THE ROLE OF MEAT IN THE HUMAN DIET

Herbert W. Ockerman
The Ohio State University, Columbus, Ohio, USA

Norma Pensel
ITA-INTA, Buenos Aires, Argentina

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Summary

Although humans are omnivorous by design, our digestive and biochemical processes will allow us to survive without eating meat. If humankind can survive without eating meat, what then are the driving forces for meat eating and its desirability from the perspectives of the individual or the population? Questions arise such as:

- Will there be enough food in the future to feed the world's population?
- What kind of food will be more convenient?
- Will the population be transformed to vegetarians?
- What will be the health-related issues surrounding meat?
- Will people consume more or less meat?
- Who should decide such critical issues?

These concerns are frequently raised in scientific, social, religous and political discussions.

1. Population versus food supply

It is well documented that the world population is growing, but are the resources to sustain the population growing at the same rate? As an example, the population of

Canada and the USA is almost the same as the world population in year 1 AD. Fortunately food supply has also increased, and since that time more land has been discovered and put into use for food production, particularly in the Americas, Australia and New Zealand. New technology also permits higher production per unit area. However, the population is rising at 1% per year in developed countries and 2.5% in developing countries, and the world population for the year 2000 was approximately six billion. To feed the population required an 18% increase in food production during the 1990s. There are no additional large land masses to be discovered that would be available for traditional agriculture. If the world's population growth curve parallels the standard curve for most biological systems (Figure 1), it is expected that after this rapid increase there will be a decrease in the growth rate until it reaches a balance below the capacity of the environment to sustain that growth.

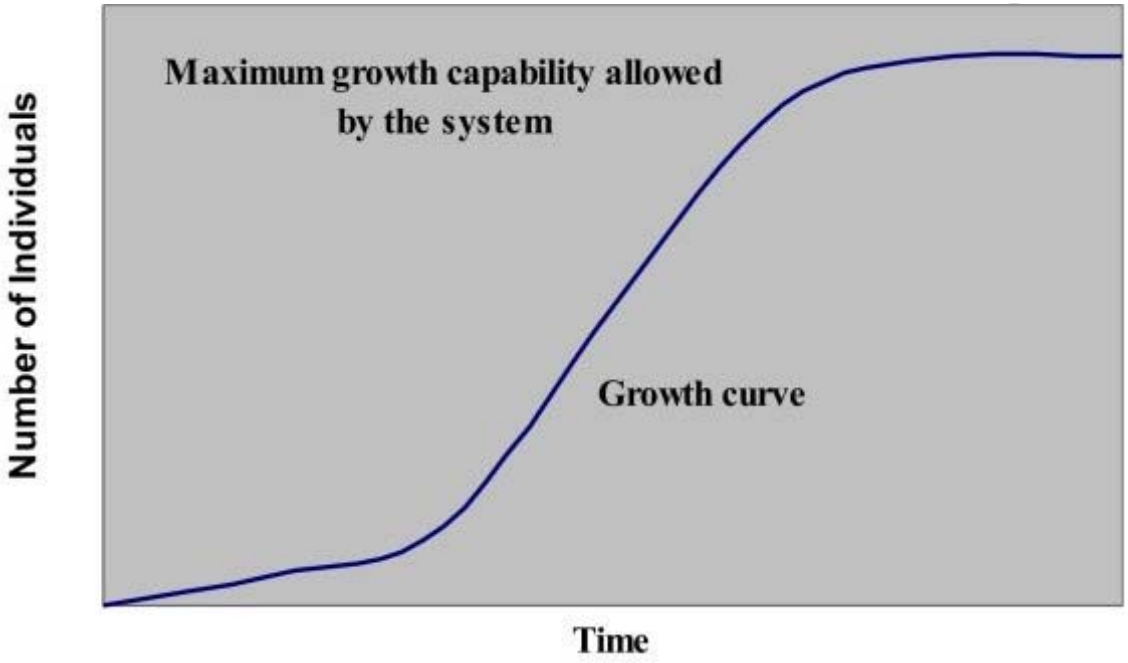

Figure 1. Typical population growth curve.

What does that mean in terms of human population? Does it mean that this balance will be achieved by high mortality due to starvation, or that we will be able to manage an increase in production on existing land, or can the birth rate of *Homo sapiens* be decreased, or can there be better distribution of the resources without exhausting them? A US Secretary of Agriculture was once asked, 'Will we be able to produce enough food for the large increase in future population?' His candid answer was, 'If we cannot, they will not be there.'

