Pan American Health Organization
Regional Office of the World Health Organization

110
1902 - 2012

Gobierno de Chile

16th INTER-AMERICAN MEETING AT MINISTERIAL LEVEL ON HEALTH AND AGRICULTURE (RIMSA 16)

"Agriculture-Health-Environment: joining forces for the well-being of the peoples of the Americas"

Santiago, Chile, 26-27 July 2012

Provisiona Agenda Item 1.l

RIMSA16/1.1 (Engt.)
16 julio 2012
ORIGINAL: PORTUGUÉS

Opportunities and challenges of food production for human health and the environment in the Americas: *Food production prospects*

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SUMMARY

This study addresses food production in Latin America and the Caribbean (LAC), particularly food of animal origin, in face of the following challenges: the growing food demand; the need to attain the basic nutritional levels for the region's population; the competition for agricultural raw materials for fuel production; the changes in consumption patterns and in the production system, related to food quality and safety and to sustainability; and the rising risk of dissemination of zoonoses and the emergence of new diseases. Some Latin American countries, though, will have to increase the production and consumption of animal protein – meat, eggs, and milk, but to this end they must face the challenge of extreme poverty and malnutrition to attain such objective. Poverty, concentrated in the rural population, is severe in some of the countries and must be addressed by the fostering of agricultural and livestock production as well. Agricultural and livestock production is relevant in LAC for its share in GDP, absorption of rural employment, and for nutritionally supplying both the rural and the urban population, the latter of which is on the rise. Agricultural policies focused on production with greater multiplying potential for local and regional communities are thus important, as is the case of the production of eggs and milk by commercial family farming. Particularly for making possible increased productivity and for maintaining food prices at accessible levels it is advisable not only to implement further targeted farm credit policies but above all to resume investment in genetic research and management. As regards both large- and small-scale production it is necessary to promote the coordination of joint actions by the human health and the animal health and production sectors at all geographical and administrative levels, aimed at prevention, control, and technological development, as well as assistance and extension actions throughout the entire value chain.

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INTRODUCTION

This study addresses the importance of food production in Latin America and the Caribbean (LAC), particularly food of animal origin, and the factors conducive to its growth, given its role in food security and social development in the region. Also addressed are the challenges faced in view of the world's growing food demand and the importance of animal protein to ensure the minimum nutrition levels recommended by the World Health Organization. In addition to this interface with human health, this paper also addresses the importance of adjusting food provision to more sustainable production models.

Food demand is on the rise, as is the use of agricultural raw materials other than for food, such as for the production of energy, which puts additional pressure on food prices. As per capita income increases, so does the tendency toward increased consumption of animal protein in developing countries (DVC) and in LAC. These two factors intensify the concern over the compromising of food security.

According to recent FAO projections, the world population will total 9.1 billion by 2050, a 34 percent increase; this increase will take place mostly in developing countries. The population's urbanization is projected to rise from today's 50 percent to 70 percent. In view of this alone, food production should grow also 70 percent to a total of about three billion tons of cereals and 470 million tons of meats.

It is not only a question of producing food in sufficient quantity and ensuring a per capita income consistent with access to food that challenges production chain and government agents. It is also necessary to address the geographical distribution of production and to lower the levels of poverty and malnutrition, which are still significant in the region. In Latin America and the Caribbean in 2010 a worrisome 34.4 percent of the population still lived in poverty and 12.5 percent lived in extreme poverty. In the rural area, these indicators are 52.6 percent and 30 percent, respectively.

Food of animal origin – meat, milk, eggs, and their byproducts – play a major role in ensuring the supply of proteins and calories necessary for the proper development of children, from conception trough pregnancy, so that they can grow into healthy, productive adults. Fostering the production of food of animal origin and improved productivity in the countries with high poverty and malnutrition levels in the rural area may speedily and effectively contribute to improving these levels, thereby playing a role not only in the economic but also in the local and regional social development.

In view of the preceding, this paper seeks to show the importance of the production of food of animal origin in Latin American and Caribbean countries owing to its significance for the various economic and social aspects of the life of their population, aspects related to nutrition and public health, the health of herds, and protection of the national territory, income, employment, and trade. These considerations provide the basis for the recommendations made at the conclusion.

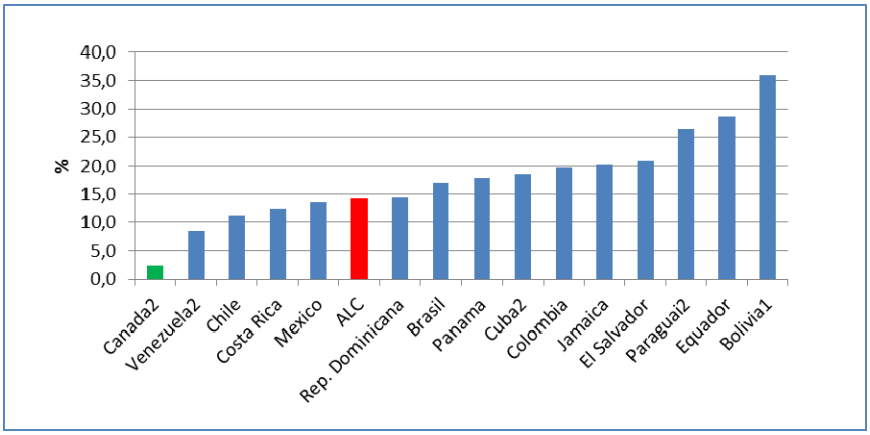
Commercial production of food of animal origin in Latin America and the Caribbean

According to FAO (2011), in the next ten years the world's urban population should reach 55.4 percent of the total, while in Latin America this percentage will be still higher, namely, 72.2 percent in the Caribbean, 75.8 percent in Central America, and 87.1 percent in South America. Urbanization requires a better organization of production and distribution systems so as to ensure supply in appropriate quantity and of appropriate quality. In addition to posing quantitative and qualitative challenges to production, this requires distribution coordination.

In Latin America and the Caribbean, a considerable percentage of rural labor is occupied in nonagricultural activities, and the percentage still carrying out agricultural activities depends on increased productivity to raise income and also to contribute to food security (FAO, 2011). World Bank data show that the average percentage of the Latin American and Caribbean labor employed in agricultural activities (including livestock-related

activities) is about 15 percent, although in countries such as Bolivia this average exceeds 35 percent of the national population, as Chart 1 shows.

Chart 1 – Agriculture's share in total employment (%) in some Latin American and Caribbean countries – 2009.



Source: World Bank (2012)

Note: [1]Dados de 2007; [2] Dados de 2008.

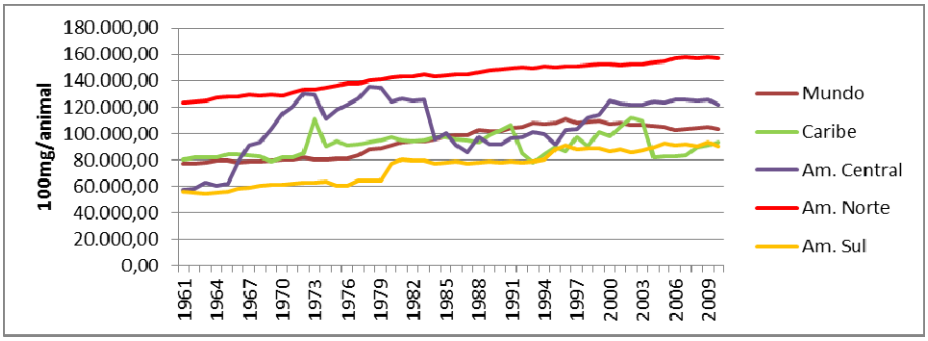
According to projections in the World Bank's reference scenario (2009), GDP's average annual growth in developing countries should be 5.2 percent between 2005 and 2050, while in high-income countries it should be only 1.6 percent. To meet food and animal feed demand alone, world production must grow 70 percent by 2050, adding one billion tons of grain and 200 million tons of meat to the supply (FAO, 2011).

Increased food production depends on two factors: expansion of the area allocated to grain and animal production; and higher productivity. Currently, expansion comes up against relevant environmental limitations. With respect to arable land, FAO projections for 2050 foresee a 70 million-hectare expansion, or 5.0 percent of the current area (as a result of a 120 million-hectare addition in developing countries and a 50 million-hectare reduction in developed countries). It may be said that a significant portion of this expansion in developing countries should take place in Latin America: in 2005, 200 million hectares were under cultivation, but by 2050 this figure could rise to over one billion hectares, according to Bruinsma (2009), cited by FAO (2011). Bruinsma also points out that Latin America has the globe's largest renewable water reserve, which is essential to food production, although he also points out the infrastructure limitations in the very same regions with a potential for expanding cultivable areas.

