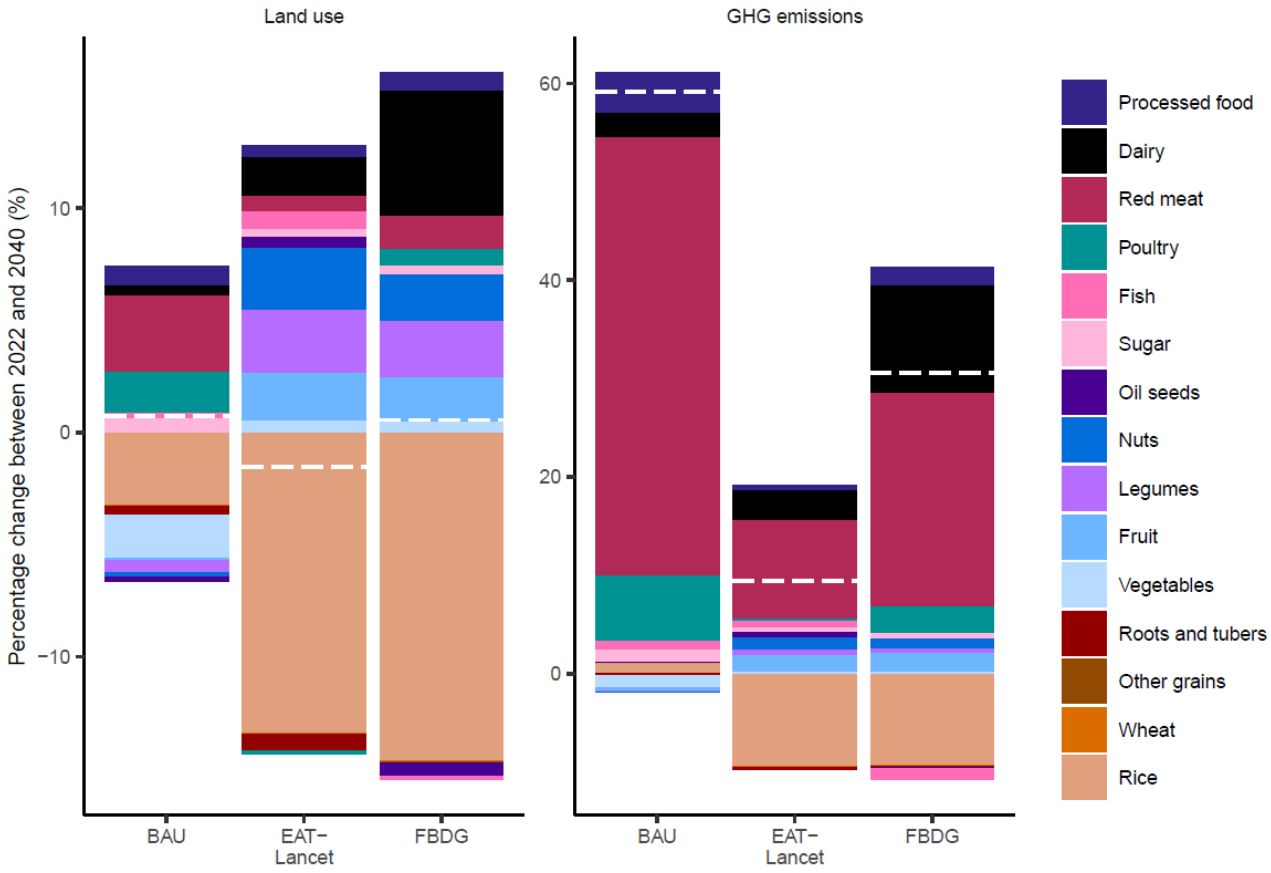


Note: SSR=Self-sufficiency ratio and SHDI=Sustainable and Healthy Diet Index. The change in environmental indicators includes both domestic and international effects. GHG emissions reflect only emissions related to food production.

It is important to examine whether the environmental impacts occur in Bangladesh or in the countries from which it imports. Detailed results indicate that the expected increase in crop land occurs almost entirely abroad because of the limited availability of agricultural land in Bangladesh, while the change in GHG emissions occurs in Bangladesh, mainly because of national growth in animal meat production. The impact on water, phosphorus and nitrogen has mixed effects in Bangladesh and abroad.

