Trends in Food and Nutrient Availability in China, 1950-81

Alan Piazza

WORLD BANK STAFF WORKING PAPERS
Number 607

WORLD BANK STAFF WORKING PAPERS
Number 607

Trends in Food and Nutrient Availability in China, 1950-81

Alan Piazza

The World Bank
Washington, D.C., U.S.A.

The International Bank for Reconstruction
and Development / THE WORLD BANK
1818 H Street, N.W.
Washington, D.C. 20433, U.S.A.

First printing September 1983

Manufactured in the United States of America

Alan Piazza is a consultant to the Projects Department of the East Asia and Pacific Regional Office and to the Population, Health, and Nutrition Department of the World Bank.

Library of Congress Cataloging in Publication Data

Piazza, Alan Lee, 1955-
Trends in food and nutrient availability in China, 1950-81.

(World Bank staff working papers ; no. 607)
1. Agricultural productivity--China. 2. Food supply--China. 3. Nutrition policy--China. I. Title.
II. Series.
HD2097.P5 1983 338.1'9'51 82-12381
ISBN 0-8213-0217-5

Abstract

Agricultural production and trade data recently released from China are the basis of this assessment of per capita nutrient availability in China over time and by province. This large body of data has been compiled into national level food balance sheets for the period 1950-81 and provincial nutrient production figures for 1979-80. Despite limited knowledge of production, trade, utilization and nutrient composition for some foods for some years, the food balance sheets present a comprehensive picture of nutrient availability for each year and of trends in nutrient availability over time and by province.

National average daily per capita energy, protein, and fat availability grew rapidly during the 1950s and marginally exceeded requirements by 1958. The sharp setback of the agricultural sector during the years 1959-64, however, depressed nutrient availability far below requirements in those years. Nutrient availability steadily recovered from the low in 1960 and during the last five years has surpassed requirements by a significant margin. Per capita availability of fine grains, vegetable oils, animal products and other preferred commodities have also increased since 1978. China seems likely to be able to maintain present favorable levels of per capita nutrient availability during the 1980s. Per capita average nutrient availability differs greatly by province. Several Northwestern and Southwestern provinces were below national average nutrient availability levels in 1979-80. Special efforts will be required to improve agricultural productivity and nutritional status in these areas during the 1980s.

Acknowledgements

This report has benefitted from the contributions of a number of World Bank staff members. Rae Nickell carefully prepared the food conversion rates, did most of the work on the nutrient requirements section, and otherwise took part in the compilation of the food balance sheets. Jim Goering and Dean Jamison first proposed the idea of compiling a food balance sheet time series for China, and they have reviewed and commented upon the work throughout its progression. The author would also like to acknowledge the kind assistance of Alan Berg, Lucy Cindoyan, Timothy King, Joanne Leslie, Kyle Peters, Ian Porter, Peter Ting, and Tom Wiens. Several scholars outside of the World Bank have also made important contributions to the report. Charlie Liu and Frederic Surls of the USDA, Bruce Stone of the IFPRI, and John Aird and Judith Bannister of the US Census Bureau were all very generous with their time and their knowledge of China.

Summary and Conclusions

i. The most direct means of assessing a nation's ability to feed its people is through the compilation of food balance sheets. This study presents the results of a time series of yearly food balance sheets for China for the period 1950-81. The food balance sheets model the production, trade, and utilization of food and estimate the levels and sources of net energy, protein, and fat available in the average Chinese diet. The food balance sheets calculate only national average nutrient availability, however, and may be misleading indicators of actual nutritional status for some segments of the society. Disparities in food availability across locality are examined through the compilation of per capita provincial grain production figures over time and per capita provincial nutrient availability in 1979 and 1980.

ii. The substantial increase in the flow of information from China during the last several years has facilitated the compilation of the food balance sheet time series. Despite inadequate knowledge of production, trade, utilization and nutrient composition for some commodities for some years, the food balance sheets are believed to present reasonably accurate nutrient availability figures for each year 1950-81 and a more accurate picture of trends in nutrient availability over time. The provincial data assess disparity in nutrient availability by province for recent years and outline provincial trends in food production over time. Together these national and provincial level data present generally favorable trends in nutrient availability in China.

