

AS
**GENERAL STUDIES
(SPECIFICATION A)**

Unit 2 AS Science and Society

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Section A

Source for Question 1.1 to 1.30.

Should we be eating less meat?

- (1) The debate about western eating habits and the relative merits of vegetarianism versus a traditional omnivorous diet have been discussed endlessly. But the issues are far more wide-ranging than the typical 'Meat is Murder' headline.
- (2) The Triangle Vegetarian Society states the following reasons why environmentalists and those seeking economic and social justice should consider vegetarianism:

'One-half of the Earth's land mass is currently grazed by livestock. It is estimated that between 19% and 22% of all threatened and endangered species are harmed by livestock grazing, mainly as a result of habitat destruction. This increase has meant that manure produced by all farm animals in the United States (US) annually is approximately 130 times the waste produced by the human population.'

- (3) The Triangle Vegetarian Society reports that factory farms are the biggest contributors to polluted rivers and streams in the US, while resources used in the production of livestock are substantial. For example, 33% of the world's fish catch and 38% of the world's grain harvest are used for animal feed. In the US alone, almost half of all energy expended in agriculture is used on raising livestock. It has been further estimated that 10–30 kg of grain is required to make 1 kg of beef; whereas only 35%–40% of a steer's body weight actually becomes beef for people. Using these estimates, together with the existing data, the Triangle Vegetarian Society claims that eating a plant-based diet would save 90% of the energy used in raising meat.
- (4) World consumption of animal protein is on the rise everywhere. Meat consumption increased from 40 million tonnes in 1950 to 258 million tonnes in 2009, more than doubling annual consumption per person to over 40 kg. The rise in consumption of milk and eggs is equally dramatic. Wherever incomes rise, so does meat consumption.

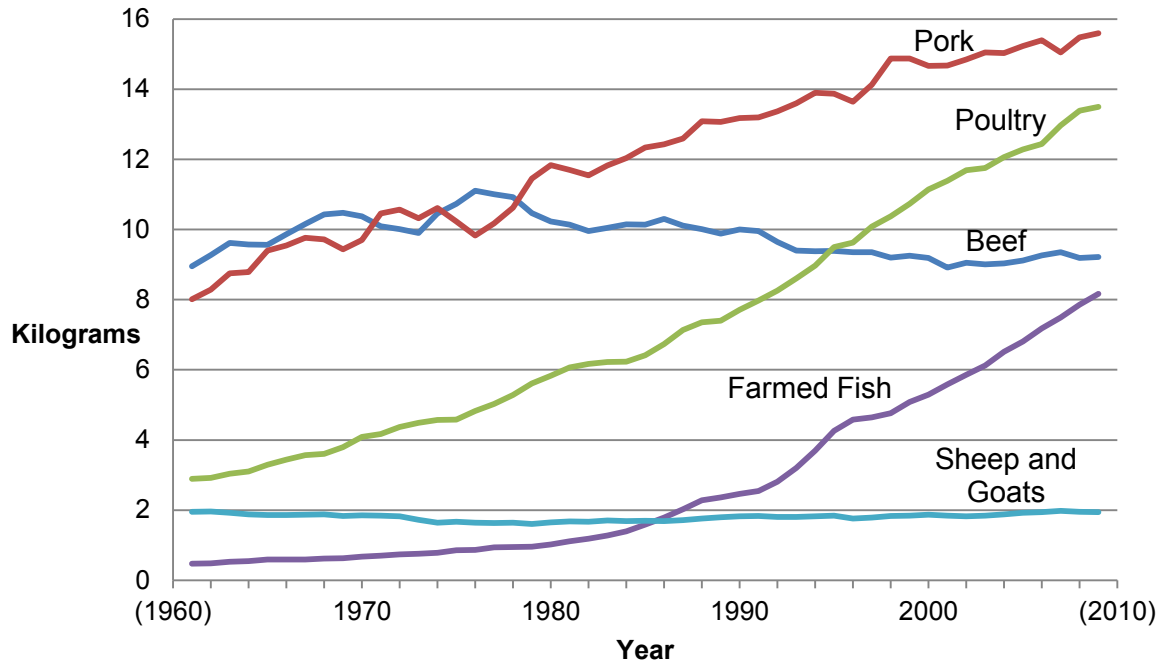
Figure 1 Meat consumption, kilograms/person/year

Country	1961	1969	1979	1989	1999	2009
Argentina	103.6	119.9	114.5	90.1	105.5	98.3
Botswana	28.9	33.4	14.2	22.8	21.8	26.2
China	3.8	9.3	13.3	24.3	47.8	58.2
Denmark	56.7	61.3	70.9	104.9	129.6	95.2
France	77.7	84.9	101.8	95.3	99.8	86.7
Poland	51.0	58.0	79.7	75.7	72.7	76.9
Russia	nd*	nd*	nd*	nd*	39.1	62.9
Syria	10.4	11.3	18.1	17.0	21.2	22.8
Thailand	15.3	17.8	20.0	21.7	25.2	25.8
UK	69.8	72.7	72.1	70.3	76.9	84.2
USA	89.2	102.7	106.5	112.4	123.8	120.2
Zimbabwe	16.4	11.7	11.2	12.0	12.1	21.3

