FOOD AND HEALTH

This theme examines the geography of food and health. Economic development is often accompanied by changes in diet and in disease pattern. However, neither food intake nor health is easy to measure. Food and health are closely related. The provision of food and health are influenced by gender, TNCs and governments.

You should be able to show:
- ways of measuring disparities in food and health between places;
- how physical and human processes lead to changes in food production and consumption, and incidence and spread of disease;
- the power of different stakeholders in relation to influence over diets and health;
- future possibilities for sustainable agriculture and improved health.

F.1 MEASURING FOOD AND HEALTH

- Food security – food security for a population exists when all its people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.
- Nutrition transition – the change in diet that is associated with a population becoming wealthier (shifting from low income to middle income) and consuming more meat and dairy products.
- Epidemiology – the study of diseases.
- Epidemiological transition – the shift in the major diseases experienced as a population moves from being poorer to wealthier. For example, a decrease in infectious diseases but an increase in degenerative diseases.

Global patterns in food/nutrition indicators

There are many inequalities in access to food and nutrition. Some of the data uses terms that are quite subjective, such as the Global Hunger Index, although they are comprised of many elements related to malnutrition and mortality. The Food Security Index measures the affordability, availability and quality of food. The Global Hunger Index (GHI) is a composite indicator, consisting of three main components (but four indicators). These include child mortality (as measured by the under-5 mortality rate), child undernutrition (stunting and wasting) and inadequate access to food.

You should be able to show ways of measuring disparities in food and health between places:
- Global patterns in food/nutrition indicators, including the food security index, the hunger index, calories per person/capita, indicators of malnutrition;
- The nutrition transition, and associated regional variations of food consumption and nutrition choices;
- Global patterns in health indicators, including health-adjusted life expectancy (HALE), infant mortality, maternal mortality, access to sanitation and the ratio between doctors/physicians and people;
- The epidemiological transition, the diseases continuum (diseases of poverty to diseases of affluence), and the implications of a global aging population for disease burden.

Global patterns in health indicators

Health-adjusted life expectancy (HALE)

HALE is an indicator of the overall health of a population. It combines measures of both age- and sex-specific health data, and age- and sex-specific mortality data, into a single statistic. HALE indicates the number of expected years of life equivalent to years lived in full health, based on the average experience in a population. Thus, HALE is a measure of quantity of life and of quality of life.
The social burden of ill health is higher for women than for men.

The social burden of ill health is highest among those in “early” old age, not among the very elderly.

Higher socio-economic status confers a dual advantage—longer life expectancy and a lower burden of ill health.

Infant mortality rate

The infant mortality rate (IMR) is the number of deaths in children under the age of 1 per 1,000 live births. It is an age-specific mortality rate, that is, it is comparing the death rates among the same ages, and so is more useful than the crude death rate.

Maternal mortality rates

The maternal mortality rate (MMR) is the annual number of female deaths per 100,000 live births from any cause related to or aggravated by pregnancy or its management. In 2016, South Sudan had the highest MMR with over 2,000 deaths per 100,000 live births.

Access to sanitation

Due to a combination of population growth and slow progress with the provision of facilities, the number of people in sub-Saharan Africa without access to sanitation has increased since 1990. In addition, there are rural and urban disparities: over 80% of the urban population has access to improved sanitation facilities compared to 51% in rural areas.

Global variations in access to doctors/physicians

Access to doctors varies from one doctor per 100,000 people in Burundi and one doctor per 50,000 people in Mozambique to one doctor per 250 people in Hungary and Iceland. There is also a disparity in the facilities available in hospitals and clinics.

The epidemiological transition, the diseases continuum and the implications of a global aging population for disease burden

The epidemiological transition refers to the shift in mortality from largely infectious, communicable diseases to those that are largely degenerative and non-communicable. In the last two centuries, there has been a decline in infectious diseases in many of today’s HICs and a rise in degenerative diseases. The proportion of deaths due to cardiovascular disease (CVD) increased to between 10% and 35%.

Aging and the disease burden

Of the total global burden of disease, 23% is attributable to disorders in people aged 60 years and older. This accounts for about 50% of the health burden in high-income countries and 20% of the burden in low- and middle-income countries. The leading contributors to disease burden in older people are CVD (over 30% in people aged 60 years and over) and cancer (15%).