One may say, however, that the most promising, significant ways of boosting food production, including animal food production, not only in Latin America but worldwide, have to do with increasing productivity. To improve productivity indicators it is necessary to disseminate existing techniques and knowledge as well as to invest on research and technological development for continuing to raise the productivity potential, particularly through a more rational use of natural resources, fertilizers, agrochemicals, and other inputs. A better use of production resources could significantly increase food supply in Latin America and the Caribbean right away.

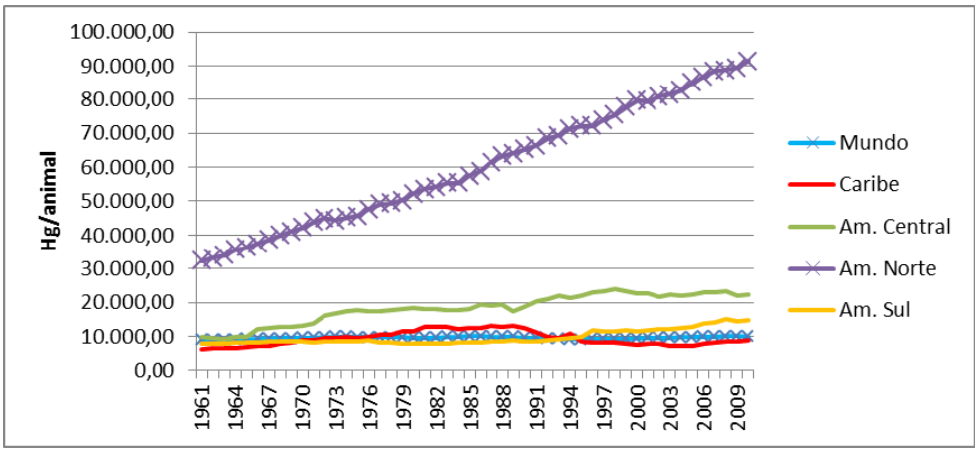
Despite this component's importance, the grain productivity growth rate has declined since the Green Revolution. From 3.2 percent a year in 1960, it dropped to 1.5 percent in 2000 (World Bank, 2008). Charts 2, 3, and 4 show that in the hemisphere only the North American countries have steadily raised their meat, egg, and milk productivity rates. South America and Central America showed more modest productivity growth rates, closer to world averages. It is thus clear that there is a potential for raising productivity in these regions.

Chart 2 – Egg production productivity in Latin America and the Caribbean and in the world (100 mg/animal), 1961-2010.



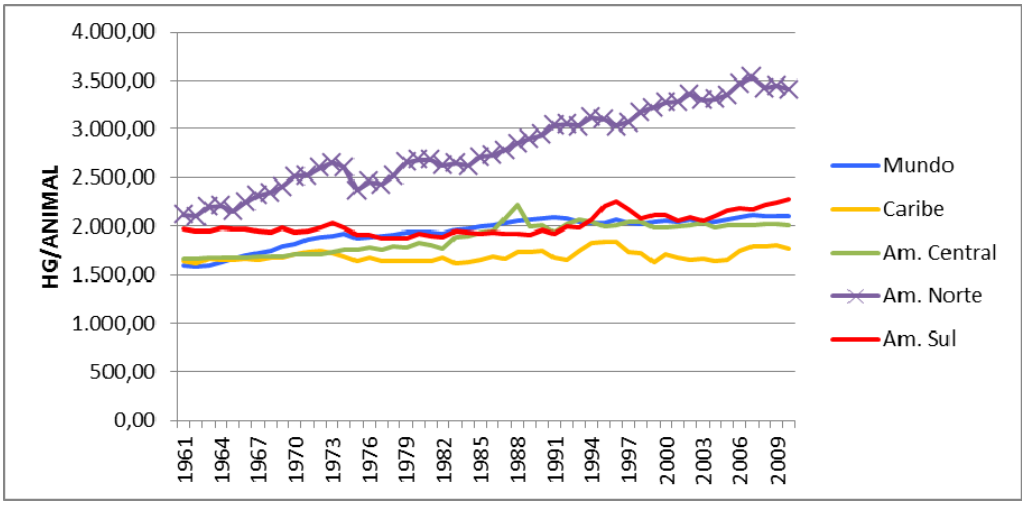
Source: FAO Statistics Division.

Chart 3 – Milk production productivity per animal in Latin America and the Caribbean and in the world (hg/animal), 1961-2010,



Source: FAO Statistics Division

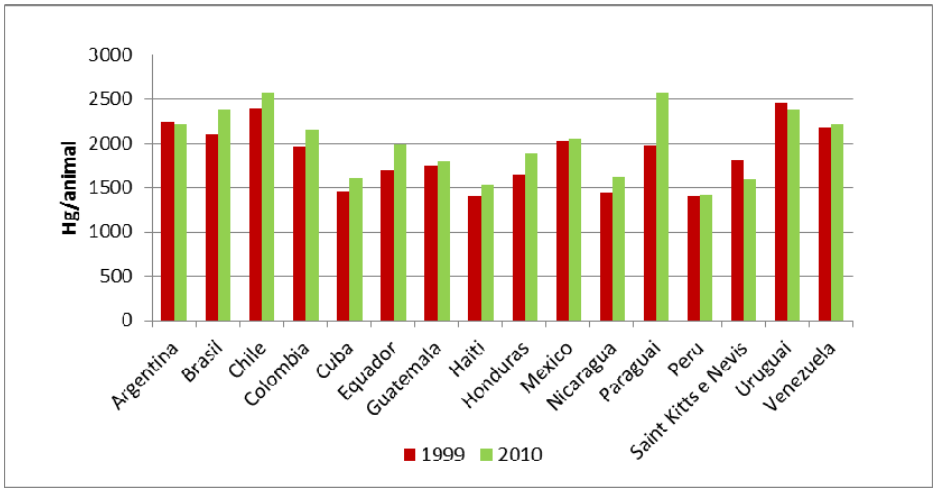
Chart 4 – Bovine herd productivity in Latin America and the Caribbean and in the world, measured in carcass weight (hg/animal), 1961-2010.



Source: FAO Statistics Division

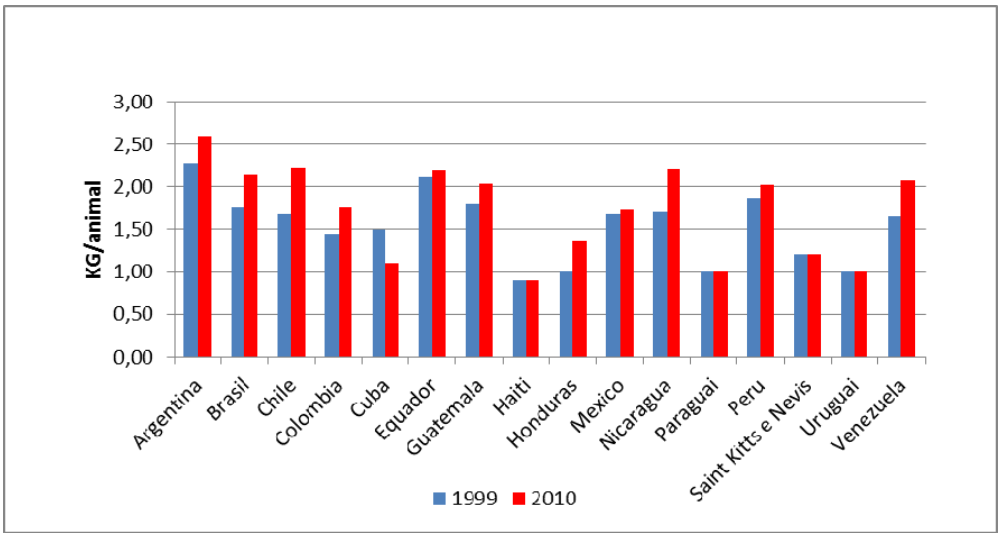
Charts 5 to 9 provide a basis of comparison between 1999 and 2010 in regard to the same animal production activities in some Latin American and Caribbean countries. When analyzing these Charts, one should also take into consideration certain countries' aptitude and factors that favor some of these activities, such as for instance the importance of beef, chicken, and pork in Uruguay, Brazil, and Argentina, which also can rely on the availability of grain and cereals for animal feed.

Chart 5 – Beef production productivity in some Latin American and Caribbean countries, 1999 and 2010.



