

CHANGING DEMOGRAPHICS AND NUTRITION PATTERNS

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ABSTRACT

The predictions for the rate of increase in the human population have been revised downwards, slightly, but it is still estimated that the global population will reach 8 billion before 2030. The accompanying rapid increase in global consumption of livestock products in recent years is predicted to continue, albeit at a slower rate. The most rapid increase has been in meat consumption in Asia, particularly China. An extra 292 million tonnes of grain would be required annually by 2020 compared to the early 1990s if the increase in animal production is to be met from high concentrate diets, but more efficient use of human-edible feeds can be made if alternatives to grain are used. The energetic efficiency of animal production has been improved in recent years but there is potential for further increase to meet the increasing demand.

INTRODUCTION

The global human population is increasing at a rate of 78 million persons per annum. Estimates for the number of people expected to be inhabiting the earth in 2020 vary, but having passed the 6 billion mark in 1999, world population is expected to exceed 8 billion before 2030 (FAO, 2000). The rate of growth is slowing down, having peaked (at a global level) in the late 1960s at 2.1% per annum and fallen to 1.3% per annum by the late 1990s. However, the global data hide a highly significant variation, from zero or even negative growth in some developed countries to over 3% in countries in sub-Saharan Africa. Population growth is, however, only one of the many factors which influence nutritional patterns. Other demographic and cultural factors also interact with the quantity and type of food produced and access to food can be constrained by both physical and economic factors.

This paper starts by presenting variations in traditional food consumption patterns in different countries, then considers demographic and food consumption trends, follows by reviewing trends in animal production and swine production, and ends with a brief consideration of the contribution of research.

GLOBAL VARIATION IN DIETARY COMPONENTS

Meat, fish, milk and eggs provide on average 13.5% of daily energy intake on a global basis (Loftas, 1995), but this global average hides a wide variation between different countries as can be seen in Table 1. Part of the reason for these differences is due to climatic and ecological factors which limit the type of crops which can be grown and the potential for

livestock production, together with the extent of poverty in rural areas, which will limit access to, for example, seeds and fertilizers. Religion and culture have also been important traditionally, but with increasing global awareness and the mixing of cultures within countries, these effects may be diminishing.

Table 1. Percentage contribution to energy intake of major dietary components by country (Loftas, 1995).

	China	Mongolia	Mali	Zaire
Cereals	35	42	72	17
Meat, fish, milk & eggs	25	37	1	1
Oils, fats and sugars	25	14	4	5
Roots and tubers	0	1	1	60
Fruits, vegetables, pulses & nuts	0	1	18	16
Other foods	15	5	4	1

There is evidence (see later) for rapid changes in the local composition of diets in some countries (notably China) due to both demographic and economic trends and globalisation is predicted to increase the extent of trade in food commodities (FAO, 2000). These changes will have an impact not only on food production systems but also the extent of processing which food has to undergo to provide the increase in shelf-life required for food which has to be transported over long distances. This raises the importance of food safety issues.

DEMOGRAPHIC TRENDS

Dire predictions concerning the inability of the world to feed growing human populations have been made since the time of Malthus (in the 18th & 19th centuries), yet the world still has the capacity to feed its current population of 6 billion if food was evenly distributed. Recent estimates put the number of people suffering from malnutrition at around 800 million (Dyson, 1996), with 200 million children under the age of 5 suffering from malnutrition, which includes over 40% of children of that age group in, for example, India, Pakistan and Ethiopia (World Bank, 1997) due to inequalities in access to food. Yet, despite the increases in population indicated in Table 2, international agencies predict that, barring severe economic crisis and with appropriate investment in research and infrastructure, it should be possible to decrease child malnutrition overall in developing countries, although an increase is likely in sub-Saharan Africa (Rosegrant *et al.*, 1995; Rosegrant and Ringler, 2000).

Table 2. Annual increments (millions) of population growth by decade (FAO, 2000).

	1964/66 to '74/76	1974/76 to '84/86	1984/86 to '95/97	1995 to 2000	2010 to 2015
World	74	76	83	78	72
Developing Countries (DC)	64	68	75	72	69
DC as % World	86	89	90	92	96

It is worth noting from Table 2 that the rate of increase in the human population appears to have passed its peak, even in developing countries, although these countries now account for over 90% of the annual increment in population. However, the term ‘developing countries’ refers to a range of countries which are by no means homogeneous. The figures in Table 3 illustrate the continuing high population growth rate in sub-Saharan Africa. Data on predicated annual growth in GDP for the same regions are also given which show that previous indications that slowing population growth may increase economic growth are now weaker. This can in part be attributed to the impact of the AIDS epidemic in slowing population growth (FAO, 2000).