You should be able to show how physical and human processes lead to changes in food production and consumption, and incidence and spread of disease:

- The merits of a systems approach (inputs, stores, transfers, outputs) to compare energy efficiency and water footprints in food production, and relative sustainability in different places;
- The physical and human processes that can lead to variations in food consumption;
- The importance of diffusion (including adoption/acquisition, expansion, relocation) in the spread of agricultural innovations, and also in the spread of diseases, and the role of geographic factors (including physical, economic and political barriers) in the rate of diffusion;
- Geographic factors contributing to the incidence, diffusion and impacts (demographic and socio-economic) of vector-borne and water-borne diseases;
- One detailed example of a vector-borne disease and one detailed example of a water-borne disease.

You should be able to explain why the energy efficiency ratio for agroforestry is higher than for dairy farms. [2]

Test yourself

F.3 Explain why the infant mortality rate is a useful indicator of development. [2]

F.4 Suggest why the number of doctors per person is not a reliable measure of the quality of health care systems. [2]

Water footprints in food production

The projected increase in the production and consumption of animal products is likely to put further pressure on the world’s freshwater resources. Large-scale commercial farming systems tend to have higher water footprints than small-scale subsistence farming systems.

The water footprint of meat from beef cattle (15,400 m³ per tonne) is much larger than the footprint of meat from sheep (10,400 m³ per tonne) or chicken (4,300 m³ per tonne).

Per tonne of product, animal products generally have a larger water footprint than crops.

Global animal production requires about 2,422 billion cubic metres of water per year. Most of this water (98%) is used in the production of feed for the animals.
The physical and human processes that can lead to variations in food consumption

Income and level of education influence food choice. Diet may vary depending on the availability of income to purchase more healthy food. For a low-income family, price plays a larger role than taste and quality in deciding whether the food will be purchased. The variety of foods carried in neighbourhood shops may also influence diet.

The importance of diffusion in the spread of agricultural innovations, the spread of diseases, and the role of geographic factors in the rate of diffusion

Diffusion of innovations

The introduction of a new agricultural technique depends upon a number of factors including information regarding innovations, financial security, the personality of the adopter and the proximity to other adopters. Initially very few people adopt an innovation. As information becomes more widespread, and often the cost is reduced, increasingly more people adopt the innovation (figure F.2.1). However, some people are reluctant to change and will take a long time, if at all, to accept the new technique.

Types of disease diffusion

There are several types of disease diffusion:

- **Expansion diffusion** occurs when the expanding disease has a source and diffuses outwards into new areas.
- **Relocation diffusion** occurs when the spreading disease moves into new areas, leaving behind its origin or the source of the disease.
- **Contagious diffusion** is the spread of an infectious disease through the direct contact of individuals with those infected.
- **Hierarchical diffusion** occurs when a phenomenon spreads through an ordered sequence of classes or places.
- **Network diffusion** occurs when a disease spreads via transportation or social networks.

Geographic factors contributing to the incidence, diffusion and impacts (demographic and socio-economic) of vector-borne and water-borne diseases

A number of geographic factors lead to the incidence, spread and impacts of diseases such as cholera (a water-borne disease) and malaria (an insect/borne disease).

**Water-borne disease: Cholera**

Each year there are between 1.3 million and 4.0 million cases of cholera, and 21,000–143,000 deaths worldwide. Most of those infected can be successfully treated with oral rehydration solution.

Cholera is an acute diarrheal infection caused by ingestion of food or water contaminated with the bacterium *Vibrio cholerae*.

Cholera transmission is closely linked to inadequate access to clean water and sanitation facilities. Typical at-risk areas include slums and refugee camps, where minimum requirements for clean water and sanitation are not being met.

The long-term solution for cholera control lies in economic development and universal access to safe drinking water and adequate sanitation.

Actions targeting environmental conditions include the implementation of adapted long-term sustainable water, sanitation and hygiene (WASH) solutions to ensure the use of safe water, basic sanitation and good hygiene practices to populations most at risk of cholera.

**Vector-borne disease: Malaria**

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female *Anopheles* mosquitoes. It is preventable and curable.

