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· AGRICULTURE - BOLIVIA

ANALYTICAL WORKING DOCUMENT # 19

ANALYSIS OF FOOD PRODUCTION RELATIVE
TO NUTRITIONAL REQUIREMENTS IN
BOLIVIA

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Analysis of Food Production Relative to Nutritional Requirements in Bolivia

One of the basic dimensions of a country's nutritional situation is the level of food production in relation to the population's nutritional requirements. The purpose of this document is to present preliminary estimates of food energy and protein production in Bolivia and to compare these estimates with the corresponding requirements of the Bolivian population.

Methodology and Data Sources

Agricultural production estimates for 15 of the most important commodities are based on a recent farm survey conducted jointly by the Bolivian Ministry of Agriculture and Utah State University. Preliminary estimates of average crop production and livestock inventories per farm in each of ten ecological zones were multiplied by the number of farms in each zone to obtain total zonal estimates. The latter, which were provided by Utah State University, are the starting point for this study. Since the survey data will undergo further editing, the zonal production estimates may be revised. However, the current estimates are considered adequate for this first stage analysis.

Although agricultural production estimates were obtained on a zonal basis, and most of the data presented in this report refer to the ten zones, the derived zonal estimates of food energy and protein production are aggregated to national and regional levels for the discussion in the second and fourth sections of this document.

Starting with the agricultural production estimates, allowances were made for feed, seed, waste, and industrial requirements to arrive at estimates of the quantities available for human food consumption. The general procedures for these calculations were based on the FAO food balance sheets. ^{1/} The detailed calculations for the various commodities are presented in Appendix A. Crop production estimates are based directly on the survey data; in the case of livestock, a takeoff rate was applied to inventory figures to estimate the number of head slaughtered because the latter data were not collected in the survey. The basing of production estimates on inventory data is an additional source of possible error in the meat production estimates, although possible errors in the estimates of grain used for livestock feed may also be substantial in some cases.

^{1/} Food and Agriculture Organization of the United Nations, Food Balance Sheets 1964-66 Average, Rome, 1971.

In the commodity tables, food production is divided by the zone's population to obtain per capita production. The latter figures are then converted to estimates of calories, proteins and fat.

As mentioned earlier, production estimates for only 15 commodities are based on the survey. Some important commodities were not analyzed in detail because the survey data were not in usable form. Data for other commodities were not used because of their very minor importance as sources of food. Nevertheless, the 15 commodities analyzed in detail account for over 80 percent of total food production (see Table 2).

Aside from possible estimation errors, it should be pointed out that the level of food production relative to aggregate needs is not necessarily a good measure of the incidence of malnutrition. Even though enough food may be available to provide adequate nourishment for everyone, a significant portion of the population may suffer from malnutrition because of the unequal distribution of food. This is often due in large part to the basic problem of extremely low incomes in some segments of the population. On the other hand, the nutritional status of a country or a region may be good even though its food production is less than its nutritional requirements.

Production estimates are useful, however, in determining the "food gap" which must be filled either by imports from outside the country or interregional shipments within the country as a precondition to attaining adequate nutritional levels. In the absence of any better indicators, a large shortfall in food production in a primarily agricultural area would at least indicate the possibility of a severe malnutrition problem. Nutritional programs, however, should be preceded, if possible, by direct measures of individual's nutritional status.

National Averages

Before proceeding to the regional analysis, a brief discussion of national average consumption and requirements will lend some perspective to the more disaggregated figures in the following sections. Four previous estimates of consumption or intake of food energy and protein are presented in Table 1 along with the estimates obtained in the present study. The conventional measures--calories per person per day and grams of protein per person per day--are used. The last two lines of the table provide two estimates of minimum nutritional requirements, which are standards for measuring the adequacy of consumption.

Per capita food energy consumption is inadequate except for the estimate obtained in the present study. The latter was obtained by summing net production of food energy for the 15

commodities analyzed in this report (Table 5) and adjusting the result for other commodities and net imports. (See Appendix B for procedures used in making these adjustments). Since the adjustments are based on data in the 1969-71 food balance sheet, the higher (compared to 1969-71 FAO) food energy estimate obtained in the present study is the result of the higher agricultural production estimates based on the farm survey.

The adequacy of protein consumption per capita depends upon which minimum requirement is used. If the higher standard (56.0 grams) is used, per capita consumption is inadequate in three of the five cases. However, this standard, which is based on a document published in 1964 appears to be too high in light of more recent expert opinion. If we use the standard of 41.0 grams, which is in accord with current estimates,^{2/} all protein consumption estimates exceed the standard.

^{2/} Joint FAO/WHO Ad Hoc Expert Committee, Energy and Protein Requirements, Food and Agriculture Organization of the United Nations, Rome, 1973.

Table 1. Estimates of Food Energy and Protein Consumption and Minimum Requirements Per Capita Per Day, Bolivia

Year	Source	Food Energy (Calories Per Day)	Protein (Grams Per Day)
<u>Consumption</u>			
1958-62	ICNND ^{1/}	2,108	66.1
1964-66	FAO ^{2/}	1,765	45.8
1970	MINAG ^{3/}	1,834	48.7
1969-71	FAO ^{4/}	1,900	45.8
1972	Survey ^{5/}	2,507	62.9
<u>Minimum Nutritional Requirements</u>			
	ICNND ^{6/}	2,232	56.0
	FAO/WHO ^{7/}	2,263	41.0

^{1/} Interdepartmental Committee on Nutrition for National Defense, Bolivia Nutrition Survey cited in U.S. AID Mission to Bolivia, Agricultural Development in Bolivia: A Sector Assessment, La Paz, August 1974, p.9.

^{2/} Food Balance Sheets 1964-66 Average, FAO, Rome, 1971.

^{3/} Bolivian Ministry of Agriculture, unpublished data cited in U.S. AID Mission to Bolivia, op. cit., p.11.

^{4/} Unpublished food balance sheet.

^{5/} Based on farm survey results described in text, with adjustments for excluded commodities and net imports. See Table 4, 5 and A3 and Appendix B, this document.

^{6/} Bolivia Nutrition Survey, cited in U.S. AID Mission to Bolivia, op. cit., p.8.

^{7/} Based on report of Joint FAO/WHO Expert Committee. See Table A2, this document.

In conclusion, it appears that the average intake of food energy is adequate, although this cannot be stated with a very high degree of certainty, particularly because it is at variance with earlier estimates. We can conclude with a greater degree of confidence that average protein intake is greater than the minimum requirement. However, a significant but unknown percentage of the population probably suffers from inadequate food energy and protein consumption. Furthermore, serious health problems may be caused by inadequate intake of other nutrients.

The direct evidence of malnutrition is fragmentary. While it effects all age groups, its greatest impact is registered in the high mortality and morbidity rate among pre-school children. Sample surveys indicate that 40 to 50 percent of pre-school children in Bolivia are malnourished. Based on a study by PAHO, malnutrition was judged to be associated with 50 percent of all deaths in this group. ^{3/}

^{3/} U.S. AID Mission to Bolivia, Health Sector Assessment, La Paz, January 1975.

Regions and Zones

Bolivia has been divided into ten ecological zones described in the recent agricultural sector assessment. ^{4/} The zones are aggregated into three regions: (1) Oriente, (2) Valleys and Yungas, and (3) Altiplano. Following is a list of the regions with their constituent zones.

<u>Region</u>	<u>Zones</u>
Oriente	Amazon Rain Forest Beni Plain Brazilian Shield Santa Cruz Bolivian Chaco
Valley and Yungas	Valleys Yungas
Altiplano	North Altiplano Central Altiplano South Altiplano

^{1/} U.S. AID Mission to Bolivia, Agricultural Development in Bolivia: A Sector Assessment, La Paz, August 1974, p. 42-49.

The Oriente region is a tropical and sub-tropical lowland area comprising the eastern part of the country. The Valleys and Yungas are located on the eastern slopes of the eastern chain of the Andes at elevations ranging from 1,000 to 9,000 feet above sea level. The Altiplano is a generally flat plain at altitudes of 11,500 to 14,000 feet. The zones are described in some detail in the agricultural assessment, to which the interested reader is referred.

Regional Production and Requirements

Production estimates by region for the 15 commodities treated in detail in the present report and production of other commodities are added in Table 2 to obtain estimates of total regional food production. (See Appendix B for procedures used to derive the totals). The first group of 15 commodities is referred to as "included commodities" and the second as "excluded commodities". Additional sources of possible error are introduced in the process of allocating production among regions. This is particularly true of production of many of the excluded commodities which, in the absence of better information, was allocated among regions in proportion to rural population. However, the differences in estimated production per capita among regions are so great that meaningful conclusions can be reached, despite possible measurement errors.