Table 3. Growth rates (% per annum) in developing regions in population and per caput GDP (FAO, 2000).

	Population		GDP
	1967 to '97	1995/'97 to 2015	1995/'97 to 2015
World	1.7	1.2	2.0
Developing countries	2.1	1.4	3.4
Sub-Saharan Africa	2.8	2.4	1.5
Latin America	2.1	1.4	2.3
South Asia	2.2	1.5	3.6
East Asia	1.7	0.9	4.9

Another demographic trend, that is exerting a major influence on patterns of food consumption is that of urbanisation. While 45% of the world’s population were estimated to be living in urban areas in 1990, it is predicted that this figure will rise to 62% by 2020 (Dyson, 1996). There is evidence linking this trend towards urbanisation with increased income and increased consumption of animal products (e.g. Anderson *et al.*, 1997).

FOOD CONSUMPTION TRENDS

Global variation in diet composition was illustrated in Table 1, but the demographic changes presented in the previous section, together with economic globalisation are having a major impact on consumer demand for different food commodities. In particular there has been a rapid growth in the consumption of livestock products in Asia (Table 4).

There are also differences in the type of livestock product consumed in different countries. Thus, while China is predicted to dominate (45%) the developing world in relation to the increased demand for meat, India will dominate (41%) the demand for milk. These trends are based on FAO historical data (1983 to 1993) and predictions from the IFPRI IMPACT model for the future. The IMPACT model has been described in detail by Rosegrant *et al.* (1995) and updated since then as described in the references quoted in the text.

Table 4. Estimated demand (kg/hd/yr) for meat in 1993 and projected demand in 2020 (Rosegrant and Ringler, 2000).

	1993	2020
Developed countries	78	83
Developing countries	4	7
South Asia (except India)	7	10
Southeast Asia	15	27
China	33	62
Other East Asia	44	79

The demand for different types of meat also varies between regions: beef currently constitutes 50% of total production in Latin America, 41% in sub-Saharan Africa and only 5% in China (Delgado *et al.*, 1998). Pork, in contrast, constitutes 59% of total meat production in China but is insignificant in West and North Africa. These variations reflect very different religions and cultures in different regions of the world and there has been little change in the relative proportions of beef : pork over the last decade, despite a doubling in total meat consumption in some developing regions (Delgado *et al.*, 1998).

TRENDS IN ANIMAL PRODUCTION

The geographical trends in consumption of animal products are closely mirrored by trends in production (Table 5). There was a 1.1% increase in total production of meat in the developed world, compared to a 5.4% increase in the developing world between 1983 and 1993. The rate of increase was greatest for poultry meat, followed by pork, with beef production mirroring population increases with no increase in per capita production (Table 5).

Table 5. Meat production, 1983 & 1993 (Delgado *et al.*, 1999)

	Total production (million tonnes)		Per capita production (kg)	
	1983	1993	1983	1993
Developed world				
Beef	36	35	27	26
Pork	35	37	29	29
Poultry	19	27	16	21
Developing world				
Beef	16	22	5	5
Pork	21	39	6	9
Poultry	9	21	3	5

However, there are significant differences between regions in the developing world in the distribution of monogastric animals as illustrated in Table 6. Pigs are concentrated in Asia and Latin America, with China having an estimated 44% of the world's pig population in 1993 and 38% of world production (Delgado *et al.* 1999). These figures represent a growth rate of 5.8% per year between 1983 and 1993 in pigs slaughtered in China, with the percentage growth rate for sub-Saharan Africa being higher (7.7%) but from a lower population base (Table 6).

Table 6. Global distribution (millions) of livestock, 1983 and 1993 (Delgado *et al.*, 1999).

	Pigs		Poultry	
	1983	1993	1983	1993
Developing world	442	562	4514	8408
Developed world	334	316	4166	4528
China	295	386	1302	3105
Southeast Asia	39	44	608	1423
Latin America	78	79	1042	1552
Sub-Saharan Africa	8	18	434	647

Future projections based on IFPRI's IMPACT model (Rosegrant *et al.*, 1995) suggest continued growth in meat consumption and production but at a slower rate (Table 7). Percentage growth will remain highest in sub-Saharan Africa (3.4%), but the absolute increase in production will remain highest in Asia, particularly China (Delgado *et al.*, 1999).

Table 7. Past and projected future trends in meat production (% growth/year) (Delgado *et al.*, 1999).