In 2016 there were an estimated 216 million cases of malaria and 445,000 deaths. Africa accounted for 90% of malaria cases deaths (40% in Nigeria and DR Congo).

Total funding for malaria control and elimination reached an estimated US$2.7 billion in 2016. Vector control is the main way to prevent and reduce malaria transmission.

**Key**
- Malaria transmission occurs throughout
- Malaria transmission occurs in some parts
- Malaria transmission is not known to occur

Source of data: Centers for Disease Control and Prevention
Two forms of vector control—insecticide-treated mosquito nets and indoor residual spraying (IRS)—are effective in a wide range of circumstances.

Indoor residual spraying with insecticides is a powerful way to rapidly reduce malaria transmission. Its potential is realized when at least 80% of houses in targeted areas are sprayed.

Test yourself

F8 Outline the ways in which disease may be spread. [5]
F9 (a) Describe the distribution of malaria as shown in figure F.2.2. [3]
(b) Explain two reasons for the distribution that you have described. [2+2]
F10 Compare the main conditions required for the development of cholera with the main conditions required for the development of malaria. [2+2]

F.3 STAKEHOLDERS IN FOOD AND HEALTH

You should be able to show the power of different stakeholders in relation to influence over diets and health:

- The roles of international organizations (such as the World Food Programme, Food and Agriculture Organization of the United Nations and World Health Organization), governments and NGOs in combating food insecurity and disease;
- The influence of TNCs (agribusinesses and the media) in shaping food consumption habits;
- Gender roles related to food and health, including food production/acquisition and disparities in health;
- Factors affecting the severity of famine, including governance, the power of the media and access to international aid;
- One case study of the issues affecting a famine-stricken country or area.

The roles of international organizations, governments and NGOs in combating food insecurity and disease

Combating food insecurity

Many stakeholders contribute to achieving food security:

- The Food and Agriculture Organization (FAO), whose main aims include the eradication of hunger, food insecurity and malnutrition;
- The World Food Programme (WFP) aims to end global hunger. It focuses on food assistance for the poorest and most vulnerable;
- National governments may subsidize food production;
- A number of NGOs help to deliver food to those with insufficient access to it, such as Operation Hunger in South Africa.

The influence of TNCs (agribusinesses and the media) in shaping food consumption habits

The nutrition transition in LICs leads to a change in diet away from starchy staples to include more fruit and vegetables, meat and dairy, but there is also a tendency towards an increase in intake of processed, energy-dense, non-traditional foods which are often high in sugar, salt and harmful fatty acids, and are poor in micronutrients.

Multinational retailers have followed multinational food manufacturers, soft-drink companies and fast-food chains into food and drink sectors in virtually all countries; they have introduced the types of supply-chain management previously seen only in the developed world.

The move towards more Western-style diets in MICs and LICs may be seen as demand driven. Growing incomes, urbanization and female labour-force participation have led to a demand for convenience processed and fast food and eating out.

There has been a rapid expansion of supermarkets in MICs and LICs. In Latin America, supermarkets deliver 50%–60% of retail food sales. Modern food systems reduce the price of processed convenience foods relative to traditional staples and fresh fruit and vegetables. Modern manufacturers, fast-food and soft drink firms and supermarkets employ sophisticated marketing, often targeted at children, to encourage a preference for Western foods.

There is some evidence that supermarkets (and convenience stores) have reduced the prices of packaged foods relative to fresh produce, particularly in the early stages of supermarket penetration in a country. In Brazil, some packaged food was 40% cheaper than in traditional outlets.

Test yourself

F.11 Explain how TNCs influence global food consumption. [4]
Gender roles related to food and health

Gender, food security and nutrition

In low-income countries, such as Ethiopia and Eritrea, rural women and men play different roles in guaranteeing food security in their households and communities. While men grow mainly field crops, women are usually responsible for growing and preparing most of the food and rearing small livestock, which provides protein. Rural women also carry out most food processing, which ensures a diverse diet, minimizes losses and can provide marketable products. Women represent about half of the food-producing workforce in South-East Asia and sub-Saharan Africa, but often as unpaid workers involved in subsistence farming.