Table 2. Estimated Production of Food Energy and Protein by Region in Bolivia

Region	Food Energy 1/ (Million Calories)	Protein 1/ (Million Grams)
<u>Oriente</u>		
Included Commodities 2/	5,332	94.6
Excluded Commodities 3/	578	10.9
Total	<u>5,910</u>	<u>105.5</u>
<u>Yungas and Valleys</u>		
Included Commodities 2/	2,794	87.7
Excluded Commodities 3/	910	21.7
Total	<u>3,704</u>	<u>109.4</u>
<u>Altiplano</u>		
Included Commodities 2/	941	41.1
Excluded Commodities 3/	668	17.2
Total	<u>1,609</u>	<u>58.3</u>
<u>Bolivia</u>		
Included Commodities 2/	9,067	223.4
Excluded Commodities 3/	2,156	49.8
Total	<u>11,223</u>	<u>273.2</u>

1/ Production is expressed on a per day basis

2/ Refers to the 15 commodities treated in detail in the present report. See tables 5, 6, and A-4.

3/ Refers to commodities not treated in detail in the present report. See tables A-3, and A-5.

Regional production and nutritional requirements are compared in Table 3. Per capita requirement figures were multiplied by population to obtain requirements for entire regions. Our estimate of food energy production is only slightly less than the population's consumption requirement for Bolivia as a whole, however, there are great differences among regions. Production in the Oriente region is more than three times the requirement of the Oriente population, while the Altiplano produces less than one-third its needs.

Protein production is considerably greater than Bolivia's minimum consumption requirement. The Valleys and Yungas produce adequate protein, although they exhibit a substantial shortfall in food energy. Production of protein in the Altiplano is higher relative to minimum needs than is food energy, but is still low. Production in the Oriente in terms of protein relative to the minimum requirement is almost identical to food energy.

If the major economic activity of the rural population is the production of food, production of food per person in the rural population should be greater than per capita nutritional requirements. Production in the Altiplano, however, falls far short of this standard for food energy (2,263 calories). The Valleys and Yungas barely produce enough food energy to fulfill the needs of their rural population, but protein production is considerably above the minimum standard. If the rural residents of the Altiplano are to obtain adequate diets, they must earn substantial

amounts of income from activities other than food production. Although mining and other industries are sources of income for the rural population in the Altiplano, it is questionable whether this income is enough for them to purchase adequate food. The Ministry of Agriculture/Utah State survey collected data on family consumption and expenditures which can be used to investigate this question after the editing of individual records is completed.

Table 3. Summary of Population, Nutrient Production and Requirements, Bolivia, 1972

	Oriente Region	Valleys and Yungas	Altiplano	Bolivia Total
Rural Population (Thousands) <u>2/</u>	552	1,614	1,362	3,528
Urban Population (Thousands) <u>2/</u>	249	466	933	1,648
Total Population (Thousands) <u>2/</u>	801	2,080	2,295	5,176
Rural Food Energy Requirement (Million Calories) <u>1/</u>	1,249	3,652	3,082	7,984
Urban Food Energy Requirement (Million Calories) <u>1/</u>	563	1,055	2,111	3,729
Total Food Energy Requirement (Million Calories) <u>1/</u>	1,813	4,707	5,194	11,713
Food Energy Production (Million Calories) <u>1/</u>	5,910	3,704	1,609	11,223
Rural Protein Requirement (Million Grams) <u>1/</u>	22.6	66.2	55.8	144.6
Urban Protein Requirement (Million Grams) <u>1/</u>	10.2	19.1	38.3	67.6
Total Protein Requirement (Million Grams) <u>1/</u>	32.8	85.3	94.1	212.2
Protein Production (Million Grams) <u>1/</u>	105.5	109.4	58.3	273.2
Production as a Percentage of Total Requirements:				
Food Energy (Percent)	326	79	31	96
Protein (Percent)	322	128	62	129
Production per Person in the Rural Population:				
Food Energy (Calories) <u>1/</u>	10,707	2,295	1,181	3,181
Protein (Grams) <u>1/</u>	191.1	67.8	42.8	77.4

1/ Food energy and protein requirements and production are expressed on a per day basis. Production estimates are taken from Table 2. See Appendix Table A-2 for derivation of per capita requirements.

2/ Population data obtained from U.S. AID Mission to Bolivia, Agricultural Development in Bolivia: A Sector Assessment, LaPaz, August 1974, P. 52.

If Bolivia's food production, which is nearly adequate for the nation as a whole, is to meet the nutritional needs of the people in all regions, there must be large shipments from the Oriente to the other regions to supplement the food intake of the rural population and fulfill the needs of the urban populace. Table 4 illustrates the magnitude of interregional shipments that would be needed to attain food energy requirements in all three regions. This does not purport to be a description of actual interregional trade, the magnitude of which is unknown, but rather an indication of what needs to be done given the present geographical distribution of production and population. Nearly 70 percent of food production (measured in terms of food energy) in the Oriente would have to be moved to the Altiplano and the Valleys and Yungas. This would have to be supplemented by shipments from abroad equivalent to four percent of national production.

Even if the residents of deficit areas possess adequate purchasing power, transportation and marketing services to realize these interregional shipments would be formidable. This raises questions as to whether a strategy to improve the nutritional status of Bolivia's population should focus on increased food production in the deficit areas or increased production in the Oriente, perhaps accompanied by improved food marketing and transport systems. Migration of people from the Valleys and Yungas and especially the Altiplano would also ameliorate the problem.

Table 4. Interregional and International Shipments Needed to Attain Food Energy Requirements ^{1/}

Region	Production	Interregional Shipments	International Shipments	Consumption Requirement
Oriente	5,910	- 4,097	-	1,813
Valleys and Yungas	3,704	1,003	-	4,707
Altiplano	1,609	3,094	491	5,194
Bolivia (Net)	11,223	-	491	11,713

^{1/} All figures are in terms of million calories per day. A negative sign indicates shipments out of the region. Production and consumption requirements are taken from Table 3.

Commodity Production by Zone

Tables 5 and 6 show production of food energy and protein per capita by zone for the 15 commodities analyzed in this report. The sum of calories or protein attributed to these products is designated "sub-total of production" to indicate that these food commodities do not constitute an exhaustive list of food commodities produced in Bolivia. Likewise, the "deficit", which is the difference between the minimum requirement for food energy or protein and the sub-total of production, will be filled to some extent by other foods. However, the most important commodities have been accounted for, namely, corn, wheat, rice, potatoes, yuca, beef and veal, and sugar.

Table 5. Production of Major Food Commodities in Terms of Food Energy (Calories) per Capita per Day by Zone, Bolivia, 1972

Food Commodity	Amazon Rain Forest	Beni Plain	Brazilian Shield	Santa Cruz	Bolivian Chaco	Valleys	Yungas	North Altiplano	Central Altiplano	South Altiplano	National Average
Corn	748	548	938	1,392	3,460	648	441	2	76	64	518
Wheat	2	-	-	*	*	145	*	-	111	9	78
Barley	-	-	-	-	-	37	1	16	36	4	25
Rice	897	643	660	2,047	24	1	370	-	-	-	164
Quinoa	-	-	-	-	-	4	-	20	35	244	19
Potatoes	11	-	-	51	23	323	50	38	193	128	176
Oca	-	-	-	-	-	34	-	12	8	-	16
Yuca	2,199	374	463	1,381	45	-	508	-	-	-	165
Sweet Potatoes	-	8	-	6	13	1	5	-	-	-	2
<u>Meat</u>											
Beef & Veal	221	1,932	323	313	263	64	28	18	65	4	124
Sheep	*	2	2	3	11	25	9	12	66	31	29
Goat	*	1	4	2	63	23	*	-	5	5	11
Pork	56	33	38	30	84	18	14	9	14	4	20
Poultry	10	8	20	18	13	3	9	*	2	1	4
Sugar	61	70	145	8,408	109	*	26	-	-	-	394
Sub-Total of Production	4,205	3,619	2,593	13,731	4,108	1,326	1,461	127	611	494	1,745
Deficit	-	-	-	-	-	937	802	2,136	1,652	1,769	518
Minimum Requirement ^{1/}	2,263	2,263	2,263	2,263	2,263	2,263	2,263	2,263	2,263	2,263	2,263

* Less than 0.5 calorie per capita

^{1/} See Appendix Table A2 for derivation of per capita requirement

Table 6. Production of Major Food Commodities in Terms of Protein per Capita per Day by Zone, Bolivia, 1972

Food Commodity	Amazon Rain Forest	Beni Plain	Brazilian Shield	Santa Cruz	Bolivian Chaco	Valleys	Yungas	North Altiplano	Central Altiplano	South Altiplano	National Average
	(Grams)	(Grams)	(Grams)	(Grams)	(Grams)	(Grams)	(Grams)	(Grams)	(Grams)	(Grams)	(Grams)
Corn	19.4	14.2	24.3	36.1	89.7	16.8	11.4	0.1	2.0	1.6	13.4
Wheat	0.1	-	-	-	*	5.8	*	-	4.5	0.4	3.1
Barley	-	-	-	-	-	0.9	*	0.4	0.9	0.1	0.6
Rice	16.6	11.9	12.2	37.8	0.4	*	6.8	-	-	-	3.0
Quinoa	-	-	-	-	-	0.2	-	0.7	1.2	8.1	0.6
Potatoes	0.3	-	-	1.4	0.6	8.9	1.4	1.1	5.3	3.5	4.9
Oca	-	-	-	-	-	1.1	-	0.4	0.3	-	0.5
Yuca	12.1	2.1	2.5	7.6	0.3	-	2.8	-	-	-	0.9
Sweet Potatoes	-	0.1	-	0.1	0.2	*	0.1	-	-	-	*
<u>Meat</u>											
Beef & Veal	19.3	169.1	28.3	27.4	23.0	5.6	2.5	1.6	6.3	0.3	10.8
Sheep	*	0.2	0.2	0.3	0.8	1.7	0.7	0.9	4.8	2.1	2.1
Goat	*	0.1	0.3	0.1	4.5	1.6	*	-	0.3	0.3	0.8
Pork	3.5	2.1	2.3	1.9	5.2	1.2	0.9	0.6	0.9	0.2	1.2
Poultry	1.5	1.2	3.0	2.6	2.0	0.5	1.4	0.1	0.3	0.1	0.6
Sugar	-	-	-	-	-	-	-	-	-	-	-
Sub-Total of Production	72.8	201.0	73.1	115.3	126.7	44.3	28.0	5.9	26.8	16.7	42.5
Deficit	-	-	-	-	-	-	13.0	35.1	14.2	24.3	-
Minimum Requirement ^{1/}	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0	41.0