iii. Per capita nutrient availability in 1981 greatly exceeded the 1950 level, though this improvement has not been stable over time. Average daily per capita nutrient availability grew rapidly after 1949 and by 1958 roughly equaled requirements. The subsequent sharp decline of agricultural production with the Great Leap Forward (1959), however, resulted in a sudden fall of per capita nutrient availability to below the 1950 level. The food crisis of 1959-64 involved a great deal of human suffering. It is likely that total population declined during part of that period. By the mid-1970s per capita nutrient availability had recovered to the levels achieved in 1958. In the last five years, average per capita nutrient availability has surpassed requirements by a significant margin due to increased agricultural production and record grain imports.

iv. The percentage shares of energy, protein, and fat availability coming from crop production and from grains have been remarkably steady over time. Per capita availability of individual commodities has, however, changed significantly. Per capita availability of preferred commodities increased during the 1950s. With the sharp fall in agricultural production at the end of the 1950s, however, per capita production of preferred commodities declined. Since 1978, the increase in preferred commodities' share of total production has resumed.

v. China's agriculture has now achieved a level of production where national average per capita nutrient supply exceeds requirements by a significant margin. It is quite likely, moreover, that per capita nutrient supply will be maintained at least at the current levels. Even pessimistic projections for China's agricultural output suggest per annum growth rates that are above the current population growth rate, indicating continued growth in per capita nutrient availability. The ability to produce above the levels set by minimum food requirements suggests some changing priorities for China's agriculture during the 1980s.

vi. Continued growth in per capita food production remains imperative to further improvements in nutritional status and economic progress in China during the 1980s. Improving the infrastructure and technology for the handling of food after harvest will become increasingly important. Expansion of marketing infrastructure would improve the diversity and stability of food supplies available to consumers. With the increase in land area under private production and the limited acceptance of free trade markets, the transportation and market systems for such trade have been found inadequate. China is also currently interested in upgrading and extending capacity for food fortification. Fortification of foods with vitamin D or iron, for example, would be useful given the incidence of vitamin D and iron deficiency in China. The post-harvest handling of food (transportation, processing and fortification, marketing, and storage) is potentially a profitable labor-intensive industry amenable to international assistance.

vii. Per capita nutrient availabilty differs greatly by province. Provincial nutrient availability was below average nutrient requirements in 10 of China's 29 provinces in both 1979 and 1980 despite the fact that national average nutrient availability was well above requirements in those years. Between 10 and 15% of China's population lived in provinces where average nutrient availability fell below 90% of average nutrient requirements in 1979-80. The shortfalls in nutrient availability are concentrated in several Northwestern and Southwestern provinces. Trends in per capita provincial grain production suggest that the provinces below the national avergae have changed over time. Per capita production has suffered a relative decline in Sichuan and Yunnan while per capita production in Hebei, Liaoning, Shandong and Jiangsu has increased since the 1950s.

viii. The current situation dictates that further improvements in nutritional status will increasingly depend upon more egalitarian distribution of available food. Though China has an admirable record of egalitarian food distribution, there still appears to be significant disparity of nutrient availability by province and at the local and household levels. Though provincial nutrient availability figures are only rough approximations, a very large and nutritionally significant disparity is discernable between provinces with above and below average nutrient availability. The nutrient shortfall (expressed in wheat equivalent) of those provinces producing below average nutrient requirements represents less than three percent of China's total grain production. At issue, however, is the more difficult problem of

increasing agricultural production and income in the poorer Northwestern and Southwestern provinces. Improving production and nutrition in these areas will require special attention.

ix. The production responsibility systems introduced in recent years may have caused the emergence of disparities in access to food supplies at the local and household levels. The emphasis on "linking remuneration with output" (i.e., equating income with output) may further exacerbate the conditions of brigades and teams handicapped by their physical environment. Such groups may have previously benefitted from pooling their income with larger groups. Implementation of the agricultural responsibility system, furthermore, may have put households with few able bodied workers at a disadvantage. With these changes, and their impact on China's rural social welfare system, nutrition of these low income families may be adversely affected.

x. Achievement of a per capita level of nutrient availability which exceeds requirements does not translate directly into adequate or even improved nutritional status for all segments of the population. Although China has tried, apparently quite successfully, to prevent food supplies in poor or climatically-affected areas from falling below the minimum needed for reasonably healthy subsistence, there are significant disparities among locations in nutrient availability. These disparities in local food supplies may cause a significant amount of malnutrition in China. Thus, although there has been remarkable progress in recent years in raising average per capita nutrient availability, much remains to be accomplished.