2. Vegetarianism vs omnivory

The main argument for vegetarionism is that "eating closer to the Sun" will support a larger number of people due to large metabolic losses associated with animal production (see Table 1). This would be true if people had multiple stomachs or bacteria and protozoa in their digestive tract capable of digesting hemicellulose and cellulose.

Because humans do not have these faculties they are not in direct competition with all domesticated animals. Cattle, sheep and goats grazing on land that should never be cultivated or on semiarid grasslands or steep slopes and mountain meadows are not in competition with humans since they are consuming cellulose which is indigestable by humans. Resource competition is also absent when animals are consuming crop residues, cover crops planted in rotation with food crops, residues from crop processing and other organic waste.

3. Land use

It is true that animals are inefficient at converting feed calories to animal product calories.

Calculation Methods	Milk	Eggs	Chicken	Pork	Beef	Carp	Salmon
Feed kg/kg Edible wt.	1.1	2.8	4.5	7.3	20.0	2.3	1.4
Protein Conversion Efficiency %	30-40	30-40	20-30	10-15	5-8	20-25	40-45

Source; Smil, 2000

Table 1. Efficiencies of Animal Food Production

However, calculations of efficiency should also take into account the utility of the initial product and quality of the final product. Non-ruminants can and often do consume plant and animal processing by-products that humans will not consume. This recycles calories that otherwise would be wasted, which is excellent efficiency. Ruminants, often considered inefficient by some, are probably the most efficient since their digestive systems can utilize cellulose and fibrous materials, the most abundant raw food material on earth, and even non-protein nitrogen, all of which are less well digested or indigestible by monogastrics, and these animals convert them into well balanced food for people.

Also, a major percentage of the world's land area cannot be cultivated due to steepness of the terrain or climatic conditions. The only way it can be harvested is with animals, and again, this is maximum efficiency for the human population. It is true that animals in some countries are fed grain that could be consumed by humans. However, this will stop when grain becomes more expensive than alternative by-products which today's animal husbandry experts know how to use.

So, far from being inefficient, animals can be very efficient by converting undesirable material to well balanced protein and energy for human consumption.

4. The purpose of food

The taste for variety and diversity in foods is quite varied due to differences in the human race, religion (Table 2) and politics. There are also different ways of looking at food—it can be seen as necessary for our nutritional well-being and/or as contributing to the quality of life. Once our basic nutritional needs have been satisfied, food fulfills other roles. As an example, the public is becoming more demanding for information to

assist them in making choices that will permit them to live longer and healthier lifestyles. Clearly people have many different needs. Agriculturists should, therefore, continue studying not just the food supply and preservation problem, but also the people who demand it. Another example is that India's 'middle class' population (200 million) is expected to continue increasing in the near future, and they will wish to include more fresh fruits and vegetables, cooking oil and high-protein food in their diets. Current technology has had more success at increasing the yield of feed grains than of protein meal-type crops. This would suggest that the items in highest demand in the international food trade will be high-protein foods. This is confirmed by recent figures. Between 1985 and 1995, US exports of beef, pork and broiler meats, for example, each increased by more than 20%, while corn increased only moderately and soybean meal declined slightly.

Buddhism	Says its adherents must not kill or eat any animal.
Hinduism	Prohibits high caste members from killing and eating any animal. Otherwise it mainly prohibits the eating of beef.
Islam	Prohibits the use of blood and the eating of pork. It also prohibits the consumption of intoxicating liquor.
Judaism	Prohibits all animals and their products that do not chew the cud and do not have cloven hoofs, for example pigs and horses. Other animals not eaten include: fish without scales and fins; the blood of any animal; shellfish, for example clams, oysters, shrimps, and crabs; all "animals that creep"; certain birds such as vultures, hawks, owls and heron.
Mormons	Prohibits the use of tobacco, alcohol and caffeine-containing beverages. They also encourage only sparing consumption of meat and the eating of more vegetables and herbs.
Seventh-day Adventists	Abstain from meat as well as stimulants such as tea and coffee, alcohol and tobacco and, many spices. They also do not allow eating between meals.
Sikhism	Prohibits the eating of beef.

Source: Ockerman and Nxumalo, 1998.

Table 2. Summary of religious meat and food avoidance.