* Less than 0.05 grams of protein

^{1/} See Appendix Table A2 for derivation of per capita requirement

Production in each zone comprising the Oriente region--Amazon Rain Forest, Beni Plain, Brazilian Shield, Santa Cruz and Bolivian Chaco--is greater than the population's requirements in terms of both food energy and protein. Corn and beef are important food items produced in all five zones, while rice and yuca are important in all except the Bolivian Chaco. Most of Bolivia's sugar is produced in one zone, Santa Cruz. In terms of food energy produced per capita, Santa Cruz is far above any other zone, mainly because of its large sugar production. Protein production per capita is highest in the Beni Plain because of its high output of beef and veal.

Both the Valleys and the Yungas zones show deficits in food energy, although substantial quantities of many different commodities are produced. Protein is adequate in the Valleys, but a fairly large deficit exists in the Yungas. A large share of the Valleys' protein supply is obtained from corn and potatoes, but nearly one-fourth is obtained from animal sources. Although no systematic attempt has been made to evaluate the quality of protein in terms of amino acid composition, it appears that the quality of protein is relatively high in the Valleys, as well as other zones; the combination of about one-fourth animal and three-fourth plant protein probably yields a fairly good amino acid balance.

All three zones in the Altiplano exhibit large deficits in food energy and protein. The extremely low levels in the North Altiplano is partly explained by the high percentage of urban population in that zone. The most important food commodities are corn, wheat, quinoa (which is insignificant in the other regions), potatoes, beef and veal, and sheep meat.

Appendix A

This Appendix includes 20 tables; the last 15 contain the detailed commodity calculations.

Following is a list of these tables.

Table A1. Bolivian Population by Zone and Region.

Table A2. Calculation of Minimum Requirements for Calories and Proteins Per Day.

Table A3. Estimates of Consumption of Excluded Commodities, Net Imports of Included Commodities, and Production of Excluded Commodities Per Capita, Bolivia, 1972

Table A4. Total Food Energy and Protein Production by Zone and Region for Included Products.

Table A5. Percentage Distribution by Region with Total Production of Food Energy and Protein from Excluded Products.

Commodity Tables

Table A6. Maize	Table A15. Cattle
Table A7. Wheat	Table A16. Sheep
Table A8. Barley	Table A17. Goats
Table A9. Rice	Table A18. Pork
Table A10. Quinoa	Table A19. Poultry
Table A11. Potatoes	Table A20. Sugar Cane
Table A12. Oca	
Table A13. Yuca	
Table A14. Sweet Potatoes	

Table A1 Bolivian Population by Zone and Region

Zone Number	Zone Name and Region	Population
		(1,000)
	I Oriente	
1	Amazon Rain Forest	132
2	Beni Plain	116
3	Brazilian Shield	109
4	Santa Cruz	233
5	Bolivian Chaco	213
	Sub-total	803
6	II Valleys	1,811
7	Yungas	269
	Sub-total	2,080
	III Altiplano	
8	North	927
9	Central	1,257
10	South	112
	Sub-total	2,296
Total		5,176

Source: Agricultural Development in Bolivia: A Sector Assessment, United States AID Mission to Bolivia, La Paz, August 1974, p. 52

Table A2 - Calculation of Minimum Requirements for Calories and Proteins per Day.

Age Group (Years)	Percent of Population ^{1/}	Per Capita Energy ^{2/} Requirements (Calories)	Per Capita Protein ^{3/} Requirements (Grams)
Less than 1	4	820	33
1-4	14	1,318	25
5-9	15	2,068	33
10-14	13	2,550	45
15 and Over	54	2,600	47
Weighted Average	-	2,263	41.0

^{1/} Estimates based on Colombian data in Enrique Perez Sanin, Parametros Demograficos Colombiano 1951-1964, proyecciones de Poblacion, 1965-1985, Bogota, Colombia, p. 269.

^{2/} Estimates based on data in FAO/WHO Ad Hoc Expert Committee, Energy and Protein Requirements, Rome, 1973, p. 34-35.

^{3/} Estimates based on data in FAO/WHO Ad Hoc Expert Committee, Energy and Protein Requirements, Rome, 1973, p. 74 and 87. The entry for children less than one year old represents allowances for pregnancy and Lactation. Protein score is assumed to be 70.

Table A3

Estimates of Consumption of Excluded Commodities, Net Imports of Included Commodities, and Production of Excluded Commodities
Per Capita, Bolivia, 1972.

Commodity	Consumption of Excluded Commodities			Net Imports of Included Commodities			Production of Excluded Commodities	
	Quantity Consumed	Food Energy Per Capita	Proteins Per Capita	Net Quantity Imported	Food Energy Per Capita	Proteins Per Capita	Food Energy Per Capita	Proteins Per Capita
	(1,000 MT)	(Calories Per Day)	(Grams Per Day)	(1,000 MT)	(Calories Per Day)	(Grams Per Day)	(Calories Per Day)	(Grams Per Day)
Wheat	-	-	-	169	272.6	8.57	-	-
Barley	-	-	-	1	1.5	0.05	-	-
Oats	2	2	0.1	-	-	-	2	0.1
Other Cereals NES	9	20	0.7	-	-	-	20	0.7
Plantains	48	22	0.2	-	-	-	22.5	0.2
Other Roots NES	36	19	0.3	-	-	-	19	0.3
Pulses, Nuts & Oil Crops	18	35	1.9	-	-	-	38	1.9
Vegetables	251	43	2.0	-	-	-	43	2
Oranges-Tangerines	58	11	0.2	-	-	-	11	0.2
Lemons-Limes	16	2	-	-	-	-	2	-
Bananas	119	47	0.6	-	-	-	47.4	0.6
Other Fruit NES	119	34	0.5	-	-	-	33.3	0.5
Other Meat NES	6	4	0.5	-	-	-	4	0.5
Eggs	10	9	0.7	-	-	-	9	0.7
Fish	2	2	0.2	-	-	-	2	0.2
Whole Milk & Cheese	77	40	2.2	-	-	-	28.5	0.9
Fats & Oils	42	166	0.2	-	-	-	101.2	0.1
Beverage Crops	6	5	0.3	-	-	-	6.6	0.5
Alcoholic Beverages	73	27	0.2	-	-	-	27	0.2
Totals	-	488	11.8	-	274.1	8.62	416.5	9.6

Source: FAO, Unpublished Food Balance Sheet, 1969-71.

Table A4 - Total Food Energy and Protein Production by Zone and Region for Included Products

Zone and Region	Food Energy ^{1/} (Million Calories)	Protein ^{1/} (Million Grams)
I Oriente		
1) Amazon Rain Forest	555.1	9.6
2) Beni Plain	419.8	23.9
3) Brazilian Shield	282.6	7.9
4) Santa Cruz	3,199.3	26.9
5) Bolivian Chaco	875.0	26.9
Sub-total	5,331.8	94.6
II Valleys		
6) Valleys	2,401.4	80.2
7) Yungas	393.0	7.5
Sub-total	2,794.4	87.7
III Altiplano		
8) North	117.7	5.5
9) Central	768.0	33.7
10) South	55.3	1.9
Sub-total	941.0	41.1
National Total	9,067.2	223.4

^{1/} Calculated by multiplying per capita production figures in Table 5 and 6 by population figures from Table A1.

Table A5

Percentage Distribution by Region with Total Production of Food Energy
and Protein from Excluded Products

	National ^{2/}	Oriente	Valleys & Yungas	Altiplano
<u>Percent Distribution</u>				
Plantains	100	25	75	-
Oranges-Tangerines	100	63	37	-
Lemons-Limes	100	34.5	53	12.5
Bananas	100	98	2	-
Other ^{1/}	100	15.6	45.8	38.6
<u>Food Energy</u> (Million Calories)				
Plantains	116.5	29.1	87.4	-
Oranges-Tangerines	56.9	35.8	21.1	-
Lemons-Limes	10.4	3.6	5.5	1.3
Bananas	245.3	240.4	4.9	-
Other ^{1/}	1,726.7	269.4	790.8	666.5
Total	2,155.8	578.3	909.7	667.8
<u>Protein</u> (Million Grams)				
Plantains	1.1	0.28	0.83	-
Oranges-Tangerines	1.1	0.69	0.41	-
Lemons-Limes	-	-	-	-
Bananas	3.1	3.0	0.1	-
Other ^{1/}	44.5	6.9	20.4	17.2
Total	49.8	10.9	21.7	17.2

^{1/} It is assumed that energy and protein production derived from "other" products are distributed by region according to the percentage of rural population.