Life expectancy for women is generally higher than for men. This may be partly because men are more likely to have a more “self-destructive” lifestyle than women. However, more men work full-time than women, and retire at a later age, and that may hasten their death. Nevertheless, women in LICs have very physical jobs, which may explain, in part, the low life expectancy compared with HICs. Poverty and diseases are also likely to play an important part.

You should be able to show examples of future possibilities for sustainable agriculture and improved health:

- Possible solutions to food insecurity, including waste reduction;
- One case study of attempts to tackle food insecurity;
- Advantages and disadvantages of contemporary approaches to food production, including genetically modified organisms (GMOs), vertical farming and in vitro meat;
- The merits of prevention and treatment in managing disease, including social marginalization issues, government priorities, means of infection and scientific intervention;
- Managing pandemics, including the epidemiology of the disease, prior local and global awareness, international action and the role of media;
- One case study of a contemporary pandemic and the lessons learned for pandemic management in the future.

Factors affecting the severity of famine

There are many causes of famine. Prolonged low and/or unreliable rainfall may lead to water shortages and food shortages. Deforestation or overgrazing may cause soil degradation. Increased population pressure or a lack of secure land tenure could lead to a reduction in the amount of land per person. Decreasing affordability of food or a decrease in food entitlement (such as unemployment) could lead to outbreaks of famine. A lack of proper storage facilities may lead to increased food waste. However, the main factor is likely to be political—civil war disrupts farming, transport and access to aid. Civil war was the main factor in causing a famine in South Sudan in recent years.

Case study: Famine in Africa and the Middle East, 2017

In 2017, South Sudan was declared to be in a state of famine by the UN. It was the first time since 2011 that the UN had used the term. A further 1.1 million people were said to be in an “emergency” situation. Some 250,000 children under the age of 5 suffer from “severe acute” malnutrition. Nearly 6 million people relied on food aid during 2018. Three other countries—Nigeria, Somalia and Yemen—were said to be at a “credible risk of famine”. Between the four countries, 20 million people are at risk of starvation. The factor that they share is war. Since 2013, over 25% of South Sudan’s population have fled their homes to escape ethnic killings. People who flee cannot harvest their crops or work to pay for food.

Possible solutions to food insecurity

Case study: Achieving food security in Bangladesh

Food insecurity in Bangladesh is affected by international trade, land scarcity, the need to increase production of nutritional food, natural hazards and climate change. Food security remains an issue at national, household and individual levels. Bangladesh has made significant progress in improving food security by increasing production of rice using irrigation and high-yielding varieties. Increased emphasis on rice has necessitated increased imports of other foods. The government has also invested in storage facilities for rice, and cold-storage facilities for meat, fish, eggs and potatoes. The transport infrastructure has been upgraded to enable faster and better distribution of food, including imports.

Advantages and disadvantages of contemporary approaches to food production

The advantages and disadvantages of genetically modified organisms (GMOs)

There are many advantages related to GMOs. For example, food supplies become more predictable, and food quality can be improved by the

Test yourself

F.13 Define the term famine. [2]
introduction of more vitamins. GMOs can be modified to last longer and may even have medical benefits (increased nutrients, proteins and vaccines designed into the food). There may be less need to use herbicides and pesticides, as genetic resistance is designed into the GMO. However, GMOs may cause antibiotic resistance. Crops that are genetically modified may produce seeds that are genetically modified. It is possible for genes to get into wild species—a number of weed species are known to be resistant to the herbicide atrazine. GMOs are heavily controlled by TNCs, and independent research regarding their impacts is generally not allowed.

Vertical farming
Vertical farming allows crops to be grown throughout the year, and by day and night, as it uses LED lighting. It reduces transport costs as many vertical farms are found in high-rise buildings in cities. This reduces air pollution and emissions of CO₂. It uses minimal water, as water use can be controlled and recycled. Vertical farming also grows food organically—no pesticides are needed as there are no pests to damage the crops. However, vertical farming could lead to a loss of jobs in the transport sector. The cost of pollination increases as there are no insects to pollinate the plants naturally. This increases the costs of production. There is a great reliance on technology, for lighting, heating and irrigation. This means that if there are power cuts, the crops could die. Vertical farming occurs mainly in HICs in urban areas, for example “Plenty” in San Francisco.