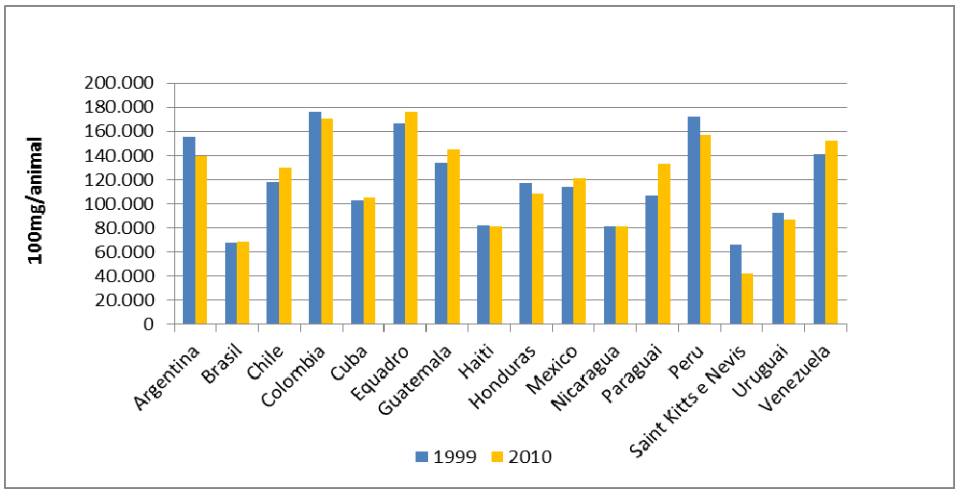
Source: Fao Statistics Division

Chart 6 – Chicken production productivity in some Latin American and Caribbean countries, 1999 e 2010.



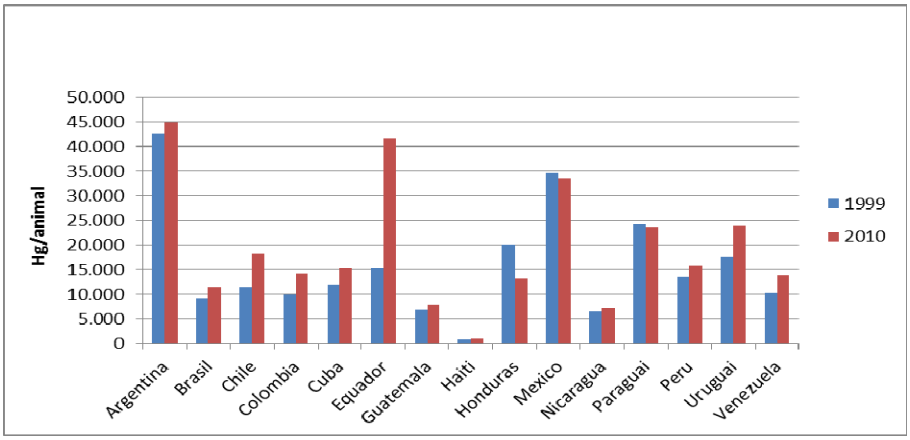
Source: Fao Statistics Division

Chart 7 – Egg production productivity in some Latin American and Caribbean countries, 1999 e 2010.



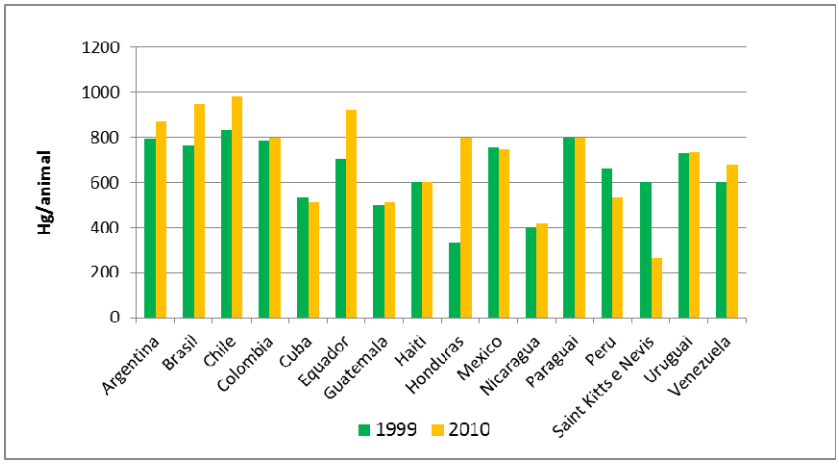
Source: Fao Statistics Division

Chart 8 – Milk production productivity in some Latin American and Caribbean countries, 1999 e 2010.



Source: Fao Statistics Division

Chart 9 – Pork production productivity in some Latin American and Caribbean countries, 1999 e 2010.

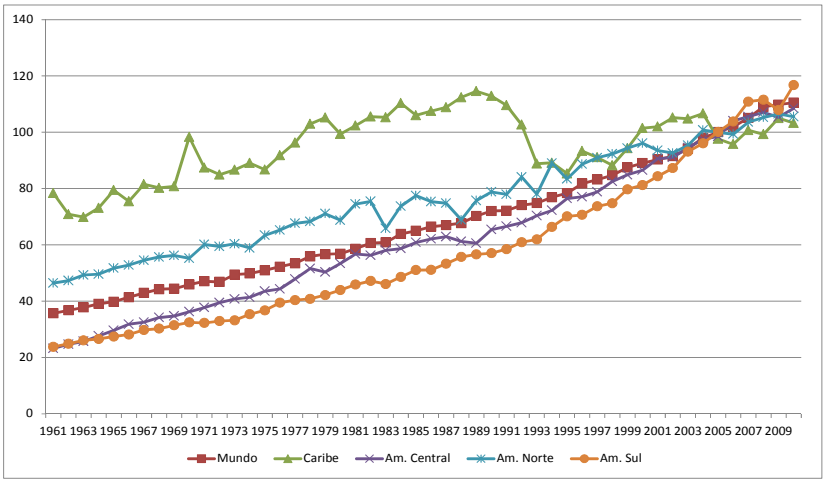


Source: Fao Statistics Division

Other countries, such as Haiti and Nicaragua have significantly lower productivity than the countries that are more efficient in meat production. As regards milk, with the exception of Argentina, Mexico, and Ecuador (the latter has recently experienced a productivity jump), the sample countries still seem to face a serious challenge in raising productivity. In the specific case of milk, it is important to consider that many countries where animals are not raised necessarily for milk production end up by being seasonally integrated into production statistics, in an extractive manner, thereby contributing to lower productivity and efficiency indicators.

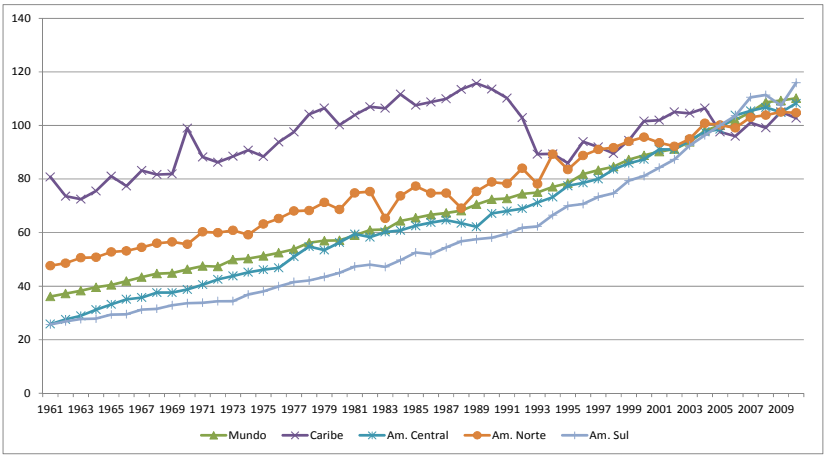
It is worth noting that the aggregate food production indicators in Charts 10, 11, and 12 show that all Latin American and Caribbean regions experience a trend to raise production volumes, and highlight South America's rapid growth in the last decade. In the early 1990s, the Caribbean indicator showed a drastic drop to resume then the previous trend afterwards. Livestock and agricultural indicators are quite similar as regards direction and movement, and special notice should be taken of the fact that in recent years the Caribbean animal production has grown more rapidly than the production of other agricultural items.

Chart 10 – Gross food production indicator in the world and in the Americas, 1961-2010. (Base: 2004-2006 = 100).



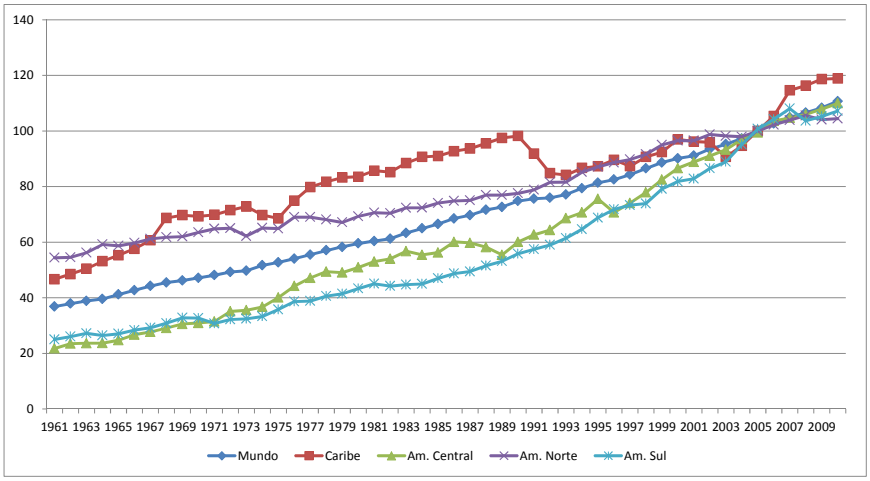
Source: FAO

Chart 11 – Gross agricultural food production indicator in the world and in the Americas, 1961-2010. (Base 2004-2006 = 100).