^{2/} National production is estimated by multiplying per capita figures in Table A3 by national population.

Table A6

Country: Bolivia

Commodity: Maize (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization				Per Capita Consumption						
	Input 4/	Output 5/	Feed	Seed 1/	Manufacture for Food 3/	Waste 2/	Food	Kilograms per Year	Grams per Day	Calories per Day 6/ (Number)	Proteins per Day 6/ (Grams)	Fat per Day 6/ (Grams)	
			(Metric tons unless specified otherwise)										
1 Maize	-	12,759.0		125.0	11,996.0	638.0							
Maize/Meal	10,916.0	10,152.0					10,152.0	76.91	210.71	748.0	19.4	8.2	
Maize/Beer	1,080.0	*											
2 Maize		8,215.0		82.0	7,722.0	411.0							
Maize/Meal	7,027.0	6,535.0					6,535.0	56.37	154.44	548.3	14.2	6.0	
Maize/Beer	685.0	*											
3 Maize		12,949.0		171.0	12,130.0	648.0							
Maize/Meal	11,038.0	10,516.0					10,516.0	96.48	264.33	938.4	24.3	10.3	
Maize/Beer	1,092.0	*											
4 Maize		42,042.0		527.0	39,413.0	2,102.0							
Maize/Meal	35,866.0	33,355.0					33,355.0	143.15	392.19	1,392.3	36.1	15.3	
Maize/Beer	3,538.0	*											
5 Maize		90,086.0		1,072.0	84,510.0	4,504.0							
Maize/Meal	76,904.0	71,521.0					71,521.0	335.78	974.74	3,460.3	89.7	38.0	
Maize/Beer	7,606.0	*											
6 Maize		156,146.0		5,958.0	142,381.0	7,807.0							
Maize/Meal	129,567.0	120,497.0					120,497.0	66.57	182.38	647.5	16.8	7.1	
Maize/Beer	12,814.0	*											
7 Maize		15,453.0		282.0	14,398.0	773.0							
Maize/Meal	13,102.0	12,185.0					12,185.0	45.30	124.12	440.6	11.4	4.8	
Maize/Beer	1,296.0	*											
8 Maize		267.0		24.0	230.0	13.0							
Maize/Meal	203.0	195.0					195.0	0.21	0.58	2.1	0.05	0.02	
Maize/Beer	21.0	*											
9 Maize		12,650.0		447.0	11,671.0	633.0							
Maize/Meal	10,621.0	9,877.0					9,877.0	7.86	21.53	76.4	2.0	0.08	
Maize/Beer	1,050.0	*											
10 Maize		875.0		26.0	805.0	44.0							
Maize/Meal	733.0	733.0					733.0	6.54	17.92	63.6	1.6	0.7	
Maize/Beer	73.0	*											
X Maize		351,442.0		8,614.0	325,256.0	17,573.0							
Maize/Meal	295,983.0	275,566.0					275,566.0	53.24	145.86	517.8	13.4	5.7	
Maize/Beer	29,273.0	*											

1/ Source: Based on an unpublished survey conducted by the Bolivian Ministry of Agriculture and Utah State University, 1974.

2/ 5% of Maize output.

3/ Manufacture for food is output minus feed, seed waste and food.

4/ Assumes 91% of Maize under manufacture for food is utilized as meal and 9% as beer.

5/ Extraction rates are 93% for meal and 45% for beer.

6/ 100 Grams of unbolted corn meal contain 355 calories, 9.2 grams of protein and 3.99 grams of fat.

Source: USDA, Composition of Foods, Ag. Handbook No. 8, P. 28.

Table A7

Country: Bolivia

Commodity: Wheat (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization				Per Capita Consumption					
	Input ^{4/}	Output ^{1/}	Feed	Seed ^{1/}	Manufacture for Food ^{3/}	Waste ^{2/}	Food	Kilograms per Year	Grams per Day	Calories per Day ^{6/} (number)	Proteins per Day ^{6/} (Grams)	Fat per Day ^{6/} (Grams)
1 Wheat Wheat/Flour	- 43.28	45.0 32.46 ^{5/}		0.82	43.28	0.9	32.46	0.250	0.684	2.3	0.091	0.014
4 Wheat Wheat/Flour	-0.68	9.0 -0.51		9.48	-0.68	0.2	-0.51	0.002	0.005	0.02	-	-
5 Wheat Wheat/Flour	12.0	14.0 9.0		1.17	12.0	0.3	9.0	0.042	0.115	0.4	0.02	0.002
6 Wheat Wheat/Flour	38,255.63	46,781.0 28,691.72	7,589.75		38,255.63	935.62	28,691.72	15.840	43.400	144.5	5.8	0.9
7 Wheat Wheat/Flour	17.14	20.0 12.86		2.46	17.14	0.40	12.86	0.048	0.131	0.4	0.02	0.003
9 Wheat Wheat/Flour	20,452.08	22,211.0 15,339.06		1,314.70	20,452.08	444.22	15,339.06	12.202	33.430	111.3	4.5	0.7
10 Wheat Wheat/Flour	147.23	183.0 110.42		32.11	147.23	3.66	110.42	0.986	2.701	9.0	0.4	0.05
11 Wheat Wheat/Flour	58,926.68	69,263.0 44,195.01	8,950.49		58,926.68	1,385.30	44,195.01	8.538	23.400	77.9	3.1	0.5

^{1/} Source: Based on an unpublished survey conducted by the Bolivian Ministry of Agriculture and Utah State University, 1974.

^{2/} 2% of output.

^{3/} Manufacture for food equals output minus feed, seed, waste and food.

^{4/} Assumes 100% of Wheat under "Manufacture for Food" is utilized as flour.

^{5/} Extraction rate for flour is 75%.

^{6/} 100 Grams of whole (from hard wheats) wheat flour contains 333 calories, 13.3 grams of protein and 2.0 grams of fat. Source: Composition of Foods, Agriculture Handbook No. 8., p.66.

Table A8

Country: Bolivia

Commodity: Barley (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization					Per Capita Consumption				
	Input ^{5/}	Output ^{6/}	Feed ^{1/}	Seed ^{2/}	Manufacture for Food ^{4/}	Waste ^{3/}	Food	Kilograms per Year	Grams per Day	Calories per Day ^{7/}	Protein per Day ^{7/}	Fat per Day ^{7/}
6 Barley	-	34,524.0	16,571.5	5,869.1	11,047.7	1,035.7				(Number)	(Grams)	(Grams)
Barley/Wholeseed	7,733.4	6,960.1					6,960.1	3.84	10.52	36.7	0.86	0.105
Barley/Malt	3,314.3	2,552.0			2,552.0							
7 Barley	-	135.0	64.8	23.0	43.1	4.1						
Barley/Wholeseed	30.2	27.2					27.2	0.10	0.27	0.9	0.02	0.003
Barley/Malt	12.9	9.9			9.9							
8 Barley	-	7,480.0	3,590.4	1,271.6	2,393.6	224.4						
Barley/Wholeseed	1,675.1	1,508.0					1,508.0	1.63	4.47	15.6	0.37	0.045
Barley/Malt	718.1	552.9			552.9							
9 Barley	-	23,571.0	11,314.1	4,007.1	7,542.7	707.1						
Barley/Wholeseed	5,279.9	4,751.9					4,751.9	3.78	10.36	36.2	0.85	0.104
Barley/Malt	2,262.8	1,742.4			1,742.4							
10 Barley	-	231.0	110.9	39.3	73.9	6.9						
Barley/Wholeseed	51.7	46.6					46.6	0.42	1.15	4.01	0.09	0.012
Barley/Malt	22.2	17.1			17.1							
N Barley	-	65,941.0	31,651.7	11,210.1	21,101.0	1,978.2						
Barley/Wholeseed	14,770.7	13,293.8					13,293.8	2.57	7.04	24.6	0.58	0.070
Barley/Malt	6,330.3	4,874.3			4,874.3							

^{1/} 48% of Barley output.^{2/} 17% of Barley output.^{3/} 3% of Barley output.^{4/} Manufacture for food is output minus seed, seed waste and food.^{5/} Assumes 70% of Barley under "Manufacture for Food" is utilized as "Wholeseed" and 30% as malt.^{6/} Extraction rates are 90% for wholeseed and 77% for malt.^{7/} 100 Grams of light, pearled barley contains 349 calories, 8.2 grams of protein, and 1.0 grams of fat. Source: USDA, Composition of Foods, Ag. Handbook No. 8, P.9.