Contents

Page No.

ANNEXES (Cont'd)

FIGURES IN TEXT

TABLES IN TEXT

Tables in Annex 2

Page No.

Tables in Annex 2 (cont'd)

Tables in Annex 3

Tables in Annex 4

1. METHODOLOGY

1.01 The substantial increase in the flow of information from China during the last several years has facilitated the compilation of a food balance sheet time series with a greater degree of accuracy than was previously possible. Nevertheless, the accuracy and availability of information regarding China's food system differ widely by commodity and by year. Compilation of the food balance sheets has necessarily relied upon certain assumptions regarding food production, trade, utilization, and nutrient composition. The data sources, models, and assumptions used to compile the food balance sheets are detailed in Annex 2. Agricultural production and trade, and national population time series are presented in Annex 3. A brief summary of these data resources and methodology is presented in this section.

1.02 The food balance sheets model China's production, international trade, and utilization of food (Annex 1). The 21 commodities included, rows 1-21 of the food balance sheets, are comprehensive in terms of the nutritionally important items in the Chinese diet. Production, trade, end uses, and nutrient availabilities for the 21 commodities are presented in columns I-X of the food balance sheets. Domestic supply of the commodities (unprocessed) (column IV) are derived from agricultural production figures/1 net of trade. There are no data available for foodgrain reserves, so changes in stocks are assumed to be negligible in the study. Seed, feed, and nonfood manufacturing requirements, dehusking, milling, crushing, other processing losses, and waste are then deducted from domestic supply to determine net food available for human consumption (column VI). The yearly net food availability figures are then converted to per capita daily nutrient availabilities (energy, protein, and fat) according to the mid-year population, the number of days per year, and the nutrient composition of the commodity.

1.03 Agricultural production data have been drawn from Chinese sources as far as possible. Population figures are from the World Bank's demographic model of China, which is also closely tied to official Chinese figures. (Midyear population figures for 1950-81 are presented in Table 9 of Annex 3). Foreign data have played a subsidiary role in the substantiation of the Chinese production data and in providing selected year production data for minor commodities. Trade, processing and utilization, and nutrient composition data rely upon foreign sources because of the absence of Chinese sources. The food balance sheets exclude Taiwan.

/1 Agricultural production data are harvest figures (i.e., net harvest after crop losses during the growing season and harvest).

1.04 All data and models used to compile the food balance sheets have been retained on computer files. With these computer models, the food balance sheets are easily revised to accommodate new data and/or changes in the underlying assumptions. In particular, the impact upon per capita nutrient availability of different values for population, foodcrop production, feedgrain consumption, and other variables is readily determined.

A. Production Data

1.05 Complete time series are only available for China's production of total grains, rice, wheat, and aquatic products./1 Selected year data are available for production of all other commodities except pulses, vegetables, poultry, other meat, eggs, and animal fat.

1.06 Although these production data appear to be reasonably accurate and consistent, one must remain generally cautious with their use. Understatement of production is typical of most newly developed agricultural reporting systems such as China's./2 In China, these likely technical difficulties may have been of secondary importance relative to political pressures in the collection and reporting of statistical information. China's statistical system fell into considerable disarray during the Great Leap Forward (1959 and following years). Production data currently reported for those several years are in part based upon more recently conducted "multiyear recall" surveys.

/1 The primary reference for production data is the 1980 Chinese Agricultural Yearbook (Beijing, Agricultural Publishing House, 1981). Ten Great Years (Beijing, Foreign Language Press, 1960) supplies some additional production data for the 1950s. Finally, China: Country Economic Memorandum (Washington, World Bank, 1982) and China: Review of Agriculture in 1981 and Outlook for 1982 (Washington, USDA Economic Research Service, 1982) (and previous issues of this USDA supplement) have provided some other selected year production figures.

Bruce Stone of the IFPRI has reviewed the currently available agricultural production data in "The Use of Agricultural Statistics," Appendix A of Barker, et al. eds. The Chinese Agricultural Economy, (Colorado, Westview Press, Inc., 1982) pp. 205-245. Also see Fred Surls' brief summary in USDA, China: Review of Agriculture in 1981 and Outlook for 1982 op. cit. pp. 11-12.

