Meat Science 109 (2015) 106–111

Contents lists available at ScienceDirect

Meat Science

journal homepage: www.elsevier.com/locate/meatsci

World meat consumption patterns: An overview of the last fifty years (1961–2011)

P. Sans [a,b,*], P. Combris [b]

[a] INP-Ecole Nationale Vétérinaire de Toulouse, 23 chemin des Capelles, F-31076 Toulouse, France
[b] Institut National de la Recherche Agronomique, UR1303 Aliss, 65 boulevard de Brandebourg, F-94205 Ivry-sur-Seine, France

ARTICLE INFO

Article history:
Received 30 January 2015
Received in revised form 13 May 2015
Accepted 15 May 2015
Available online 21 May 2015

Keywords:
Animal-based protein
Meat
Consumption
Income

ABSTRACT

Driven by economic development and urbanisation, animal-based protein (ABP) consumption has surged worldwide over the last 50 years, rising from 61 g per person per day in 1961 to 80 g per person per day in 2011. This contribution analyses the apparent convergence of dietary models worldwide with respect to the proportion of ABP and especially meat in intake. By using FAO data for 183 countries over the period 1961–2011, the authors show the connection between annual per capita GDP and the level of ABP ($R2 = 0.62$) and meat consumption ($R2 = 0.62$). They emphasise the surge in ABP intake in emerging countries (China, Brazil) which has partly replaced plant protein. However, for similar degrees of economic development, the composition of ABPs and the position of meat within this category vary significantly among countries, suggesting that historical, geographical, cultural and religious factors may be involved.

1. Introduction

Actual access to food determines the development of human societies and shapes dietary models (dietary quantities and patterns). Observations over long time spans make it possible to pinpoint the various stages of change in these models in most countries. After a subsistence economy stage, the dietary transition is characterised by quantitative growth in consumption of traditional foods, essentially of plant origin, through the combined effect of higher agricultural output and lower prices (Combris & Soler, 2011; Grigg, 1995a). Then came a nutritional transition characterised by a radical change in dietary structure when calorie saturation occurred: more expensive foods such as meat, fruit and vegetables superseded in part traditional foods as mean per capita income rose (Popkin, 2006).

Indeed, over the last 50 years, meat consumption rose worldwide from 23.1 kg per person per year in 1961 to 42.20 kg per person per year in 2011. The same is true of proteins from dairy foods. The most developed countries have thus achieved on average levels of animal-based protein (ABP) consumption that exceed needs. Various authors have shown a degree of convergence in dietary models, especially as regards the boom in ABP consumption, first in groups of countries with high purchasing power (Blandford, 1984; Gil, Gracia & Perez y Perez, 1995; Herrmann & Röder, 1995) then in countries with intermediate incomes (Regmi, Takeshima & Unnevehr, 2008): when incomes rise, the proportion of food-budget spending on proteins rises concomitantly with the share of ABPs in the diet and approaches the proportion in developed countries. Over the last 20 years, emerging countries have experienced a livestock revolution characterised by a surge in meat consumption especially meat from monogastric livestock (pork and poultry) (Delgado, 2003; Speedy, 2003). This observation, which seems to accredit the claim that dietary models are converging or at least evolving along parallel courses, raises questions about the levels of ABP consumption such countries will reach. Could it be that they will approach the levels of the most developed countries or will they hit a consumption ceiling before that? This question relates to the determination of an inflection point in the consumption curve, as in the models described by Kuznets (1955). There would seem to be an income level beyond which ABP consumption falls off. By using data from 150 countries for the period 1980–2009, Rivers Cole and McCoskey (2013) confirm that there is a turning point for meat (bovine meat, pig meat and poultry) consumption. However, that point is at a high per capita income level (estimated at US$36,400) that few countries in the world have reached. The authors therefore conclude that policy makers need to curb the increase in individual consumption. The inverted U-shaped relation between meat consumption and the level of income is confirmed by Vranken, Avermaete, Petalios, and Mathijs (2014) for data on 120 countries for the period 1970–2007: according to the specifications in the model chosen, the turning point lies between US$32,000 and US$55,000. For countries below the inflection point, a 1% rise in GDP expressed in constant 2005 international dollars would engender a 0.5% rise in meat consumption whereas a 1% rise in the same GDP for countries beyond the inflection point would generate a 1.2% reduction in consumption.

The potential consequences for the environment and the use of farmland of an individual increase in meat consumption combined

* Corresponding author at: INP-Ecole Nationale Vétérinaire de Toulouse, 23 chemin des Capelles, F-31076 Toulouse, France.
E-mail addresses: p.sans@envt.fr (P. Sans), Pierre.Combris@ivry.inra.fr (P. Combris).

http://dx.doi.org/10.1016/j.meatsci.2015.05.012
0309-1740/

with strong demographic growth on the scale of the planet (9 billion individuals in 2050) are incentives to change dietary practices in developed countries. Changes to nutritional recommendations (Reynolds, Buckley, Weinstein & Boland, 2014) and the promotion of individual behaviour intended to cut down on how often meat is consumed ('meatless days') or portion sizes are some of the levers recently proposed in these countries (Dagevos & Voordouw, 2013; de Boer, Schosler & Aiking, 2014). The search for new sources of both plant and animal protein is also recommended (Boland et al., 2013). Recent studies have tried to measure the impact of such a reduction of meat and milk consumption in Europe (Tukker et al., 2011; Westhoek et al., 2014) and the world (Hedenus, Wirsenius & Johansson, 2014) on the environment, climate and land use. For example, Westhoek et al. (2014) report that replacing 25 to 50% of current EU consumption of meat, eggs and dairy products would cut animal production by 50% and lead to reductions of 25 to 40% in greenhouse gases and about 40% in reactive nitrogen.