Table A9

Country: Bolivia

Commodity: Rice (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization			
	Inputs	Output ^{2/} _{3/}	Seed ^{3/}	Manufacture for Food	Waste ^{1/}	Food
1 Rice Paddy paddy/Milled	- 17,760.83	18,512 11,899.76	195.77	17,760.83	555.4	11,899.8
2 Rice Paddy paddy/Milled	- 11,199.6	11,654 7,503.7	104.84	11,199.6	349.6	7503.7
3 Rice Paddy paddy/Milled	- 10,799.8	11,297 7,235.9	178.28	10,799.8	338.9	7,235.9
4 Rice Paddy paddy/Milled	- 71,564.5	74,934 47,948.2	1,121.50	71,564.5	2,248.0	47,948.2
5 Rice Paddy paddy/Milled	- 761.2	799 510.0	13.80	761.2	24.0	510.0
6 Rice Paddy paddy/Milled	- 313.3	330 209.9	6.77	313.3	9.9	209.9
7 Rice Paddy paddy/Milled	- 14,935.9	15,571 10,007.1	168.05	14,935.9	467.1	10,007.1
N Rice Paddy paddy/Milled	- 127,315.1	133,097 85,314.6	1,789.01	127,315.1	3,992.4	85,314.6

^{1/} 3% of output^{2/} One ton of paddy yields 0.67 tons of milled rice.^{3/} Paddy output and use for seed based on Utah State survey.^{4/} 100 grams of rice contains 363 calories, 6.7 grams of protein, and 0.4 grams of fat.Source: USDA, Composition of Foods, Ag. Handbook No.8, p.52.

Table A9 (CONT.)

Country: Bolivia

Commodity: Rice (Metric tons unless otherwise specified)

Zone and Products	Per Capita Consumption				
	Kilograms per year	Grams per Day	Calories per Day ^{4/} (Number)	Proteins per Day ^{4/} (Grams)	Fat per Day ^{4/} (Grams)
1 Rice Paddy paddy/Milled	90.15	246.99	896.6	16.55	0.988
2 Rice Paddy paddy/Milled	64.69	177.23	643.3	11.87	0.709
3 Rice Paddy paddy/Milled	66.38	181.86	660.2	12.18	0.727
4 Rice Paddy paddy/Milled	205.79	563.81	2,046.6	37.78	2.255
5 Rice Paddy paddy/Milled	2.39	6.55	23.8	0.44	0.026
6 Rice Paddy paddy/Milled	0.12	0.33	1.2	0.02	0.001
7 Rice Paddy paddy/Milled	37.20	101.92	370.0	6.83	0.408
N Rice Paddy paddy/Milled	16.48	45.15	163.9	3.03	0.181

1/ 3% of output

2/ One ton of paddy yields 0.67 tons of milled rice.

3/ Paddy output and use for seed based on Utah State survey.

4/ 100 grams of rice contains 363 calories, 6.7 grams of protein, and 0.4 grams of fat.

Source: USDA, Composition of Foods, Ag. Handbook No. 8, p. 52.

Table A10

Country: Bolivia

Commodity: Quinoa (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization				
	Inputs <u>4/</u>	Output <u>1/</u>	Feed	Seed	Manufacture for Food <u>3/</u>	Waste <u>2/</u>	Food
6 Quinoa quinoa/flour	1058.44	1,376.0 899.7 <u>5/</u>		207.48	1058.44	110.08	899.7
8 Quinoa quinoa/flour	2387.07	3,380.0 2029.0 <u>5/</u>		722.53	2387.07	270.40	2029.0
9 Quinoa quinoa/flour	5743.80	6,537.0 4882.2 <u>5/</u>		270.24	5743.80	522.96	4882.2
10 Quinoa quinoa/flour	3521.33	3,906.0 2993.1 <u>5/</u>		72.19	3521.33	312.48	2993.1
N Quinoa quinoa/flour	12,710.64	15,199.0 10,804.0 <u>5/</u>		1,272.44	12,710.64	1215.92	10,804.0

1/ Source: Based on unpublished survey conducted by the Bolivian Ministry of Agriculture and Utah State University, 1974.

2/ 8% of output.

3/ Manufacture for food equals output minus feed, seed, waste and food.

4/ Assumes 100% of Quinoa under "manufacture for food" is utilized as flour.

5/ Extraction rate is 85% for flour.

6/ 100 grams of quinoa contains 333.3 calories, 11.1 grams of proteins and 3.70 grams of fat.
Source: FAO Food Balance Sheets, United Nations, Rome Italy, 1971, p. 78.

Table A10
(CONT.)

Country: Bolivia

Commodity: Quinoa (Metric tons unless otherwise specified)

Zone and Products	Per Capita Consumption				
	Kilograms per year	Grams per Day	Calories per Day <u>6/</u> (Number)	Proteins per Day <u>6/</u> (Grams)	Fat per Day <u>6/</u> (Grams)
6 Quinoa quinoa/flour	0.50	1.37	4.3	0.15	0.051
8 Quinoa quinoa/flour	2.19	6.0	20.0	0.67	0.22
9 Quinoa quinoa/flour	3.88	10.63	35.43	1.18	0.393
10 Quinoa quinoa/flour	26.72	73.21	244.01	8.13	2.71
11 Quinoa quinoa/flour	2.09	5.73	19.10	0.64	0.21

1/ Source: Based on unpublished survey conducted by the Bolivian Ministry of Agriculture and Utah State University.

2/ 8% of output.

3/ Manufacture for food equals output minus feed, seed, waste and food.

4/ Assumes 100% of Quinoa under "manufacture for food" is utilized as flour.

5/ Extraction rate is 85% for flour.

6/ 100 grams of quinoa contains 333.3 calories, 11.1 grams of proteins and 3.70 grams of fat.
Source: FAO Food Balance Sheets, United Nations, Rome Italy, 1971, p. 78.

Table A11

Country: Bolivia

Commodity: Potatoes (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization				Per Capita Consumption					
	Input	Output	Feed 1/	Seed 2/	Manufacture for Food	Waste 3/	Food 4/	Kilograms per Year	Grams per Day	Calories per Day 5/	Proteins per Day 5/	Fat 5/ per Day
1 Potatoes	-	975	48.8	185.3		68.3	672.6	5.10	13.97	(Number) 165	(Grams) 0.29	(Grams) 0.014
4 Potatoes	-	8,210	410.5	1,559.9		574.7	5,664.9	24.31	66.60	50.6	1.40	0.067
5 Potatoes	-	3,452	172.6	655.9		241.6	2,381.9	11.18	30.63	23.2	0.64	0.031
6 Potatoes	-	407,594	20,379.7	77,442.9		28,531.6	281,239.8	155.30	425.48	323.4	8.94	0.425
7 Potatoes	-	9,354	467.7	1,777.3		654.7	6,454.3	24.00	65.75	50.0	1.38	0.066
8 Potatoes	-	24,543	1,227.2	4,663.2		1,718.0	16,934.6	18.27	50.05	38.0	1.05	0.050
9 Potatoes	-	168,789	8,439.5	32,069.9		11,815.2	116,464.4	92.65	253.83	192.9	5.33	0.254
10 Potatoes	-	9,979	499.0	1,896.0		698.5	6,885.5	61.48	168.44	128.0	3.54	0.168
N Potatoes	-	632,896	31,645.0	120,250.4		44,302.6	436,698.0	84.37	231.15	175.7	4.85	0.231

1/ 5 % of output

2/ 19% of output

3/ 7 % of output

4/ Output minus seed, seed, and waste

5/ 100 Grams of potatoes contain 76 calories, 2.1 grams of protein and 0.1 grams of fat. Source: USDA Composition of Foods, Ag Handbook No.8, p. 50.

TABLE A12

COUNTRY: BOLIVIACOMMODITY: OCA (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization			Per Capita Consumption				
	Input	Output 1/	Seed 2/	Waste 2/	Food	Kilograms Per Year	Grams Per Day	Calories Per Day 4/	Proteins Per Day 4/	Fat Per Day 4/
								(Number)	(Grams)	(Grams)
6 OCA		51,229	5,123	5,123	40,983	22.6	61.9	34.0	1.05	0.371
8 OCA		9,295	930	930	7,435	8.0	21.9	12.0	0.37	0.131
9 OCA		8,278	828	828	6,622	5.3	14.5	8.0	0.25	0.087
N OCA		68,802	6,881	6,881	55,040	10.6	29.0	16.0	0.49	0.174

1/ Source: Based on unpublished survey conducted by the Bolivian Ministry of Agriculture and Utah State University, 1974.

2/ 10% of Production

3/ 10% of Production

4/ 100 grams contain 55 calories, 1.7 grams protein, and 0.6 grams fat. Source: FAO Balance Sheets.

TABLE A13

COUNTRY: BOLIVIACOMMODITY: Yuca (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization			Per Capita Consumption				
	Input	Output 1)	Feed 2)	Waste 3)	Food	Kilograms Per Year	Grams Per Day	Calories	Proteins	Fat
								Per Day 4)	Per Day 4)	Per Day 4)
							(Number)	(Grams)	(Grams)	
1 YUCA		111,638	22,328	16,746	72,564	549.7	1,506.0	2,198.8	12.05	1.506
2 YUCA		16,663	3,333	2,499	10,831	93.4	255.9	373.6	2.05	0.256
3 YUCA		19,422	3,884	2,913	12,625	115.8	317.3	463.3	2.54	0.317
4 YUCA		123,762	24,752	18,564	80,446	345.3	946.0	1,381.2	7.57	0.946
5 YUCA		3,696	739	554	2,403	11.3	31.0	45.3	0.25	0.031
7 YUCA		52,624	10,525	7,894	34,205	127.2	348.5	508.8	2.79	0.349
N YUCA		327,805	65,561	49,170	213,074	41.2	112.9	164.8	0.90	0.113

1/ Source: Based on unpublished survey conducted by the Bolivian Ministry of Agriculture and Utah State University, 1974

2/ 20% of Output

3/ 15% of Output

4/ 100 grams contains 146 calories, 0.8 grams protein and 0.1 grams fat. Source: Instituto de Investigaciones Tecnológicas, Diseño de Dietas de Costo Mínimo, Bogota, Colombia, 1972, P. 78.