Source: FAO

Chart 12 –Gross animal production indicator in the world and in the Americas, 1961-2010. (Base 2004-2006 = 100).



Source: FAO

Although Latin America and the Caribbean account for only 13.5 percent of the world population, it has produced slightly over 23 percent of the world's bovine and bubaline meat and 21.40 percent of the global production of poultry. In the case of eggs and milk, its share drops to a little over 10 percent and 11.2 percent weightwise, respectively (Table 2).

Table 2 – Production of products of animal origin in Latin America and in the world in 2010 (In tons). Source: FAO

Product	World	Caribbean	Central Am.	North Am.	South Am.
Bovine/bubal. Meat	65,736,987	232,563	2,211,146	13,319,489	12,784,785
Poultry meat	98,089,871	596,792	3,492,867	20,799,961	16,904,476
Pork	109,215,302	325,783	1,340,855	12,111,602	4,846,907
Lamb meat	8,532,257	11,295	56,372	92,440	246,839
Eggs	68,893,060	253,785	2,698,729	5,840,514	4,040,849
Milk	720,870,390	2,009,170	14,400,968	95,705,700	64,690,817

The Latin American and Caribbean region encompasses countries that have some of the highest food trade surpluses as well as some of the greatest trade deficits. In 2009, Haiti ranked seventh in agricultural imports in relation to total imports (32.3 percent), while Argentina and Brazil appeared on the same list with the lowest agricultural imports x total imports ratios: 4.07 percent and 4.95 percent, respectively, according to FAO data.

As regards Paraguay and Nicaragua, 70 percent of total exports come from agriculture and livestock, while Venezuela exports only 0.10 percent in agricultural and livestock products, according to FAO.

A look at FAO data on the ranking of animal products importing and exporting countries in general shows that Latin America and the Caribbean are net importers of eggs and of milk products and net exporters of live animals and meat. In Mercosur, according to ECLAC/CEPAL's 2011 report, meat and poultry products accounted for 2.8 percent of the region's total exports, and ranked among the ten most important items. In 2007 and 2008 beef exports ranked ninth.

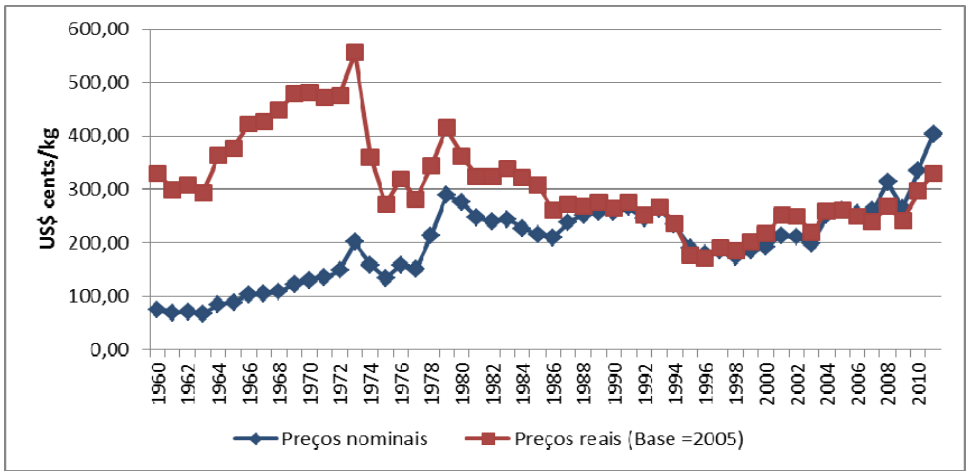
It should be recalled that countries that face limitations regarding food production (scarceness of land or water or technology) have the alternative of ensuring supply through international trade. To this effect it is necessary to guarantee fair and transparent trade conditions so that food may be channeled to countries with excess demand at compatible prices. One should thus examine in greater detail signs of potential for strengthening the intraregional trade in animal products in Latin America and the Caribbean, keeping in mind the preceding observations and having in view greater availability of these food products in the region.

As already seen, whether through production or trade, developing countries will tend to consume a greater food volume and satisfy a larger proportion of the daily protein needs through animal products. According to FAO projections (2011), the share of grains and cereals in food consumption will drop in the coming decades, while the share of the meat, milk, and fish group will increase. In richer countries, on the contrary, projections indicate a reduction in meat consumption, owing in part to health concerns.

Another challenge facing the Latin American and Caribbean productive sector and governments is to ensure that food production and distribution will be consistent with the population's income, particularly in the case of populations that need to reach more adequate levels of animal protein consumption most.

Food prices have become one of the priorities in recent discussions about world agriculture and livestock and food security owing to the 2008 crisis. Chart 13 indeed shows that in 2008 a shock occurred in relation to world beef price levels, as an illustration, but in recent years, in this product's specific case, there were already signs that real prices showed a rising trend.

Chart 13 – Nominal and real beef prices. Real prices at 2005 US$. World, 1960-2011. World. 1960-2011.



The 2007-2008 price crisis showed that the world's agricultural and food system is vulnerable and requires a reformulation of agricultural policies and trade norms. OCED/FAO and IFPRI projections indicate that agricultural commodities prices should remain above the levels prior to 2006, adding to the concern over food supply and combating hunger.

The importance of animal production in relation to the nutritional issue

Food production and the value chains are currently and increasingly related to objectives that go beyond the volume of products generated, adding other values such as the nutritional value and the values of quality and safety of the products produced and marketed. Although only consumers with a greater purchasing power express their preference for these additional attributes, the lack of food and the compromising of food quality and safety are associated with some of the most serious malnutrition and public health problems in developing countries. Food quality and safety have thus become attributes to be taken into consideration in food sector projections, particularly as regards food products of animal origin.

The connection between agricultural growth and improved malnutrition indicators has been already recorded in the literature in studies that point out that in several agrarian countries this sector's performance is more effective in reducing malnutrition than is growth in other sectors, including industrial sectors (Fan, Pandya-Lorch and Fritschel, 2012).

In Latin America and the Caribbean, child malnutrition is a very serious problem, as can be seen from Table 3, which shows the percentage of children under five who are below the proper height and weight for their age. In the same Table one can notice that the countries with the highest indicators of children under the proper height and weight seem to have a positive correlation with those whose energy availability, measured in kcal/day/per capita, is lower. Such is the case of Bolivia and Colombia.

Table 3 – Energy supply in food and effects of child malnutrition in some Latin American and Caribbean countries, 2008

Country	Child malnutrition in Latin America and the Caribbean (2008)		Food energy supply (kcal/p.c./day)
	Percentage of children under five below normal height	Percentage of children under five below normal weight	
Argentina	8	2	3.030
Bolívia	27	4	2.100
Brasil	7	2	3.120
Chile	2	0.5	2.960
Equador	29	6	2.300
El Salvador	25	6	2.580
Guatemala	54	18	2.150
Honduras	30	9	2.610
Jamaica	4	2	2.840
México	16	3	3.260
Nicaragua	19	4	2.420
Rep. Dominicana	10	3	2.270
Uruguai	14	6	2.840

Venezuela	16	6	2.650

Source: Anuario Estadístico de América Latina y Caribe, CEPAL, 2011, p.58

According to WHO (2010), poor nutrition accounts for about 3.0 percent of the occurrence of diseases in low-income countries. In addition, malnutrition and diseases have negative consequences for work productivity, schooling, and capacity in these countries, thereby aggravating the effects of poverty.

Despite increased availability of per capita calories per year in meat and eggs (except in the Caribbean, where growth indicators are more modest. See Charts in the Annex), health indicators in Latin America and the Caribbean point to the need to improve the nutritional level and to solve sanitary problems related to the main zoonoses associated with agricultural and livestock activities. The data in Table 4 show the DALY[1] for some countries; it is worth noting that the level of lost human lives in Latina America and the Caribbean owing to diseases (such as diarrhea) and zoonoses associated with food is significant if compared with Switzerland and other developed countries.