/2 See T. Poleman, "Quantifying the Nutrition Situation in Developing Countries" in Food Research Institute Studies, XVIII:1, 1981, pp. 1-58.

1.07 The Chinese Government has reported production data for grains other than rice and wheat for only 9 of the 32 years under study. The residual "other grains" (row 9) is derived as the difference between total grains /1 and all other grains for which production data were available for that year. For the years with an incomplete disaggregation of grain production data, the other grains composite residual is the total of all coarse grains, tubers, soybeans, and other minor grains. For the nine years with a complete disaggregation of grain production, the other grains residual includes only other minor grains (i.e., the residual estimates barley, oats, and other minor grains).

1.08 There are no national figures for production of pulses, vegetables, and eggs. For the nine years with a complete breakdown of grain production, pulse production has been estimated as a residual of the total grain production figures for those years. The procedure relies on the USDA time series for China's production of oats and barley and should be considered as a rough estimate. Vegetable production data are based upon the available selected year vegetable acreage data and assumed yields. The 1957 yield is assumed to have been 20 tons per hectare and to have been increasing at 2% p.a. The resulting vegetable production figures must be regarded as only very rough estimates. Egg production figures have been estimated from per capita consumption figures reported for recent years.

1.09 Production of red meat (pork, beef, and mutton), poultry, other meat, and animal fat was estimated using assumed liveweights, slaughter rates, dressing weights and time series of animal populations and yearly slaughter of swine in accordance with selected year production data. Production figures for edible oil and sugar have been estimated using assumed crush and extraction rates and time series for oilseed, sugar cane and sugar beet production in accordance with selected year production data. Underlying coefficients and models are fully specified in Annex 2. The models and coefficients reflect information available in late 1982 and are generally incomplete in the case of poultry, other meat, and animal fat. Production data for the nutritionally more important commodities (i.e., red meat and edible oil) are believed to be reasonably accurate for most years.

/1 The State Statistical Bureau defines total grains as the sum of rice, wheat, coarse grains (corn, sorghum, millet, and pulses), tubers converted to dry weight, soybeans, and other minor grains (e.g. barley and oats).

B. Trade Data

1.10 Agricultural trade data for China for the period 1950-81 are available in the FAO Trade Yearbook and other sources./1 Imports and exports to China for all reporting countries are summed to derive estimates of China's yearly trade. Trade with nonreporting countries (most notably other communist countries of Asia during the 1950s) is not included and, therefore, the total trade figures understate actual trade to a minor extent. The FAO Trade Yearbooks' figures for China's agricultural trade in the 1970s include Taiwan. As Taiwan's production and trade figures have been excluded from all other segments of the food balance sheets in this exercise, Taiwan's trade figures have also been subtracted from FAO's trade figures for China for the 1970s. Rice trade figures have been converted to their paddy rice equivalents in the food balance sheets and trade in flour and other processed commodities has been expressed in their unprocessed equivalents.

C. Processing and Utilization Data

1.11 Part of China's domestic food supply is diverted from human consumption during transportation, storage, processing and through alternative end uses./2 These losses and alternative end-use requirements are summed and entered as column V of the food balance sheets. Knowledge of the magnitude of food disappearance due to waste and through alternative end uses is incomplete and represents a weak element in the composition of food balance sheets. Disappearance through waste, manufacturing, seed and feed grain requirements, etc., have been approximated using available information and in conjunction with the relevant biological and manufacturing limits. The impact of different assumptions regarding food disappearance upon nutrient availability is discussed in Section 2 E below.

/1 FAO trade data for China for the period 1950-69 have been summarized in the USDA's Agricultural Trade of the PRC, 1935-69 (Washington, Economic Research Service, 1972), pp. 26-39. For other years, the FAO Trade Yearbook (Rome, FAO), USDA, China: Review of Agriculture in 1981 and Outlook for 1982, op. cit., and World Bank, China: Country Economic Memorandum, op. cit., have been relied upon for trade data.

/2 Roughly 30% of domestic food supply is diverted from direct human consumption. Much of this loss, however, represents inedible portions of domestic food supply (e.g., about 40% of this loss is in the form of rice husk).