TABLE A14

COUNTRY: BOLIVIA

COMMODITY: Sweet Potatoes (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization		Per Capita Consumption				
	Input	Output 1/	Waste 2/	Food	Kilograms Per Year	Grams Per Day	Calories Per Day 3/ (Number)	Proteins Per Day 3/ (Grams)	Fat Per Day 3/ (Grams)
2 Sweet Potatoes		324	32	292	2.5	6.8	7.8	0.13	0.027
4 Sweet Potatoes		484	48	436	1.9	5.2	5.9	0.10	0.021
5 Sweet Potatoes		954	95	859	4.0	11.0	12.5	0.21	0.044
6 Sweet Potatoes		606	61	545	0.3	0.8	0.9	0.02	0.003
7 Sweet Potatoes		510	51	459	1.7	4.7	5.4	0.09	0.019
N Sweet Potatoes		2,878	287	2,591	0.5	1.4	1.6	0.03	0.006

1/ Source: Based on unpublished survey conducted by the Bolivian Ministry of Agriculture and Utah State University, 1974.

2/ 10% of Production

3/ 100 grams contain 114 calories, 1.7 grams protein and 0.4 grams fat. Source: USDA, Composition of Foods, Ag. Handbook No.8, P. 61.

Table A15

Country: Bolivia

Commodity: Cattle (Metric tons unless otherwise specified)

Zone and Product	Production		Utilisation		Per Capita Consumption				
	Input	Output	Manufacture for Food	Food	Kilograms per Year	Grams per Day	Calories 5/ per Day	Proteins 6/ per Day	Fat per Day 6/
1 Cattle 1/ Cattle/Meat Cattle/Offals	193,728 2/	25,185 3/	25,185				(Number)	(Grams)	(Grams)
	25,185 1/	4,281 4/		4,281	32.4	88.8	199.8	17.23	14.030
	25,185 1/	622 5/		622	4.9	13.4	20.9	2.09	0.222
2 Cattle 1/ Cattle/Meat Cattle/Offals	1,490,300 2/	193,739 3/	193,739						
	193,739 1/	32,935 4/		32,936	283.9	777.8	1,750.1	150.89	122.852
	193,739 1/	4,920 5/		4,920	42.6	116.7	182.1	18.21	7.352
3 Cattle 1/ Cattle/Meat Cattle/Offals	234,078 2/	30,430 3/	30,430						
	30,430 1/	5,173 4/		5,173	47.5	130.1	292.7	25.24	20.556
	30,430 1/	776 5/		776	7.1	19.5	30.4	3.04	1.229
4 Cattle 1/ Cattle/Meat Cattle/Offals	483,685 2/	62,879 3/	62,879						
	62,879 1/	10,689 4/		10,689	45.9	125.8	283.1	24.41	19.876
	62,879 1/	1,603 5/		1,603	6.9	18.9	29.5	2.95	1.191
5 Cattle 1/ Cattle/Meat Cattle/Offals	371,625 2/	48,311 3/	48,311						
	48,311 1/	8,213 4/		8,213	38.6	105.8	238.1	20.53	16.716
	48,311 1/	1,232 5/		1,232	5.8	15.9	24.8	2.42	1.022
6 Cattle 1/ Cattle/Meat Cattle/Offals	769,499 2/	100,035 3/	100,035						
	100,035 1/	17,006 4/		17,006	9.4	25.8	58.1	5.01	4.076
	100,035 1/	2,551 5/		2,551	1.4	3.8	5.9	0.59	0.239
7 Cattle 1/ Cattle/Meat Cattle/Offals	51,312 2/	6,671 3/	6,671						
	6,671 1/	1,134 4/		1,134	4.2	11.5	25.9	2.23	1.817
	6,671 1/	170 5/		170	0.6	1.6	2.5	0.25	0.101
8 Cattle 1/ Cattle/Meat Cattle/Offals	111,426 2/	14,485 3/	14,485						
	14,485 1/	2,462 4/		2,462	2.7	7.4	16.7	1.44	1.169
	14,485 1/	369 5/		369	0.4	1.1	1.7	0.17	0.069
9 Cattle 1/ Cattle/Meat Cattle/Offals	548,465 2/	71,300 3/	71,300						
	71,300 1/	12,121 4/		12,121	9.6	26.3	59.2	5.70	4.155
	71,300 1/	1,818 5/		1,818	1.4	3.8	5.9	0.59	0.239
10 Cattle 1/ Cattle/Meat Cattle/Offals	2,493 2/	324 3/	324						
	324 1/	55 4/		55	0.5	1.4	3.2	0.27	0.221
	324 1/	8 5/		8	0.1	0.3	0.5	0.05	0.019
N Cattle 1/ Cattle/Meat Cattle/Offals	4,256,611 2/	553,359 3/	553,359						
	553,359 1/	94,070 4/		94,070	18.2	49.9	112.3	9.68	7.822
	553,359 1/	14,109 5/		14,109	2.7	7.4	11.5	1.15	0.466

1/ Head of cattle.

2/ Number of head in 1972. Unpublished Survey conducted by Bolivia Ministry of Agriculture and Utah State University, 1974.

3/ Number of head times take-off ratio of 0.13.

4/ 170 Kilograms carcass weight per animal slaughtered.

5/ 25.5 Kilograms offals per animal slaughtered.

6/ 1.33 Grams of meat contains 225 calories, 19.4 grams protein and 15.8 grams fat; 100 grams offals contains 156 calories, 15.6 grams protein, and 6.3 grams fat. Data for meat refer to standard grade trimmed to retail level in USDA, Composition of Foods, Ag. Handbook No.8, p.11. Data for offals calculated from FAO balance sheet.

Table A16

Country: Bolivia

Commodity: Sheep (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization		Per Capita Consumption				
	Input	Output	Manufacture for Food	Food	Kilograms per Year	Grams per Year	Calories per Day ^{6/}	Proteins per Day ^{6/}	Fat per Day ^{6/}
							(Number)	(grams)	(Grams)
1 SHEEP ^{1/}	3,907 ^{2/}	469 ^{3/}	469						
sheep/MEAT	469 ^{1/}	7 ^{4/}		7	0.053	0.145	0.358	0.024	0.028
sheep/OFFALS	469 ^{1/}	2 ^{5/}		2	0.015	0.041	0.065	0.007	0.002
2 SHEEP ^{1/}	19,392 ^{2/}	2327 ^{3/}	2327						
sheep/MEAT	2327 ^{1/}	33 ^{4/}		33	0.285	0.781	1.929	0.131	0.152
sheep/OFFALS	2327 ^{1/}	8 ^{5/}		8	0.069	0.189	0.299	0.029	0.010
3 SHEEP ^{1/}	15,274 ^{2/}	1833 ^{3/}	1833						
sheep/MEAT	1833 ^{1/}	26 ^{4/}		26	0.239	0.655	1.618	0.110	0.127
sheep/OFFALS	1833 ^{1/}	6		6	0.055	0.151	0.239	0.024	0.008
4 SHEEP ^{1/}	53,603 ^{2/}	6432 ^{3/}	6432						
sheep/MEAT	6432 ^{1/}	90 ^{4/}		90	0.386	1.058	2.613	0.261	0.205
sheep/OFFALS	6432 ^{1/}	23 ^{5/}		23	0.099	0.271	0.428	0.043	0.014
5 SHEEP ^{1/}	182,260 ^{2/}	21,871 ^{3/}	21871						
sheep/MEAT	21,871 ^{1/}	306 ^{4/}		306	1.437	3.937	9.724	0.661	0.376
sheep/OFFALS	21,871 ^{1/}	77 ^{5/}		77	0.362	0.992	1.567	0.157	0.052
6 SHEEP ^{1/}	3,402,029 ^{2/}	408,244 ^{3/}	408,244						
sheep/MEAT	408,244 ^{1/}	5715 ^{4/}		5715	3.156	8.647	21.358	1.453	1.676
sheep/OFFALS	408,244 ^{1/}	1429 ^{5/}		1429	0.789	2.162	3.416	0.242	0.115
7 SHEEP ^{1/}	188,449 ^{2/}	22,614 ^{3/}	22614						
sheep/MEAT	22,614 ^{1/}	317 ^{4/}		317	1.178	3.227	7.971	0.542	0.526
sheep/OFFALS	22,614 ^{1/}	79 ^{5/}		79	0.294	0.806	1.273	0.127	0.043
8 SHEEP ^{1/}	831,468 ^{2/}	99,776 ^{3/}	99,776						
sheep/MEAT	99,776 ^{1/}	1397 ^{4/}		1397	1.507	4.129	10.159	0.694	0.801
sheep/OFFALS	99,776 ^{1/}	349 ^{5/}		349	0.376	1.030	1.627	0.163	0.055
9 SHEEP ^{1/}	6,309,907 ^{2/}	757,189 ^{3/}	757189						
sheep/MEAT	757,189 ^{1/}	10601 ^{4/}		10601	8.436	23.112	57.097	3.683	4.464
sheep/OFFALS	757,189 ^{1/}	2650 ^{5/}		2650	2.108	5.775	9.125	0.913	0.306
10 SHEEP ^{1/}	244,061 ^{2/}	29,287 ^{3/}	29287						
sheep/MEAT	29,287 ^{1/}	410 ^{4/}		410	3.661	10.030	24.774	1.685	1.946
sheep/OFFALS	29,287 ^{1/}	103 ^{5/}		103	0.920	2.521	6.227	0.424	0.469
11 SHEEP ^{1/}	11,350,250 ^{2/}	1,362,030 ^{3/}	1,362,030						
sheep/MEAT	1,362,030 ^{1/}	19,068 ^{4/}		19068	3.684	10.093	24.930	1.696	1.958
sheep/OFFALS	1,362,030 ^{1/}	4,767 ^{5/}		4767	0.921	2.523	3.986	0.399	0.134