Almost all nutritionists recommend consuming a variety of food items from several sources. The distribution for some countries between animal and plant percentages for proteins, fat and calories can be found in Table 3.

Country	**Percent Protein**		**Percent Fat**		**Percent Calories**	
	Animal	**Plant**	**Animal**	**Plant**	**Animal**	**Plant**
Argentina	63.4	36.6	57.8	42.2	29.6	70.4
Australia	67.7	32.3	64.6	35.4	35.4	64.6
Brazil	47.0	53.0	45.4	54.6	18.3	81.7
Canada	57.2	42.8	53.4	47.6	28.5	71.5
China	31.7	68.3	60.9	39.1	16.6	83.4
Egypt	15.4	84.6	26.8	73.2	6.2	93.8
France	65.2	34.8	65.9	34.1	37.9	62.1

Germany	61.6	38.4	58.5	41.5	32.0	68.0
India	16.3	83.7	26.4	73.6	7.2	92.8
Mexico	39.6	60.4	42,8	57.2	16.4	83.6
Netherlands	67.9	32.1	56.4	43.6	34.1	65.9
New Zealand	64.7	35.3	73.6	26.4	36.8	63.2
Nigeria	12.6	87.4	9.1	90.9	3.4	96.6
Pakistan	31.8	68.2	37.0	63.0	14.7	85.3
Poland	49.6	50.4	64.2	35.8	27.0	73.0
Russia, Federation	50.6	49.4	70.3	29.7	26.6	73.4
South Africa	33.3	66.7	33.5	66.5	12.7	87.3
Turkey	26.2	73.8	26.9	73.1	11.5	88.5
United Kingdom	57.3	42.7	60.1	39.9	32.9	67.1
United States	63.6	36.4	48.4	51.6	27.8	72.2

Source: FAO, 1994-1996.

Table 3. Animal vs Plant Consumption in 20 Selected Countries.

The most obvious observation in the percent distribution of animal and plant consumption by countries is the tremendous range encountered. For example, protein ranges from 12 to 68% from animals, fat ranges from 9 to 74% from animals, and calories ranges from 3 to 38% from animals. Countries with 60% or more of the protein coming from animals would include The Netherlands, Australia, France, New Zealand, United States, Argentina, and Germany. These countries are either large meat producers or are economically able to afford meat.

Countries with 35% or lower of their protein coming from animal sources would include Nigeria, Egypt, India, Turkey, China, Pakistan and South Africa. These countries each have predominate religions that prohibit eating of certain types (and sometimes all) of meat or they are not currently economically able to afford meat.

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Biographical Sketches

Dr. Herbert W. Ockerman is a Professor at The Ohio State University in the Meat Science Area of the Department of Animal Sciences, Columbus, Ohio, USA. He is involved in both food teaching and research and his areas of specialty include, Food Biochemistry, Food Microbiology, Statistics, and International Education. Prof. has received 26 local and national honors as well as 67 international honors from 6 continents. His publications exceed 1,650 scientific and industry focused articles, including 80+ books or chapters in books. He belongs to 24 professional societies and is listed in 56 biographical listings. He has established five International University Endowments and his hobby is shipping textbooks to his alumni around the word who are currently Secretary of Agriculture, numerous Universitys Deans of Agriculture, numerous Departmental Chairmans, and numerous Faculty members both at Universities, National Research Originations, and Private Businesses. He currently has advised 98 international students from 32 countries and supervised 61 visiting professors from 24 courtiers. He has been invited to give 100+ international presentations, keynote speeches, short courses, and seminars in his discipline.

Norma A. Pensel is head of Biochemical Area at the Food Technology Institute (INTA), Castelar Buenos Sires, Research Coordinator, project and idea generation, leader of multidisciplinary research team, and liaison with private sector. Norma received her education in Biochemistry at Buenos Aires University and her Masters of Science from the Ohio State University and honors from the International Meat Secretariat for the first International Gianni Schellino Memorial Prize, from INTA for advancement of Argentine agricultural science the National Academy of Agronomy and Veterinary Award, from the Ohio State University the Frances J. Ockerman International Award, the Gamma Sigma Delta award, the Honor Society of Phi Kappa Phi, the Phi Beta Delta International Honor Society, and from Winrock International Institute for Agriculture a scholarship for Graduate Studies, and from INTA a scholarship for research.