In vitro meat
In vitro meat (IVM) already exists but is very expensive. It refers to meat that is grown in a laboratory rather than on a farm. IVM offers a potentially more environmentally friendly and animal-welfare friendly, ethical and disease-free type of farming compared to conventional meat production systems that are energy- and water-intensive and contribute to local and global pollution. On the other hand, IVM is perceived as unnatural, potentially less tasty and likely to put farmers out of business.

The merits of prevention and treatment in managing disease
Preventative treatment means adopting policies and lifestyles that will reduce the risk of disease. This may range from people having a healthy diet to not smoking or drinking to excess to reduce the risk of cancer, heart attacks and strokes.

Curative treatment is required to treat cancers, heart disease and stroke. This is much more expensive than preventative health care and may involve lengthy hospitalization.

There are many benefits of preventing diseases—treatment, lost productivity and health-care costs are major burdens to the economy, businesses and families.

Many of the world’s poor are at increased risk of disease. Many lack information, money or access to health facilities for adequate health care. The poor may be socially marginalized, and may have to make difficult choices.

The provision of health-care services may be public, for example, the UK’s National Health Service, or it may be private, as is largely the case in the USA. However, not everyone can afford private health-care.

Managing pandemics
Pandemics are global epidemics. Their large scale makes them difficult to manage and they may involve new diseases or relatively unknown ones.

Following the outbreak of Ebola in West Africa in 2015, the Nigerian government established a massive public health campaign. Containment was the key to ending Ebola. Everyone who had been exposed to the virus was found and monitored, and isolated if they developed the symptoms. Television broadcasts and social media were used to reassure people. Gatherings were banned. Markets and schools were closed, and school lessons were given over the radio. Although Ebola had the potential to become a pandemic, it did not happen due to the speedy response of health officials not only in West Africa but in other areas such as North America and Europe.

Case study: The diabetes pandemic
The number of people worldwide with diabetes is around 422 million, a figure likely to double by 2035. Diabetes is a chronic, lifelong condition and a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation. The disease reduces both a person’s quality of life and life expectancy.

Four major trials have demonstrated that lifestyle changes involving diet (reducing fat intake), preventing obesity and increasing physical activity can delay or prevent type II diabetes among people at high risk.

Test yourself
F.15 Describe the advantages and disadvantages of in vitro food. [2+2]
F.16 Outline the main advantages of genetically modified food. [3]

The following diagram shows factors affecting food insecurity.

- Inadequate nutrition
- No access to finance
- No access to markets

Food insecurity

Social factor X
Social factor Y

a) Identify what social factors X and Y could be. [2]
b) i) Outline why two named groups of people experience food insecurity. [2 + 2]
   ii) Explain two ways in which improved food security can be achieved. [2 + 2]
Essays
Either: Examine the impact of one vector-borne disease.
Or: Examine the nutrition transition that occurs as countries develop.

How do I approach these questions?

a) 1 mark is awarded for each valid suggestion, with a maximum of 2 marks.
b) i) You need to outline two different population groups that are at risk of food insecurity, and give some detail for each one. Describe the conditions that mean they have limited food supply—it is not good enough to say that they have “no food”; you should think of different reasons why their food supply is limited.

ii) This asks for ways in which food security can be achieved. Each of the reasons should be developed or demonstrated using an example.

Essays
For these essays, the command term is examine. This means that you should discuss the underlying assumptions and interrelationships of the issues presented in the question. For the first essay, you should consider a number of impacts of a named vector-borne disease on people and societies, and relate these to the four key concepts (places, processes, power and possibilities). For the second essay, you should examine how people’s diet changes as they transition from LIC to MIC to HIC. Remember to refer to specific examples, and some critical thinking and evaluation should be present in your answer.