^{1/} Head of sheep^{2/} Number of head on hand in 1972. Source: Unpublished survey by Bolivian Ministry of Agriculture and Utah State University, 1974.^{3/} Number of head times take-off ratio of 0.12.^{4/} 14 Kilograms carcass weight per animal slaughtered^{5/} 3.5 Kilograms offals per animal slaughtered^{6/} 100 grams of MEAT contains 247 calories, 16.8 grams protein and 19.4 grams fat; 100 grams OFFALS contains 158 calories, 15.8 grams of protein and 5.3 grams of fat. Data for MEAT refer to composite of cuts, good grade, trimmed to retail levels in USDA, Composition of Foods, Ag Handbook No. 8, p. 35. Data for OFFALS calculated from FAD balance sheet.

Table A17

Country: Bolivia

Commodity: Goats (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization		Per Capita Consumption				
	Input	Output	Manufacture for Food	Food	Kilograms per Year	Grams per day	Calories per Day 6/ (Grams)	Proteins per Day 6/ (Grams)	Fat per Day 6/ (Grams)
1 GOATS 1/ goat/MEAT goat/OFFALS	271 2/ 85 1/ 85 1/	85 3/ 1 4/ 0.3 5/	85	1 0.3	0.008 0.002	9.022 0.005	0.054 0.009	0.004 -	0.004 -
2 GOATS goat/MEAT goat/OFFALS	4214 2/ 1327 1/ 1327 1/	1327 3/ 19 4/ 5 5/	1327	19 5	0.164 0.043	0.449 0.118	1.109 0.182	0.075 0.018	0.087 0.009
3 GOATS goat/MEAT goat/OFFALS	11785 2/ 3712 1/ 3712 1/	3712 3/ 52 4/ 13 5/	3712	52 13	0.477 0.119	1.307 0.326	3.228 0.502	0.220 0.050	0.254 0.025
4 GOATS goat/MEAT goat/OFFALS	12831 2/ 4042 1/ 4042 1/	4042 3/ 57 4/ 14 5/	4042	57 14	0.245 0.060	0.671 0.164	1.657 0.253	0.113 0.025	0.130 0.013
5 GOATS goat/MEAT goat/OFFALS	368615 2/ 116114 1/ 116114 1/	116114 3/ 1626 4/ 406 5/	116114	1626 406	8.0 2.0	22.0 5.479	54.340 8.438	3.696 2.844	4.268 0.422
6 GOATS goat/MEAT goat/OFFALS	1026656 2/ 323397 1/ 323397 1/	323397 3/ 4528 4/ 1132 5/	323397	4528 1132	3.0 0.625	8.219 1.712	20.301 2.636	1.381 0.264	1.594 0.132
7 GOATS goat/MEAT goat/OFFALS	672 2/ 212 1/ 212 1/	212 3/ 3 4/ 0.7 5/	212	3 0.7	0.011 0.003	0.030 0.008	0.074 0.012	0.007 0.001	0.006 0.001
9 GOATS goat/MEAT goat/OFFALS	166641 2/ 52491 1/ 52491 1/	52491 3/ 735 4/ 184 5/	52491	735 184	0.585 0.146	1.603 0.400	3.959 0.616	0.269 0.062	0.311 0.031
10 GOATS goat/MEAT goat/OFFALS	15127 2/ 4765 1/ 4765 1/	4765 3/ 67 4/ 17 5/	4765	67 17	0.598 0.152	1.638 0.412	4.046 0.634	0.275 0.063	0.318 0.032
11 GOATS goat/MEAT goat/OFFALS	1605812 2/ 506146 1/ 506146 1/	506146 3/ 7086 4/ 1772 5/	506146	7086 1772	1.369 0.342	4.0 1.0	9.880 1.54	0.672 0.154	0.776 0.077

1/ Head of goats.

2/ Number of head on hand in 1972. Source: Unpublished survey Bolivian Ministry and Utah State University, 1974.

3/ Number of head times take-off ratio of 0.315.

4/ 14 kilograms carcass weight per animal slaughtered.

5/ 3.5 kilograms offals per animal slaughtered.

6/ 100 grams of MEAT contains 247 calories, 16.8 grams protein and 19.4 grams fat; 100 grams OFFALS contains 154 calories, 15.4 grams protein and 7.7 grams of fat. Data for meats refer to composite of cuts, good grade, trimmed to retail levels in USDA, Composite of Foods, Ag Handbook No. 8, page 35. Data for OFFALS calculated from FAO balance sheet.

Table A18

Country: Bolivia

Commodity: Pork (Metric tons unless otherwise specified)

Zone and Product ^{1/}	Production		Utilization		Per Capita Consumption				
	Input	Output	Manufacture for Food	Food	Kilograms per Year	Grams per Day	Calories per Day 5/ (Number)	Proteins per Day 6/ (Grams)	Fat 6/ per Day (Grams)
1 Pork	51,747 2/	31,648 3/	31,648						
Pork/Meat	31,648 1/	949 4/		949	7.189	19.70	54.4	3.3	4.5
Pork/Offals	31,648	48 5/		48	0.360	0.99	1.5	0.2	0.1
2 Pork	27,662 2/	16,597 3/	16,597						
Pork/Meat	16,597 1/	497 4/		497	4.284	11.74	32.4	2.0	2.7
Pork/Offals	16,597	25 5/		25	0.215	0.59	0.9	0.1	0.25
3 Pork	29,348 2/	17,609 3/	17,609						
Pork/Meat	17,609 1/	528 4/		528	4.844	13.27	36.5	2.2	3.0
Pork/Offals	17,609	26 5/		26	0.202	0.56	1.0	0.1	0.1
4 Pork	50,481 2/	30,289 3/	30,289						
Pork/Meat	30,289 1/	909 4/		909	3.901	10.69	29.5	1.8	2.4
Pork/Offals	30,289	45 5/		45	0.195	0.53	0.8	0.1	0.04
5 Pork	127,509 2/	76,505 3/	76,505						
Pork/Meat	76,505 1/	2,295 4/		2,295	10.775	29.52	81.5	5.0	6.7
Pork/Offals	76,505	115 5/		115	0.539	1.48	2.2	0.2	0.1
6 Pork	236,523 2/	141,902 3/	141,902						
Pork/Meat	141,902 1/	4,257 4/		4,257	2.351	6.44	17.8	1.1	1.5
Pork/Offals	141,902	213 5/		213	0.118	0.32	0.5	0.1	0.03
7 Pork	26,217 2/	15,730 3/	15,730						
Pork/Meat	15,730 1/	472 4/		472	1.755	4.81	13.3	0.81	1.1
Pork/Offals	15,730	24 5/		24	0.088	0.24	0.4	0.04	0.02
8 Pork	60,264 2/	36,158 3/	36,158						
Pork/Meat	36,158 1/	1,085 4/		1,085	1.170	3.21	8.9	0.54	0.73
Pork/Offals	36,158	54 5/		54	0.059	0.16	0.3	0.03	0.01
9 Pork	121,720 2/	76,032 3/	76,032						
Pork/Meat	76,032 1/	2,281 4/		2,281	1.815	4.97	13.7	0.83	1.1
Pork/Offals	76,032	114 5/		114	0.091	0.25	0.4	0.04	0.02
10 Pork	2,663 2/	1,778 3/	1,778						
Pork/Meat	1,778 1/	53 4/		53	0.473	1.30	3.6	0.22	0.10
Pork/Offals	1,778	3 5/		3	0.024	0.07	0.1	0.01	0.01
11 Pork	734,414 2/	440,648 3/	440,648						
Pork/Meat	440,648 1/	13,326 4/		13,326	2.575	7.05	19.45	1.18	1.60
Pork/Offals	440,648	667 5/		667	0.129	0.35	0.54	0.05	0.03

1/ Head of goats.