Table 4 - Total estimated DALYs (1,000) and total population, by type of cause and by WHO member countries (2002)

Country	Infectious and parasitic diseases			Nutritional Deficiencies	All causes	Total population
	Diarrhea	Tropical Diseases	Total			
Brasil	735.40	334.63	2,870	398.60	36,522	176,257
Bolívia	142.28	28.23	382	78.32	2,338	8,645
México	253.51	88.96	959	261.83	15,387	101,965
Nicaragua	51.22	12.05	129	36.89	955	5,335
Haiti	185.46	14.49	1,730	155.41	3,490	8,218
Suiça	1.75	0.00	17	4.71	799	7,171

Source: WHO (2012)

It is in this connection that the IFPRI work (2012) stresses the value chain approach as a way of incorporating the objectives related to nutrition so as to make food more accessible and available to the poorer. According to Hawkes and Ruel (2012), the idea is to analyze each segment of raw material production in the field up to the final product on the consumer's table, determining where the value for nutrition should be inserted into the system. This is a new concept related to the value chain, which adds to the economic value creation by the chain sectors.

Thus, to improve food consumption and the availability of calories for the populations of Latin American and Caribbean countries it is necessary not only to reduce the serious malnutrition problems but also to abolish limitations related to product safety, as will seen further on. Meat, eggs, milk, and their byproducts have a major role to play, by providing more protein as well as mineral salts, calcium, and iron.

[1] DALY – Disability-Adjusted Life Year: or potentially lost years is an indicator that can show diseases and other causes leading to premature death, and is calculated by the number of to be lived if premature death had not occurred, on the basis of the country's life expectancy.

Animal protein purchase is indeed increasing in developing countries. This is illustrated by data for Brazil, collected through the Household Budget Survey (POF), shown in Table 5).

Table 5 –Relative food share in total calories, as determined by household food purchase. Brazil. In percentages.

Item	2002/03	2008/09
Ítem	35,5	35,2
Cereales e derivados	11,2	12,3
Carnes	3,9	4,4
Bovina	3,9	4,0
Pollo	1,8	2,2
Embutidos	4,8	4,4
Leche	0,9	1,1
Quesos	0,3	0,7

Source: Pesquisa de Orçamentos Familiares (IBGE, 2008/2009).

A comparison between the 2002/2003 and the 2008/2009 POF data shows that the share of meat and milk byproducts in household purchases is increasing. Also worth pointing out is the importance of eggs as a protein source in rural communities. IBGE has detected as positive consumption pattern in the entire country and in classes of every income bracket the systematic adaptation of the food protein content and the increase in proteins of high biologic value (of animal origin) (IBGE, 2010)

Animal protein plays a relevant role in meeting not only daily protein requirements but also the need for some nutrients, such as iron, whose deficiency affects the pregnancy of thousands of women in these countries, to the point of leading to deaths. Iron deficiency hampers the mental development of 40-60 percent of children aged six to 24 months in the developing world, and causes the death of 50,000 women a year during pregnancy and delivery ((Fan, Pandya-Lorch, and Fritschel, 2012, extracted from Micronutrient Initiative and UNICEF, 2004). Iron fortification was considered the third most important solution to be considered for human challenges, according to the Copenhagen Consensus, and greater access to meat can certainly contribute to such a solution.

A recent work by FAO (2011) notes that the current annual average per capita meat consumption is 41kg – 30 kg in developing countries and 44kg in developed countries – but should rise to 54 kg by 2050. In terms of average daily caloric intake, a 10-percent rise over the 2003/05 level is expected, to 2,050 kcal/weight.

It is clear that countries with a higher per capita income and lesser malnutrition problems show higher per capita meat consumption; as an illustration, one may compare the 65 kg per capita meat consumption in France with Peru’s 35 annual per capita meat consumption.

Table 6 shows the evolution of energy consumption in kcal per capita per day and of protein consumption in grams per capita per day in different regions of the world. One may notice that access to energy and protein in the diet has risen more significantly in developing countries than in richer countries, which have already attained adequate levels in their diet. Advance in poorer countries is still slower, though. In the Caribbean, as one can see, diets have not yet reached the levels prevailing in the rest of Latin America, despite growth.

Table 6 – Energy and protein consumption in the diet of some regions of the world in different periods.

	Consumption of energy in the diet (kcal/per capita/day)				**Consumption of protein in the diet (g/per capita/day)**			
Regions or groups	**1990-92**	**1995-97**	**2000-02**	**2006-08**	**1990-92**	**1995-97**	**2000-02**	**2005-07**
World	2,610	2,680	2,720	2,790	76	80	82	85
Developed regions	3,250	3,250	3,350	3,430	100	100	102	104
Developing regions	2,440	2,540	2,570	2,640	69	74	76	80
Less developed countries	1,960	1,950	2,050	2,120	48	47	50	52
Caribbean	*2,320*	*2,250*	*2,510*	*2,590*	*54*	*52*	*58*	*62*
Latin America	*2,700*	*2,770*	*2,840*	*2,940*	*70*	*75*	*79*	*81*
Latin America and the Caribbean	2,670	2,740	2,820	2,920	68	74	77	79

Source: FAO Statistics Division

In Table 7, some Latin American and Caribbean countries are discriminated by energy and protein consumption in their diets.

Table 7 – Energy and protein consumption in some Latin American and Caribbean countries

COUNTRY	Consumption of energy in the diet (kcal/per capita/day)				Consumption of protein in the diet (g/per capita/day)			
	1990-92	1995-97	2000-02	2006-08	1990-92	1995-97	2000-02	2005-07
Haiti	1730	1780	1900	1850	42	41	41	41
Bolívia	2030	2100	2160	2100	53	55	57	56
Guatemala	2290	2170	2140	2150	59	58	57	57
República Dominicana	2160	2200	2240	2270	47	48	49	52
Equador	2110	2250	2240	2300	47	55	55	57
Antigua e Barbuda	2510	2180	2110	2330	83	75	70	82
Grenada	2470	2390	2300	2400	68	65	65	74
Peru	2110	2260	2340	2410	53	63	64	67
Nicaragua	1770	1970	2250	2420	46	44	56	62
Panama	2320	2290	2330	2450	62	62	66	71
Suriname	2440	2490	2430	2460	62	57	54	55
Saint Kitts e Nevis	2580	2430	2500	2460	70	68	77	72
El Salvador	2400	2430	2630	2580	59	61	68	71
Honduras	2300	2410	2510	2610	55	60	62	67
Venezuela	2460	2390	2420	2650	63	63	68	71
Bermuda	2870	2860	2610	2650	99	93	84	76
Sao Tome e Principe	2230	2230	2450	2660	51	50	51	60
Paraguai	2390	2590	2640	2660	70	78	77	70
Colombia	2410	2580	2650	2690	56	64	65	65
Trinidad e Tobago	2610	2570	2700	2700	62	59	64	68
Saint Lucia	2580	2680	2680	2710	79	84	88	93
Belize	2510	2500	2610	2710	63	62	71	72
Bahamas	2610	2560	2700	2710	78	79	91	84
Guiana	2300	2570	2780	2740	60	71	77	75
Costa Rica	2820	2750	2820	2820	68	70	72	74
Uruguai	2660	2740	2800	2840	82	88	87	80
Jamaica	2510	2700	2800	2840	62	72	73	78
Saint Vincent e Grenadines	2360	2370	2630	2860	61	64	71	79
Chile	2600	2740	2840	2960	72	78	80	88
Barbados	3040	3010	3050	3020	90	86	90	95
Argentina	3010	3160	3140	3030	95	100	99	94
Dominica	3000	2980	3090	3090	78	87	93	93
Brasil	2760	2840	2910	3120	68	77	80	84
Antilhas Holandesas	3280	3280	3230	3260	85	91	96	84
Mexico	3090	3100	3210	3260	82	84	91	92
Cuba	2720	2450	3110	3420	62	55	71	80

Canada	3050	3280	3520	3530	96	99	106	105
USA	3510	3570	3720	3750	109	111	113	114

Source: FAO Statistics Division.

The data for Canada and the United States appear at the bottom of Table 7 for comparison purposes. One can notice that in terms of energy consumption in the diet, these two countries show higher levels of kcal consumption per capita/day. As regards protein consumption, some Latin American and Caribbean countries, such as Argentina and some Caribbean islands, attain very similar levels. This comparison within the region allows one to see that much progress must still be made in most countries of South America and Central America in relation to food, as regards both calories and protein.

In respect of protein, its share in all protein sources in the diet is rising in some countries, such as Brazil. In Europe in general this share exceeds 60 percent, while in Latin America and the Caribbean (Table 8) it varies significantly, from 20 percent in Haiti to 70 percent in Antigua and Barbuda, but with a large number of countries showing a 30-50 percent share of animal protein in the total. This indicates that there is potential for increasing animal production, including the production of eggs and milk products, which would raise the level of animal protein consumed by the populations, particularly in rural communities.