Given the scale of the challenge, it seems worth revisiting one of the assumptions underpinning much of this work, namely the increase in ABP consumption in conjunction with the growth in income in emerging or developing countries. This contribution proposes a detailed analysis for the period 1961–2011. We shall begin with a snapshot of world ABP consumption at the end of the period for the purpose of identifying the main trends. Then we shall analyse the evolution of ABP and meat-based protein (MBP) for the entire period.

2. Material and methods

We have used quantitative data from FAO food balance sheets (FAO, 2014) for the period currently available (1961–2011) and for all countries individually. FAOSTAT supply data refer to national per capita supply at a retail level. This is calculated as (national production + import + stocks) − (exports + feed + non-food usage + usage input for food + wastage + closing stocks). Per capita availability is calculated by dividing total availability by the country's population size. Given the losses after the distribution stage, these are not quantities actually consumed by individuals. Besides, as availability is the outcome of a calculation, it depends on how well production is evaluated (Hawkesworth et al., 2010), even if the FAO corrects certain data (Hallström & Börjesson, 2013). Despite these shortcomings, the source indicates intake in the form of time series and it is useful for measuring changes and for highlighting differences between countries or geographical regions.

The data are for daily per person calorie and protein intake and the proportions of plant and animal products in those intakes. Four groups are formed for animal products: (i) Meat (including offals), (ii) Milk products, (iii) Fish and Seafood products and (iv) Others (mainly eggs). This information has been enhanced by World Bank indicators about the geographical region to which the country belongs, annual per capita Gross Domestic Product (GDP), income group, population and urbanisation rate (for the period 2005–2011). The combination of the two data sets covers 183 countries (for 155 of which we have full data for the period 1961–2011).

First we analysed the variation of indicators extracted from the two bases and indicators calculated from each country's income group. This analysis was made for an average of the latest three years available (2009–2011) so as to smooth inter-annual variations. Simple regressions were calculated between the chosen indicator and per capita GDP (in natural log form) and the adjusted R-squared (R2) recorded. Then we analysed the change in calorie and protein intake and the contribution of the various groups (plant and animal) or sub-groups for the periods 1961–1963 (noted 1961 in what follows) and 2009–2011 (noted 2011). Only those countries for which complete data are available were included. Lastly, a closer analysis of ABP was conducted for six countries selected either because of their atypical consumption in their geographical or income-level sub-group (Argentina, India, Japan), or for the marked change in this aspect over the period (Spain, Brazil, China)

3. Results

3.1. Analysis by income group (2009–2011)

By using the World Bank's nomenclature of groups of countries by income, it can be observed that the number of kcal consumed by person per day on average over the period 2009–2011 tracks GDP (R2 = 0.92) and the urbanisation rate. The wealthiest groups consume 1.5 times more kcal per person per day than the poorest (Table 1). The number of grams of proteins consumed follows the same trend (R2 = 0.98), with a higher ratio between extreme groups (1.79). For the same period, the percentage of calories from ABP varies by a ratio of 3.4 between the extreme groups and is also closely related to GDP (R2 = 0.98). Expressed as percentage of total protein intake, ABPs make up between 21.9 and 59.5% for the poorest and richest countries, respectively (ratio 2.7, R2 = 0.99). Lastly the share of meat in ABP supply varies from 6 to 30 g per person per day for the extreme income groups (R2 = 0.98). This ratio of 1 to 5 between the intake levels of poorest and richest countries is the highest among the indicators studied.

3.2. Changes in protein consumption between 1961 and 2011

3.2.1. Proportion of protein in calorie intake

The proportion of protein in the calorie intake is stable between the two extremes for the period under study: 10.7% (min = 6.1, max = 16.1) in 1961 versus 11.2% in 2011 (min = 6.6, max = 15.7). This proportion is weakly correlated with per capita GDP even if it rose slightly over the period (R2 = 0.12 in 1961 versus 0.35 in 2011). Over the period, the share of plant protein in calorie intake falls (from 6.9% to 6.3%) to be replaced by ABP intake (which rises from 3.8% to 4.9%). The first exhibits a weak negative correlation with per capita GDP (R2 = 0.44 in 1961 versus 0.49 in 2011) in contradistinction to the second (R2 = 0.57 in 1961 versus 0.68 in 2011).

3.2.2. Protein intake

Protein consumption rose 31% over the period, from 61 g per person per day in 1961 to 80 g per person per day in 2011. Although the quantity of plant protein consumed rose (from 38 g to 44 g per person per day), its proportion in total intake fell (from 66% to 58%). This can be accounted for by the surge in ABP intake, the consumption of which rose from 23 to 36 g per person per day (+50%). Total protein intake levels remain highly variable depending on the countries and positively correlated with per capita GDP (R2 = 0.5 in 1961 and 0.62 in 2011) (Fig. 1)

Table 1
Calorie and protein intake by income level.

Income group[a]	Low	Lower middle	Upper middle	High non OECD	High OECD	World
n	28	40	46	30	18	162
Population (billions)	0.69	2.31	2.25	0.06	0.99	6.88
GDP[b] (USD)	566	2025	6685	26,919	41,190	9430
Urbanisation (% population)	30.1	45.4	61.5	68.7	77.8	52.0
Total calories (kcal/pers/d)	2287	2597	2896	2987	3363	2847
Protein (g/pers/d)	58	69	82	94	104	80
Animal protein (% total calories)	2.2	3.7	5.2	7.4	7.4	4.4
Animal protein (% total protein)	21.9	34.6	45.4	58.5	59.5	39.4
Meat protein (g/pers/d)	6	12	19	30	30	15

[a] Country list is available in Supplementary data section.
[b] GDP: Gross Domestic Product.