2/ Number of head in 1972. Source: Unpublished Survey conducted by Bolivian Ministry of Agriculture and Utah State University, 1974.

3/ Number of head times take off ratio of 0.60.

4/ 30 kilograms carcass weight per animal slaughtered.

5/ 1.5 kilograms offals per animal slaughtered.

6/ 100 Grams of pork contains 276 calories, 16.7 grams of protein and 22.7 grams of fat; 100 grams offals contain 154 calories, 15.4 grams protein and 7.79 grams fat. Data for meat refer to composite of cuts, lean out in USDA, Composition of Foods, Ag Handbook No. 8, p.47. Data for offals calculated from FAO balance sheet.

Table A19

Country: Bolivia

Commodity: Poultry (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization		Per Capita Consumption				
	Inputs	Outputs	Manufacture for Food	Food	Kilograms per Year	Grams per Day	Calories per Day 5/ (Number)	Proteins per Day 5/ (Grams)	Fat per day 5/ (Grams)
1 Poultry 1/ Poultry/Meat	360,003 2/	432,000 2/	432,000 389 4/	389	1.066	8.08	10.2	1.5	0.4
2 Poultry Poultry/Meat	240,699 2/	288,839 2/	288,839 260 4/	260	0.712	6.14	7.7	1.2	0.3
3 Poultry Poultry/Meat	583,958 2/	700,750 2/	700,750 631 4/	631	1.729	15.86	20.0	3.0	0.8
4 Poultry Poultry/Meat	1,104,067 2/	1,324,880 2/	1,324,880 1,192 4/	1,192	3.266	14.02	17.7	2.6	0.7
5 Poultry Poultry/Meat	742,266 2/	890,719 2/	890,719 802 4/	802	2.197	10.32	13.0	2.0	0.5
6 Poultry Poultry/Meat	1,477,540 2/	1,773,048 2/	1,773,048 1,596 4/	1,596	4.373	2.42	3.0	0.5	0.1
7 Poultry Poultry/Meat	653,413 2/	784,096 2/	784,096 706 4/	706	1.934	7.19	9.1	1.4	0.4
8 Poultry Poultry/Meat	78,469 2/	94,163 2/	94,163 85 4/	85	0.233	0.25	0.3	0.1	0.01
9 Poultry Poultry/Meat	581,070 2/	697,284 2/	697,284 628 4/	628	1.721	1.37	1.7	0.3	0.1
10 Poultry Poultry/Meat	26,199 2/	31,438 2/	31,438 28 4/	28	0.077	0.69	0.9	0.1	0.04
K Poultry Poultry/Meat	5,847,684 2/	7,017,221 2/	7,017,221 6,316 4/	6,316	17.304	3.34	4.2	0.6	0.2

1/ Head of chickens.

2/ Number of chickens in 1972. Source: Unpublished Survey conducted by Bolivian Ministry of Agriculture and Utah State University, 1974.

3/ Number of head time take-off, rate of 1.2.

4/ 0.9 Kilograms carcass weight per animal slaughtered.

5/ 100 Grams of poultry contain 126 calories, 18.8 grams, protein and 5.1 grams fat. Data for poultry refer to fryers ready-to-cook in USDA, Composition of Foods, Ag Handbook No. 8, p.22.

Table A20

Country: Bolivia

Commodity: Sugar Cane (Metric tons unless otherwise specified)

Zone and Products	Production		Utilization					Per Capita Consumption		
	Inputs	Outputs	Fuel 2/	Seed	Manufacture for Fuel 4/	Waste 3/	Fuel	Kilograms per Year	Grams per Day	Caloric per Day (Number)
1 Sugar Cane Cane/Raw Cent Raw Centr./Refined	7,771.0 824 824	10,375 1/ 824 2/ 758 6/	819.7		7,771.0 824	1,556.3	758	5.74	15.73	60.6
2 Sugar Cane Cane/Raw Cent Raw Centr./Refined	8,065.4 831	10,461 1/ 831 2/ 765 6/	826.4		8,065.4 831	1,569.2	765	5.59	18.05	69.5
3 Sugar Cane Cane/Raw Cent Raw Centr./Refined	14,584.2 1,502	18,916 1/ 1,502 2/ 1,382 6/	1,494.4		14,584.2 1,502	2,837.4	1,382	12.68	34.74	145.3
4 Sugar Cane Cane/Raw Cent Raw Centr./Refined	1,978,590.6 203,795	2,566,525 1/ 203,795 2/ 187,491 6/	202,755.5	200 1/	1,978,590.6 203,795	384,978.8	187,491	804.68	2,204.61	8,487.7
5 Sugar Cane Cane/Raw Cent Raw Centr./Refined	23,229.4 2,393	30,129 1/ 2,393 2/ 2,202 6/	2,380.2		23,229.4 2,393	4,519.4	2,202	10.34	28.33	109.1
6 Sugar Cane Cane/Raw Cent Raw Centr./Refined	119.4 12	155 1/ 12 2/ 11 6/	12.3		119.4 12	23.3	11	0.01	0.03	0.1
7 Sugar Cane Cane/Raw Cent Raw Centr./Refined	7,048.5 726	9,142 1/ 726 2/ 668 6/	722.2		7,048.5 726	1,371.3	668	2.48	6.79	26.1
8 Sugar Cane Cane/Raw Cent Raw Centr./Refined	2,039,896.9 210,083	2,645,703 1/ 210,083 2/ 193,277 6/	209,010.6		2,039,896.9 210,083	396,855.5	193,277	37.34	102.30	393.9

1/ Source Unpublished survey conducted by Bolivian Ministry of Agriculture and Utah State University, 1974.

2/ 7.5% of sugar cane output.

3/ 15% of sugar cane output.

4/ Output minus seed, good and waste.

5/ Extraction ratio of 10.3%.

6/ Extraction ratio of 92%.

7/ 100 grams of refined sugar contains 385 calories, but no proteins or fat. Source: USDA, Composition of Foods, Ag. Handbook No.8, p.61.

Appendix B: Derivation of National and Regional Estimates

National consumption and regional production estimates appear in the main text of this document. This Appendix describes the methods by which the sub-totals of production in Tables 5 and 6 were adjusted to obtain aggregate national and regional estimates.

Estimation of Consumption

The following variables, measured in terms of food energy or protein, refer to national totals.

P = Production

E = Exports

M = Imports

U = Utilization other than food, i.e., feed, seed, waste and manufacturing uses

C = Consumption, i.e., utilization as food

It is assumed that stock changes are zero; they apparently are small and their measurement probably not accurate for most if not all commodities.

Non-subscripted variables refer to the total of all food commodities produced and/or utilized in Bolivia. For any variable, the subscript "1" refers to totals of the 15 commodities treated in detail in the present report, while the subscript "2" refers to all other food commodities. The first group is referred to as "included commodities" and the second group as "excluded commodities". Then the following three equations can be stated by definition.

$$(1) C = C_1 + C_2$$

$$(2) C_1 = P_1 + M_1 - E_1 - U_1$$

$$(3) C_2 = P_2 + M_2 - E_2 - U_2$$

By substituting (2) into (1) and rearranging terms,

$$(4) C = (P_1 - U_1) + (M_1 - E_1) + C_2$$

If (4) is divided by population (Table A-1) then the left hand side of the equation is per capita consumption, which appears in Table 1. The first term in parentheses on the right hand side is production minus non-food

uses per capita for the included commodities, which appears in Table 5 and 6. The second term in parentheses is net imports per capita for the included commodities, which is estimated in Table A-3. The final term, per capita consumption of excluded commodities, is also estimated in Table A-3.

Allocation of Net Production Among Regions

We define net production of food as production of a food commodity minus non-food utilization (feed, seed, waste, and manufacturing uses). Let N represent net production, and let the subscript i refer to regions, while the subscripts "1" and "2" refer to included and excluded commodities as defined in the previous section. It then follows that,

$$(5) N_i = N_{1i} + N_{2i}, \quad i = 1, 2, 3$$

$$(6) N_{1i} = P_{1i} - U_{1i}, \quad i = 1, 2, 3$$

$$(7) N_{2i} = P_{2i} - U_{2i}, \quad i = 1, 2, 3$$

Substituting (6) and (7) into (5),

$$(8) N_i = (P_{1i} - U_{1i}) + (P_{2i} - U_{2i}), \quad i = 1, 2, 3$$

The left hand term in (8) is referred to as "Food Energy Production" and "Protein Production" in Table 3. The first term in parentheses on the right hand side is the sum of the "Sub-total of Production" in Tables 5 and 6 for a region's constituent zones multiplied by zonal populations. The second term in parentheses is estimated in three steps. First, national per capita production of excluded commodities is obtained from the 1969-71 food balance sheet (See Table A-3). Second, these figures are multiplied by population to obtain national net production estimates. Finally, these estimates are allocated among regions. Let the subscript j refer to commodities, and a_{ij} represent the proportion of national net production of commodity j produced in region i . Then, the estimating equation is,

$$(9) N_{2i} = \sum_j a_{ij} (P_{2j} - U_{2j}), \quad i = 1, 2, 3$$

The a coefficients for some commodities are based on data in the Bolivian Survey, while the remaining coefficients are the proportions of the national rural population in each region. The coefficients are presented in Table A-5.