Table 8 – Consumption of animal protein in the total protein diet of Latin American and Caribbean countries. Source: FAO Statistics Division (2012)

Country	Share of animal products in total consumption of protein in the diet (%)			
	1990-92	1995-97	2000-02	2005-07
Haiti	14	16	19	20
Guatemala	19	24	26	27
Cuba	46	39	31	29
Nicaragua	28	25	27	30
Peru	36	36	34	35
El Salvador	24	27	31	36
China	23	31	34	38
Honduras	28	36	37	38
Belize	40	40	41	39
Bolivia	37	41	40	40
Suriname	42	41	43	41
Guiana	38	46	44	44
Mexico	38	39	44	45
Paraguai	53	55	52	45
Trinidad e Tobago	41	40	43	46
Costa Rica	50	49	49	49
Uruguai	61	63	58	49
Brasil	45	50	51	50
Colômbia	47	46	46	50
República Dominicana	42	46	47	50
Chile	45	50	49	51
Jamaica	44	48	51	51
Panama	53	55	54	52
Venezuela	48	51	53	53
Equador	45	49	50	54
Saint Vincent e Grenadines	55	54	52	55
Canada	60	57	57	56
Dominica	55	58	58	56
Antilhas Holandesas	60	61	65	58
Barbados	59	58	56	59
Saint Kitts e Nevis	55	62	63	61
Bahamas	64	61	65	62
Saint Lucia	58	61	63	64
USA	64	63	64	64
Argentina	64	64	63	65

France	67	67	67	65
Grenada	58	58	62	65
Bermuda	69	63	67	66
Antigua e Barbuda	67	68	69	70

While projections point to increased consumption of products of animal origin in developing countries, particularly of meat, interestingly enough the IFPRI model points to a change in the rich countries toward less meat intensive diets. Msangi and Rosegrant (2012) even suggest that this diet change in these countries may increase availability for poorer countries.

The importance of animal food production in the Americas for the local and regional economy, rural life, and social equilibrium

In developing countries, livestock activities play a relevant role from the standpoint of income generation also, particularly in rural zones. World Bank data (2012) show that the share of agriculture (as a primary sector) of GDP in Latin American and Caribbean countries varies in relative importance but is still significant in some countries, such as Paraguay, where it was 22.3 percent and in Guyana where it was 21 percent, in 2009. In Chile, however, it was only 3.2 percent. In that same year, agriculture's average weight in the Latin American and Caribbean GDP was 6.1 percent, as a result of a declining trend in the last decades.

According to ECLAC/CEPAL (2011), GDP at constant 2005 prices in the Latin American and Caribbean region rose from US$2.39 trillion to US$3.19 trillion in 2010, a 35-percent jump. In that same period, The share of agriculture (agriculture, livestock, silviculture, hunting, and fishing) in the GDP rose from US$127.6 billion to about US$154.6 billion, or 21.14 percent.

By way of illustration, CEPEA surveys show not only agribusiness's share but also livestock's share in agribusiness. In 2011 agribusiness's GDP share was 22.15 percent, in which agriculture accounted for 15.42 percent and livestock for 6.73 percent. In monetary terms, livestock's share amounted to R$278.8 billion (CEPEA, 2012). Of the 6.73 percent, about 40.2 percent came directly from the primary activity of animal husbandry, 31.5 percent from the distribution of livestock products, and the remainder was split between the inputs and the industrialization segments.

Another factor to be considered is the weight of agricultural and livestock activities in the trade balance as well as in the balance of payments of the developing countries and of the Latin American and Caribbean region as well. Animal products exports generate foreign exchange for the country and indicate that Latin America has some animal production surplus that, although channeled currently to supplying rich countries, could be reallocated more intensively to the Latin American and Caribbean region itself, thereby contributing to its food security. The realization that the rich countries tend to reduce their per capita meat consumption in the coming years lends support to this opinion.

It is not only through the balance of trade that the agriculture and livestock sector affects the balance of payment of Latin American and Caribbean countries. In terms of Direct Foreign Investment (DFI), the agriculture, silviculture, and fisheries sector, traditionally less dynamic than investment in other sectors, is currently experiencing an intensification of such investment flows. They occur all along the value chain, from the inputs segment to production to the retail sector. Foodstuffs and beverages now stand out as targets of multinational financial flows, particularly as regards corn and cotton, but also milk products, fruit, sugar cane, and meat, among others.

From the standpoint of public policies for the livestock sector, identification of these flows makes it possible to regulate the market's operation so as to ensure that the entry of foreign capital and technology will contribute to the improvement of the sector's productivity and quality levels, whose effects will radiate to all chain segments and not only to the industrial segments, which as a rule are the main recipients of productive investment.

Although multipliers have not been calculated specifically for the livestock activity, the study of input-product matrices allows the observation that livestock activities have significant backward and forward linkages in the economy, generating multipliers above 1.0. The Rasmussen-Hirschman indicators, as calculated by Amorim et al (2009) for Brazilian agribusiness in 2005, point to a backward linkage indicator of 1.08, thereby establishing the sector as being of key importance for the economy. A key sector is one whose direct and indirect impact on the economy is greater than the average impact of the other productive sectors. In this case, for each unit variation in the end demand, there was a 1.08 impact. The pure normalized calculated linkage indicators allow the observation of the sector's importance in view of the effects it generates in the other sectors of the economy, and show that agriculture (the livestock sector included) has recorded indicators far above 1.0. These backward, forward, and total indicators were, respectively, 2.96; 2.74; and 4.70, confirming that this is a key sector for development, surpassed only by the transformation industry sector, whose total indicator was 7.32.

Particularly in agricultural, less industrialized countries, these indicators tend to be even higher, as agriculture stands out not only for its share in the GDP, but also in respect of employment generation and of the linkages with the other sectors of the economy. Moreover, its relevance as a potential development engine is still greater, if one considers the already mentioned percentage of agricultural jobs (Chart 1) and of poverty in developing countries, concentrated in rural areas, as shown by Table 9.

Table 9 – Percentage of the rural population in the total population of some Latin American countries and share of the rural population living below the poverty line, 2010

Country	**% of the rural population living below the poverty line**	**% of the population in the total population**
Honduras	65.4	51.20
Paraguai	48.9	38.50
Equador	53.0	33.10
Peru	54.2	28.40
Colombia	50.3	24.90
Mexico	60.8	22.20
Uruguai	6.2	7.50

Source: World Bank (2012)

Table 9 shows not only how significant the rural population share is in Latin American countries but also the seriousness of the poverty levels in this population segment. Once more it becomes clear that there is an urgent need to improve the productivity of agricultural and livestock activities and to ensure income generation in the rural area, which will also improve the health of its population.

One can see that in Mexico and in Honduras the population share living below the poverty line is quite significant. On the Hunger Map issued by the United Nations World Food Program in 2011, one can also see that in Latin America and the Caribbean Haiti ranks highest in regard to malnutrition (35 percent of the population), followed by Bolivia and Guatemala, both with a moderately high classification (20-34 percentage of the population), in the same rank as Sudan and other African countries.

The indication that there still is a significant rural population and that poverty is acute in this population suggests that rural migration will continue in various Latin American and Caribbean countries. This is expected as the countries move toward a development more closely connected with the secondary and tertiary sectors of the

economy and with urbanization. But when rural migration occurs without an appropriate basis in the country and under inappropriate conditions in urban zones to absorb it socially and economically, problems may certainly aggravate.

To ensure proper living conditions for agricultural and livestock productive activities and for reducing poverty is thus essential for attenuating the problems caused by disorderly rural migration as well as for keeping the rural population in the country under appropriate income and nutrition conditions. It is important that rural migration should take place without dismantling the rural productive system, which is in general responsible for supplying food to growing urban zones, and that it should occur at a pace that will allow the absorption of the technology needed in the country for producing sufficient food and permit the organization of distribution in the cities. Accordingly, although it is inevitable, rural migration should be monitored and could be reduced by the creation of worthy living conditions in the country.

Livestock activities in Latin America and the Caribbean follow numerous production models, whose intensification depends not only on specific production chains (beef or eggs), the product's final destination, and the degree of technicalization. The production of eggs and of chicken in general is more labor-intensive than cattle-raising, particularly beef-cattle raising. Chicken and pork production in Mercosur is well integrated vertically as compared with other animal production activities. Cow's milk production follows quite technified models, but is also subject to a seasonal extractive regime.

Thus, from a social and rural standpoint, it is interesting to note that people's ties to the country tend to be stronger in activities such as egg, milk, and chicken production than in cattle-raising. In Brazil, as a matter of fact, data on so-called family farming (not to be confused with subsistence farming, as a significant portion of its products is marketed) show that animal production activities accounts for a significant share of the product generated.