	1982-1994	1993-2020
Developed countries		
Beef	0.1	0.6
Pork	0.7	0.4
Poultry	3.2	1.2
Developing countries		
Beef	3.1	2.6
Pork	6.1	2.7
Poultry	7.8	3.0

Achievement of this predicted growth in production, however, depends on sufficient supply of feed and Delgado *et al.* (1999) predicted that an additional 292 million tonnes of cereals will be used as feed in 2020 compared to the early 1990s. Critics of meat consumption in developed countries (e.g. Brown, 1997) suggest that even current levels of grain use for

animals are morally unacceptable, but there is already global variation in the extent to which animals are in competition with humans for feed and there is potential for further decreasing that competition. In addition, the feeding of grain to animals provides a buffer for human grain supplies in that in years of high yield, grain is fed to animals, but when grain is scarce and more expensive, the use of grain in animal feeds decreases.

SWINE PRODUCTION

Globally, some 600 million tonnes of cereals are used as animal feed, with a further 119 million tonnes of brans, 133 million tonnes of oilseeds and cakes and 130 million tonnes of roots and tubers (Hendy *et al.*, 1995). Developing countries account for 31% of the total cereals used, but 75% of the brans and 59% of the roots and tubers. The conversion rates for grain to meat are shown in Table 8.

Table 8. Conversion of grain (million tonnes) to meat (million tonnes) 1992-93 (Hendy *et al.*, 1995 and CAST 1999).

	Beef, veal, buffalo	Sheep and goat meat	Pig meat	Poultry meat
Developing countries				
Production	22.2	6.1	38.5	18.8
Grain	5.8	2.0	67.8	29.6
Grain/Product	0.31	0.33	1.76	1.57
Developed countries				
Production	32.1	3.9	36.8	26.0
Grain	83.9	3.1	135.1	55.9
Grain/Product	2.61	0.78	3.67	2.15

The data in Table 8 indicate that the amount of grain used per kg of pig meat produced in developing countries is less than half that used in developed countries. For example in China roots and tubers are used in swine diets. Since (Table 1) they form a more important part of human diets than grains in some developing countries, development of new diets for swine with ingredients which do not compete with human use must take local human dietary traditions as well as local feed resources into account.

The CAST Task Force (CAST, 1999) calculated gross efficiencies of conversion of energy and protein for four countries with contrasting pig production systems (Table 9). Also in Table 9 are the efficiencies of energy and protein production of port and ham, based on human edible inputs, mainly cereals (CAST, 1999).

Table 9. Gross efficiencies of conversion of total and human-edible energy and protein in diets to meat in swine (CAST, 1999).

Country	Energy		Protein	
	Gross efficiency	Human-edible efficiency	Gross efficiency	Human-edible efficiency
Argentina	0.15	0.24	0.07	0.11
Mexico	0.13	0.25	0.08	0.21
South Korea	0.20	0.35	0.16	0.51
United States	0.21	0.31	0.19	0.29

The US has the highest gross efficiencies of energy and protein while South Korea has the highest efficiencies in human-edible terms, due to a relatively high percentage (20%) of by-product use in swine diets, compared to an 82% reliance on cereals in US swine diets. This suggests that there are options for increasing swine production which are not in direct competition with human food supplies.

CONTRIBUTION OF RESEARCH

Increased understanding of the optimum level of fibrous feeds in the diets of swine appropriate to the local resources and the demand for pork is one way in which research can help to meet future demand. However research has already contributed to an increased efficiency of conversion of grain to all kinds of meat (Table 10). Over the 10 years from 1983 to 1993, the efficiency of conversion increased by 15% in both developing and developed countries. There is no reason to think that this efficiency cannot be increased further, particularly in developing countries, where production levels are low.

Table 10. Improvement in the efficiency of conversion of feed grain to meat over time (CAST, 1999).

	Developed countries		Developing countries	
	1983	1993	1983	1993
Total meat (million tonnes)	88	99	50	89
Total feed grain (million tonnes)	453	443	126	194
Feed grain for meat (million tonnes)	290	284	74	114
Conversion Efficiency (unit meat/unit grain)	0.30	0.35	0.68	0.78

CONCLUSIONS

The demand for pork, particularly in Asia, is still increasing. In the past production has increased in response to demand, but 800 million people were estimated to be malnourished at the end of the twentieth century. There have been calls for a decrease in meat production in developed countries to enable grain to be used to feed the global population, but Rosegrant *et al.*, (1999) demonstrated that reduction in meat consumption in developed countries would be likely to have little impact on the nutritional status of poor people in developing countries.

However, in developing countries there are alternatives to the use of grain in pig production and, although these are not used so efficiently in gross energetic terms, they indicate the potential for a more balanced use of global food resources to meet both demand for livestock products and the total nutritional needs of the growing human population.

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