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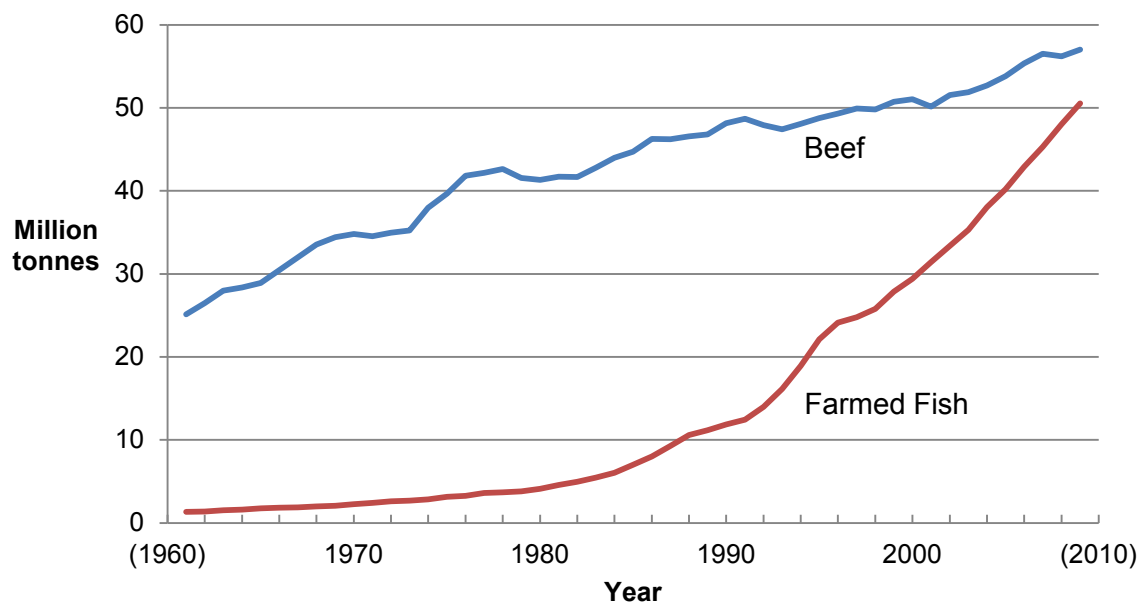
- (5) As beef production and the oceanic fish catch have both levelled off, the world has shifted to grain-based production of animal protein to expand output. With some 35% of the world grain harvest (690 million tonnes) used to produce animal protein, meat consumption has a large impact on grain consumption, and therefore global food security.

Figure 2 World animal protein production per person, 1961–2009



- (6) The efficiency with which various animals convert grain into protein varies widely. Grain-fed beef is one of the least efficient forms of animal protein. However, global beef production has grown by about 1% a year since 1990.

Figure 3 World beef and farmed fish production, 1961–2009



- (7) Fish farm output may also soon overtake beef production. In fact, aquaculture has been the fastest-growing source of animal protein since 1990, expanding from 12 million tonnes to 51 million tonnes in 2009, or 8% a year. For herbivorous species of farmed fish (such as carp and catfish), less than 2 kg of grain is required to produce a 1 kg gain of live weight.
- (8) There is a variety of ways to make animal protein production more efficient. Combining protein-rich soya bean meal with grain dramatically boosts the efficiency with which grain is converted into animal protein, sometimes nearly doubling it. Virtually the entire world, including the three largest meat producers (China, the United States and Brazil), now relies heavily on soya bean meal as a protein supplement in feed rations.
- (9) Achieving food security depends on changes on the demand side of the equation as well as the supply side. Along with moving to smaller families to curb population growth, this means cutting individual consumption by eating less grain-intensive livestock products and eliminating waste in the food system. A typical American living high on the food chain with a diet heavy in grain-intensive livestock products, including red meat, consumes twice as much grain as the average Italian and nearly four times as much as the average Indian. By adopting a Mediterranean diet, Americans can cut their grain footprint roughly in half, improving health while increasing global food security.
- (10) Then again, the choice might not prove to be as stark as vegetarianism or omnivorism, as recent food technological developments show. Professor Mark Post is a vascular scientist at the University of Maastricht in Holland. His plan is to create a lab-grown hamburger, just to prove that it could be done.
- (11) It won't come cheap though – not by any standards. Professor Post estimates that it will cost some €250 000 (approx. £180 000) to assemble the thin layers of muscle strips packed together with some lab-grown fat. The muscle strips will come from stem cells harvested from leftovers picked up from slaughterhouses.

Figure 4 A future lab-grown hamburger?



- (12) The stem cells will be left to grow in a 'soup' made of sugars, amino acids, lipids and minerals until they grow up to 2.5 cm long and 1 cm wide, and so thin that you can partially see through them. Due to their thinness, some 3000 will be required to assemble a full-grown hamburger. But it won't look like an average burger, because the meat will have no blood.

- (13) This process is made harder by the fact that lab-grown strips act just like real muscle – if they aren't exercised, they will eventually waste away. In order to avoid this, Professor Post plans to stretch them in a Petri dish to provide additional resistance due to their natural tendency to contract.
- (14) It might be very expensive, but then again, this could be the first step towards a new generation of hamburgers, Post believes. "This first one will be grown in an academic lab, by highly trained academic staff," Post said. "It's hand-made and it's time and labour-intensive, that's why it's so expensive to produce."
- (15) Also, the taste isn't spectacular either. A Russian reporter who had the pleasure of tasting the strips wasn't impressed by the experience; but Professor Post explains that the matter of taste hasn't been taken into consideration just yet. "That's not a trivial thing and it needs to be worked on."
- (16) Artificial meat research is still in its infancy. Although it is currently believed that processed meat such as sausages might be easier to create in a lab, researchers have hopes for different types of meat. One of the early goals is to make processed meats healthier, with less saturated fat and more nutrients and polyunsaturated fats.
- (17) However, in the long run, the best improvements could be the reduction of energy consumption, and the sparing of animals. Hanna Tuomisto, a food researcher, conducted an extremely interesting study, which concluded that growing some of our favourite foods *in vitro* would use 35% to 60% less energy, emit 80% to 95% less greenhouse gases and use around 98% less land than normal animal meat. Given the growth of the population of our planet, this might not only become useful, but also necessary.

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