Focusing on the impact of dietary change in Bangladesh alone, we see that although the net land use change is near zero in Bangladesh, a share of the land that is used for the production of rice will be substituted by other crops in all three scenarios (Figure 4). The most dynamic pattern of land use change is observed in the EAT-Lancet and FBDG scenarios, where land is mainly substituted for the production of (feed for) dairy products and nuts, legumes and fruits. As mentioned above, the increase in GHG emissions from food production in Bangladesh is mainly due to the increase in (red) meat and dairy production, with the highest increase in the BAU secnario, followed by the FBDG and EAT-Lancet scenarios. In the latter two scenarios, the increase in GHG emissions is partly offset by a reduction in rice production and related emissions (Figure 4).

Figure 4: Change in land use and GHG emissions per food group between 2022 and 2040 in Bangladesh



Note: The figure presents the change in land use and GHG emissions for each food group in Bangladesh. For each indicator and scenario, the sum over all food groups measures total net domestic change, indicated by a white dashed line.

Conclusions

This research suggests four key implications for policies that aim to support the transformation toward healthy diets in Bangladesh.

First, the scenario analysis showed that the transition towards a healthy diet, as shown in the two healthy diet scenarios, will be positive from a socio-economic, health and environmental perspective compared to the BAU scenario, which is consistent with the widely observed nutrition transition, and describes a shift to a diet that is higher in energy and characterized by higher consumption of meat, dairy and sugars. The desired change towards a healthy diet will require the implementation of a combination of policies that aim to change the behavior of consumers, ranging from campaigns to promote dietary guidelines, food labelling, as well as financial interventions, such as taxes and subsidies.

Second, the study showed that even the widespread adoption of healthy diets, as shown in the two healthy diet scenarios, will lead to an increase in GHG emissions and land use because of the increase in the total food demand. This is mainly caused by the expected population growth in Bangladesh between 2022 and 2040, which demands an increase in food production. This shows that there are important trade-offs between health outcomes and environmental sustainability that policymakers in Bangladesh need to be aware of when formulating policies to transform the food system. It also implies that, in addition to promoting dietary change, additional interventions are needed to reduce the environmental footprint of food consumption, including policies to reduce food loss and waste and the promotion and uptake of sustainable production practices, such as alternate wetting and drying rice production and conservation agriculture (Ministry of Environment, Forest and Climate Change, 2021).

Third, in the two healthy diet scenarios, rice consumption is expected to decrease substantially, while the demand for vegetables, fruits, legumes and nuts will grow. To meet consumer demand and ensure self-sufficiency, policies should prioritize agricultural diversification, direct investment towards market and storage facilities and foster private sector participation across the horticulture value chain (Nandi et al., 2023).

Finally, between the scenarios, strong differences were observed in whether the impacts take place in Bangladesh or in the countries that export to Bangladesh. This illustrates that national promotion of healthy diets might result in negative spillovers to other countries through international trade effects. Decisionmakers should be aware of these effects when implementing national development strategies such as Vision-2041 and the national food system transformation pathway.

Methods

For this study, we used the global computable general equilibrium (CGE) model, MAGNET (www.magnet-model.org) to analyze the potential trade-offs between socio-economic, health, and environmental impacts of dietary transformation (de Lange et al., 2024). A CGE model is an economic simulation model that covers the dynamics of the entire economy and international trade, which is particularly useful for analyzing long-term transitions in a global context. We extended the model with an environmental footprint module, which allows us to derive the environmental impact of changes in food consumption.

MAGNET is a global economic simulation model. It includes detailed economic information for 141 countries, including Bangladesh, based on national data sources. For this study, we improved the consumption data for Bangladesh by using food intake information from the 2022 Household Income and Expenditure Survey (HIES), (Bangladesh Bureau of Statistics, 2023).

The main long-run scenario drivers in MAGNET are population growth, GDP growth and technical change. Long-run future trends of these variables for Bangladesh are based on the Middle of the Road (SSP2) scenario storyline from the Shared-Socioeconomic Pathways (SSPs), which represents a business as usual future that is in line with historical economic growth and population projections (UNDESA, 2022). The SSPs are a widely adopted and scientifically validated scenario framework used in all major global health, environmental and climate assessments (Riahi et al., 2017).

To simulate the dietary scenarios, we assumed that food demand in Bangladesh will gradually converge to a target diet by 2050. The BAU dietary target was taken from Bodirsky et al. (2020), the EAT-Lancet target was taken from Willett et al. (2019) and the FBDG target was taken from the Ministry of Food (2021). All diets were adjusted for change in food waste to derive total food production targets.

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