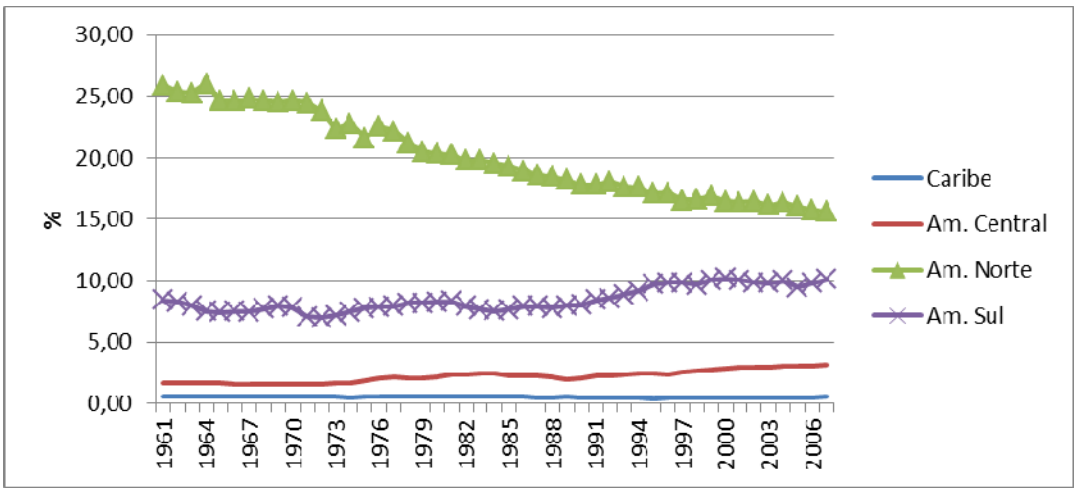
Brazil's last agricultural census (in respect of 2006) showed that family farming accounted for 84.4 percent of properties but only for 24.3 percent of the agricultural area. Yet, its share in production was significant: 38 percent of total production: 58 percent, of milk; 59 percent, of pork; 50 percent, of poultry; and 30 percent, of beef (MDA, 2009). This shows that actions aimed at food security and food safety should involve family farmers and small-scale production.

Thus, as land tenure is quite pulverized, consideration should be given to other forms of aggregating income and value in the country, such as cooperative initiatives, for example. It is also vitally important to verify if there is a need for specific regulations conducive to such aggregation on a smaller scale and in smaller areas. In the late 1990s, the Brazilian state of São Paulo adopted legislation on the processing of animal products on the property itself. The objective was to allow producers to process their products on their own properties and thus be able to market them with a higher aggregate value to consumers, provided they meet the minimum product safety requirements.

Challenges and risks of producing foodstuffs of animal origin to meet growing consumption

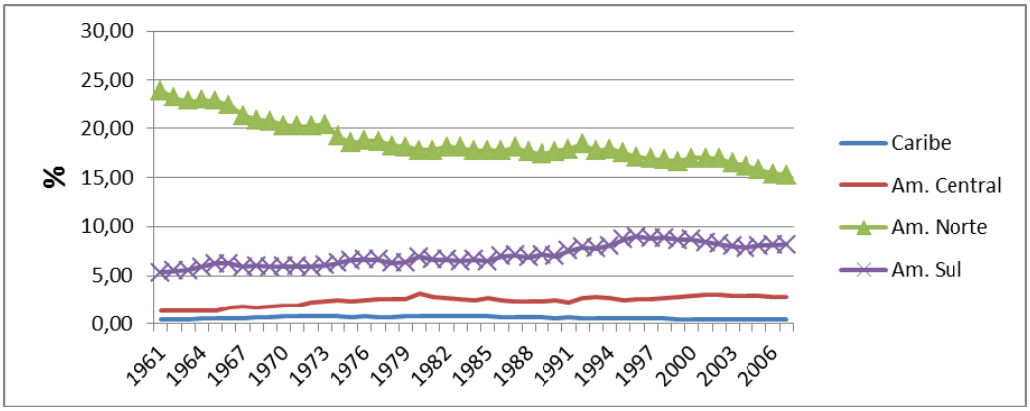
In respect of the animal sector's production, Charts 14-18 show that Latin America and the Caribbean are increasing their share in the world production of animals and their byproducts. For comparison purposes, it is interesting to note a decline in the share of the North American countries, while the share of South America and Central America increases. The most critical situation in the region is that of the Caribbean countries in terms of their share.

Chart 14 –The Americas' share in the world meat supply, 1961-2007 (in tons).



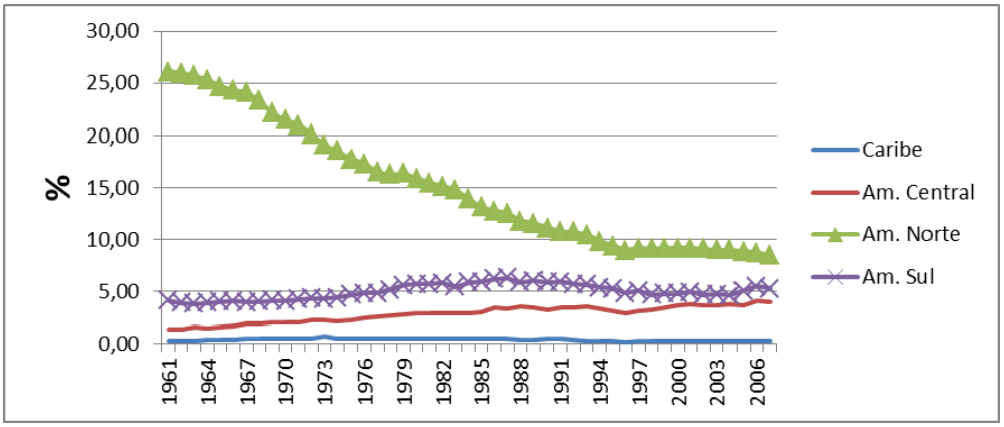
Source: FAO

Chart 15 – The Americas' share in the world milk products supply, 1961-2007 (in tons).



Source: FAO

Chart 16 – The Americas' share in the world egg supply, 1961-2007 (in tons).



Source: FAO

Chart 17 - Per capita egg supply in the Americas and in the world. In kcal/per capita/day

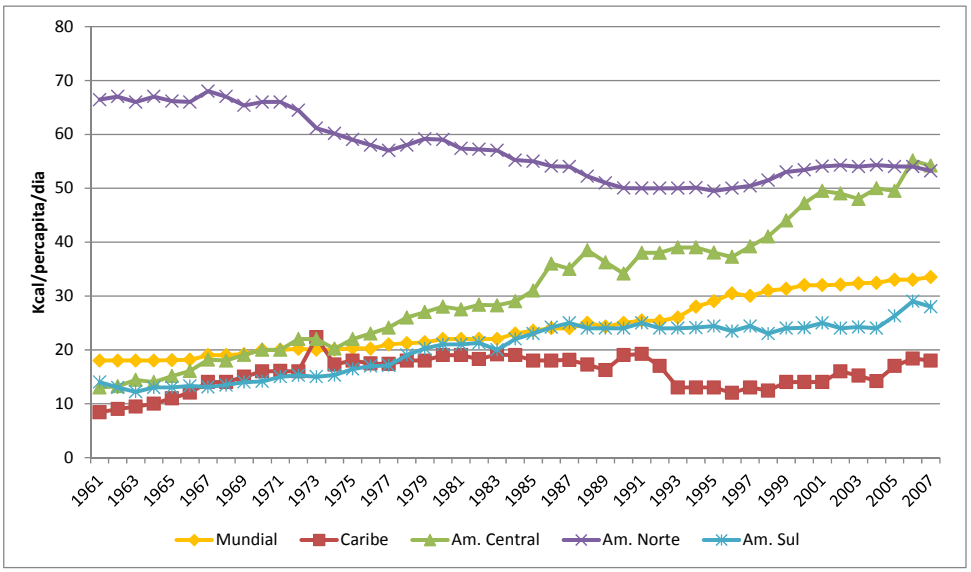
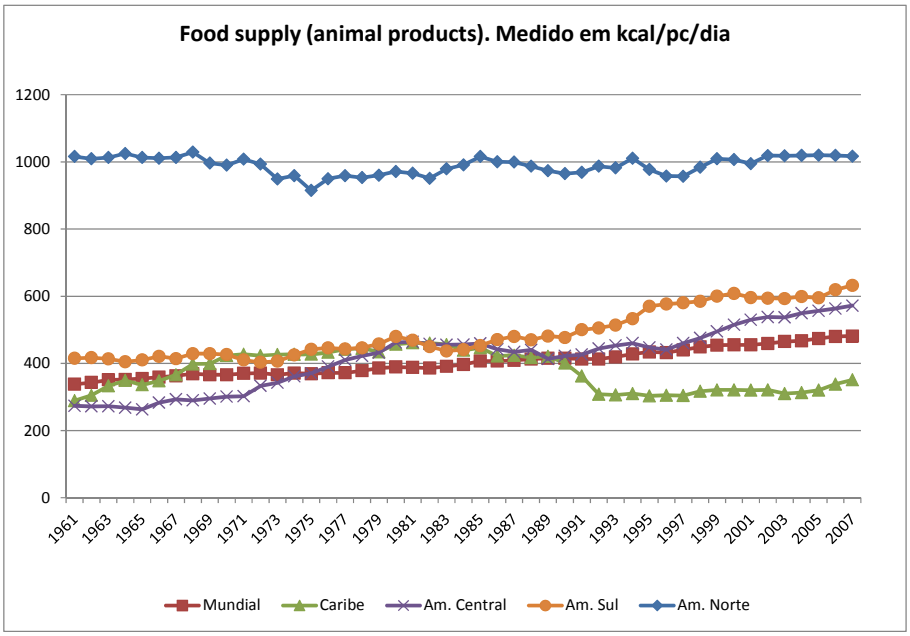


Chart 18- Supply of food of animal origin. In kcal/per capita/day. Americas and the world.