1.12 Dehusking paddy rice and the milling of other grains is quantitatively the most significant form of such food disappearance./1 Extraction rates reported in China: Rural Processing Technology /2 are somewhat below those reported to the World Bank economic mission to China (1980). A rice extraction coefficient of 67% has been adopted in light of the antiquated inefficient rice processing equipment generally in use in China.

1.13 Grain for use in animal husbandry in China is estimated to account for 7 to 11% of total grain output. Results of a feeding regimen model similar to that used by Dawson /3 suggest that roughly 12% of China's total unprocessed grain production is used as feed grain (roughly 22% when including grain millings and oilseed cake). These figures are used in the food balance sheets and may overstate the true amount of grain used in animal husbandry by several million metric tons. Little is known as to which of the grains produced in China are used as feed grains.

1.14 Seed requirements have been estimated from data reported by the World Bank Staff Appraisal Reports for the North China Plain Agricultural and Hebei Agricultural Development Projects and from other references. The 3% figure for waste which is used in the FAO provisional food balance sheets has been adopted in this study for most commodities. Coefficients for the share of domestic food supply used for nonfood manufacturing end uses (e.g. soap, candles, starch) have been taken from the FAO provisional food balance sheets for China. Due to inadequate information, food manufacturing end uses such as alcoholic beverage and tofu (soybean curd) production have not been reported in the food balance sheets. This implicitly assumes that the net nutrient loss from such food manufacturing is negligible relative to total nutrient availability.

1.15 Total domestic food supplies are converted to their per capita equivalents by dividing by mid-year population as estimated by the World Bank's demographic model. Though foreign estimates of China population are now converging, it is generally accepted that the figures released by the Chinese Government may be undercounts of the true population. The World Bank's demographic model is developed from China's official demographic data

---

/1 Over 50% of this disappearance, however, is in the form of rice husk. As rice husk is not edible, it is inaccurate to consider this food disappearance. Dehusking paddy rice generally involves some loss of the rice bran, however, especially with more antiquated rice husking technology. The milling of wheat and other grains also results in a loss of nutrient value.

/2 FAO, China: Rural Processing Technology (Rome, FAO, 1979), pp. 24-27.

/3 Owen L. Dawson, Communist China's Agriculture: Its Development and Future Potential (New York, Praeger Publishers, 1970), pp. 178-185.

using internally consistent birth and death rates. China's official figures for 1982 are based upon household registration and may omit citizens existing outside of the household registration system and thereby possibly understate total population by as much as 5 or 6%.

D. Nutrient Composition

1.16 The per capita food availabilities presented in column VII of the food balance sheets are converted to their nutrient equivalents using the food conversion rates shown in Table 2.1. Most of the figures in Table 2.1 have been adopted from FAO./1 Several of the commodities listed in Table 2.1 are composites of similar like foods. Such composites are the weighted average of each of the component foods. The "other grains" composite, for instance, is composed of 20% oats and 80% barley./2

1.17 A comprehensive reference for the food conversion rates is Tables of Food Composition /2 (in Chinese). Unfortunately, the extensive breakdown of each commodity by numerous varieties and grades makes this excellent reference unusable at present. Tables of Food Composition clearly shows the tremendous variation in nutrient content across variety and grade. Protein content, for instance, varies from a low of 47 g/kg to a high of 139 g/kg for the 28 varieties and grades of rice listed. Fat varies from 3 g/kg to 93 g/kg and energy from 3,330 kcal/kg to 3,730 kcal for these same varieties and grades./4 If, for example, the nutrient content of rice has been overestimated by 10%, then total energy availability has been overstated by 4%, total protein by 2.5%, and total fat by less than 1%.

/1 FAO, The Composition of Some East Asian Foods (Rome, FAO, 1968).

/2 The "other grains" composite food conversion rate for years with incomplete data is a weighted average of the nutrient composition of the several coarse grains, pulses, and tubers represented by the "other grain" composite. Time period specific food conversion rates for the "other grain" composite are specified in Table 2 of Annex 2.

/3 Tables of Food Composition (Beijing, People's Public Health Press, 1982).

/4 Tables of Food Composition, op. cit., pp. 4-8. Variety, grade, and degree of processing are more important determinants of protein and fat content relative to energy content.