**SAMPLE STUDENT ANSWER**

1. **a) Other social factors affecting food security include having to walk long distances to get water and firewood and poor education.**

   Marks 2/2

2. **b) i) One population group experiencing food insecurity is people living in Syria. This is because there is a civil war going on there and food supplies are disrupted. Another population group experiencing food insecurity are people in Sudan. This is because there is a famine there, and farmers are unable to produce many crops.**

   Marks 4/4

3. **ii) One way of producing more food is through the use of GM crops. In vitro farming also helps produce much food from a single stem cell.**

   Marks 2/4

**The first paragraph was full of detail but thereafter it becomes quite generic. A named, located example (such as Nigeria or DR Congo) would be good to show the changes/impacts in a real-life situation.**

**Marks 7/10**

**Dr. Examine the nutrition transition that occurs as countries develop.**

**As income increases in low-income countries (LICs), there is an increase and a change in food consumption patterns. People in LICs generally derive their food energy mainly from carbohydrates, while the contribution of fats is small and that of meat and dairy negligible. In Bangladesh, for example, an LIC, people derive 80 per cent of their nutritional energy from carbohydrates and 12 per cent from fats. People in high-income countries (HICs) generally derive most of their food energy from carbohydrates and 12 per cent from fats.**

**Malaria is a life-threatening disease of humans caused by the plasmodium parasite and transmitted to people via the bite of the female Anopheles mosquito. In 2015, around 100 countries and territories had ongoing malaria transmission. About 3.2 billion people – almost half the world’s population – are at risk of malaria. However, between 2000 and 2015, malaria incidence among populations at risk (the rate of new cases) fell by 37 per cent globally. At the same time, malaria death rates in populations at risk fell by 60 per cent globally among all age groups and by 65 per cent among children under five. Sub-Saharan Africa carries a disproportionately high share of the global malaria burden. In 2015 the region suffered 88 per cent of malaria cases and 90 per cent of malaria deaths. The direct cost of malaria to individual households includes medication, doctors’ fees and preventative measures such as bed nets, which help to reduce transmission. Infected individuals are unable to work, which can reduce family incomes during the attacks. Some population groups are at considerably higher risk of contracting malaria, and developing severe disease, than others. These include infants, children under five years of age, pregnant women and patients with HIV/AIDS, as well as non-immune migrants, mobile populations and travellers. Children with severe malaria frequently develop one or more of the following symptoms: severe anaemia, respiratory distress in relation to metabolic acidosis, or cerebral malaria.**

**The first paragraph was full of detail but thereafter it becomes quite generic. A named, located example (such as Nigeria or DR Congo) would be good to show the changes/impacts in a real-life situation.**

**Marks 7/10**
from carbohydrates and fat, with a substantial contribution from meat and dairy. The average consumer in the US, France and Denmark, for instance, derives 45–50 per cent of their food energy from carbohydrates and 40 per cent from fats. Studies of human nutrition have shown that worldwide a nutrition transition is taking place, in which people are shifting towards more affluent food consumption patterns. The nutrition transition began in developed countries 300 years ago. It coincided with great economic growth. For LICs, a small increase in income may lead to a large increase in calorie intake, while for HICs increases in income may not lead to an increase in calorie intake. Food consumption per capita has increased substantially since the 1970s (both in energy and protein content). Growth rates are consistently higher in LICs, but their consumption levels per capita are still much lower than in HICs. The transition in diet is mainly influenced by higher income per capita – but food prices, individual and sociocultural preferences, refrigeration, and other concerns also play a role.

In HICs, the main dietary changes since the 1970s have been the reduction in cereals, while mainly vegetable oil and, to a smaller extent, meat intake increased. Animal protein intake has been stabilizing: an increasing part of the population seems to be interested in reducing/replacing it for various reasons (ethical, health-related, environmental and economic).

In LICs the diet has diversified since the 1970s. Intake of cereals, including rice, as well as vegetable oil, sugar, meat and dairy is higher now compared to 1970s, although in more recent periods cereal intake has stagnated and even declined. Their share of cereals also exceeds the share in HICs.

There is a strong positive relationship between level of income and consumption of animal protein and a negative relationship with staple foods. In LICs, dairy, fish and pulses are driving increases in total protein availability per capita. Sugar intake is also stabilizing. These numbers seem to suggest that the diet in LICs is slowly evolving in the direction of the HICs, with the exception of sugar.

Good overall account—apart from the examples in the opening paragraph, most of the support relates to HICs/LICs.

Marks 8/10