Source: FAOSTAT. 1961-2007

In general, the food supply measured in kcal has also increased in recent decades, although as the data above show, there is still a wide gap in the hemisphere to be filled in relation to North America's absolute supply levels.

And there is ultimately the challenge posed by the fact that notwithstanding this growth there is still a significant number of people living below the poverty line, who must be incorporated into the food supply system.

Land and water are two of the most important resources for food production, including food of animal origin. As part of the marketed meats is still produced on the basis of animal feed, the availability of land and water and the restrictions that still affect these agricultural activities indirectly also affect meat projections. When world availability of these two resources is considered, Latin America and the Caribbean come up with the highest potential indicators, particularly in view of their availability in Brazil.

In South America, however, there is concern particularly over the effects that ensuring food security may have on the Amazon's progress and on the clearing of its forests. In Brazil, a study by EMBRAPA estimates that about half of the grazing land, or approximately 85 million hectares, are degraded pasturages, and that if they are used for a crop-livestock combination or under an integrated crop-livestock-forest system, grain production could treble. Moreover, while agriculture has increased grain production by 154 percent (and the planted area by only 25 percent) in the last three decades, the livestock sector has maintained low productivity levels (one animal per hectare), which could be at least doubled). To this effect, it is necessary to incorporate the already available technology and keep up investing on new research.

But unless the State is well prepared, consumer pressure for more food might result in the intensification of production, accompanied by the degradation of resources. It is thus essential that production intensification be closely monitored and that investment is channeled to infrastructure and to a regulatory framework sufficient enough for meeting the challenges on the way. Resorting to the Brazilian example once again, an environmental licensing requirement was established in 1997 for activities susceptible of having a significant environmental impact, such as the slaughtering of animals or their confinement, and sugar cane processing mills, for which the technical water requirements are lower, which helps the production system to be more efficient in the use of this resource.

Another challenge to production expansion is the fact that intensification of the agricultural and livestock activity is associated with greater risk of disease outbreaks. The highly pathogenic avian influenza (HPAI) is an example cited by MacDermott and Grace (2012). The raising of animals in confinement, with greater density and uniformity, including genetic uniformity, tends to give rise to systems more susceptible to sanitary problems. There are several examples of diseases that though they may not be affecting productivity in the Latin American and the Caribbean region, are already affecting trade in goods, such as foot-and-mouth disease, Newcastle disease, and swine fever, not to speak of other diseases that although they do not occur in the region are susceptible of affecting current regulations and trade relations, such as the bovine spongiform encephalopathy.

Mac Dermott and Grace (2012) point out that forecasts for the coming years focus on demand elements that may induce greater pressure in regard to sanitary problems, particularly changes in consumption habits in favor of perishable and industrialized foods; a demand for cheaper food, with greater dependency on chemical inputs; and urbanization.

Risks to public health are not limited to pathogens and zoonoses; they include also food contamination and, as the demand for food security increases, so does the tendency to intensify the use of agrochemicals, which, if not used properly, can increase the number of human intoxication cases. In Latin America and the Caribbean, Brazil stands out as one of the greatest users of agrochemicals in agriculture. As to food contamination, one of the most striking examples is the contamination by Salmonella in eggs.

According to Grace and Jones (2011), at least 61 percent of all pathogens are transmissible between men and animals, and zoonoses account for 75 percent of emerging infectious diseases, some of which with a significant impact potential (avian influenza, SARS). In low-income countries zoonoses accounted for about 8 percent of losses owing to diseases. Diseases associated with food, such as diarrhea, which is one of the major infectious diseases in poor countries, kill about 1.4 million children a year; 33-90 percent of cases are attributable to food.

The coordination of actions between public health agents and agriculture and livestock personnel is a determinant factor, having in view that some of the diseases may be prevented only at the rural property level.

Assessment of losses have been made in respect of specific events, such as the SARS epidemics, which cost between US$50 billion and US$100 billion; and a potential cost of an avian influenza pandemics, estimated at US$3 trillion (World Bank, 2010). Miranda et al. estimated the losses avoided by Brazil by preventing the entry of the avian influenza; for a four-year period they estimated a loss of R$32.8 billion, including the impact on production, jobs, exports, and domestic prices. This was reflected in a cost-benefit ratio of R$636 billion of avoided losses for each R$1, 00 invested by the federal government on the prevention program.

CONCLUSIONS AND SUGGESTIONS FOR RECOMMENDATIONS

In respect of food security, notwithstanding technological, infrastructure, institutional, and organizational limitations and the poverty conditions prevailing in some regions of Latin America and the Caribbean , there are countries in the hemisphere with potential to meet however partially the additional demand for food so as to ensure food security over the next few decades. This applies particularly to animal protein, although conditions for producing eggs and milk products still fall relatively short of the potential needs of Latin American and the Caribbean countries, given their production data and growth rates.

The potential for increasing the food supply, particularly of eggs, milk products, and some meats, such as poultry, is promising if small-scale production is coordinated. Expansion of the local production of eggs and milk can improve more immediately the nutritional level in rural zones. So far these products have not been relevant in the international trade within the Latin American and Caribbean region (with a few exceptions); benefits could be more internalized among local producers, as the export trade focus does not ensure that benefits will overflow into the primary sector, which does not in general have a guaranteed share in the gains from external revenue. With production to be locally or regionally absorbed, with shorter distribution chains, producers and their families stand better chances to have a larger portion of the activity revenues, as they themselves may distribute their product, in natura or semi-processed.

Through legislation and regulations the State can promote speedier compliance with requirements pertaining to quality, food safety, and more sustainable production along the value chains, particularly to reach the economic agents that operate on a small scale. This is so because the big producers in general align themselves more rapidly with international trends, particularly as regards export products (beef and poultry in Mercosur), as they already form part of the international chains and are connected with the great multinationals' distribution networks. As regards legislation as in instrument for fostering food security and public health, enforcement is a must.

Investments can be another instrument to help the promotion of public health policies and their coordination with the area of agricultural and livestock production. In some sectors, such as the export sector – and Brazilian beef exports may be cited in this connection – investments on food safety along the entire production and distribution chain – are promoted by national companies, which dominate this export trade and have aligned themselves with the technological and sanitary standards prevailing in the rich countries.

Agricultural and livestock production is growing at a faster pace in Latin America and more slowly in the Caribbean, which brings into relief other clear possibilities and limitations, such as cultivable areas, among others. From a strategic standpoint, assuming that food security may be guaranteed by production or trade, these countries tend to remain net importers of animal protein. But it is imperative to meet this repressed demand and to ensure minimum nutritional levels, through trade if necessary.

As the intensification of production and the lengthening of distribution chains tend to raise the risk of contamination and of the occurrence of zoonoses, it is important that, as the State plays its role, risk analyses be introduced as an instrument to support decisions in the areas of animal, human, and environmental health, and food production in general. Losses owing to zoonoses and sanitary crises have been estimated, if with limitation, and indicate that this is one of the most sensitive issues for the countries of the Latin American and Caribbean region as regards production and consumption.

Joint, coordinated actions by national governments, with international support, can be successful and have both a regional and a local reach. Brazil has one of the largest school nutritional programs, which conciliates agriculture, nutrition, and health and that, associated with macroeconomic policies, is improving the extreme poverty and malnutrition indicators. This program shows the importance of coordination among the various government agencies. The Zero Hunger program (http://www.fomezero.gov.br/o-que-e) has introduced an innovative view of implementation of the Food and Nutritional Security Policy, which integrates actions by numerous Brazilian government agencies and involves the private sector.

Diagnostic is essential for planning food security. Let milk production serve as an example. It requires more labor that is more specialized than does meat production, and particularly involves activities that expose the product directly to contamination risks. On the other hand, it plays a crucial role in supplying basic food for child nutrition and may be a major component of programs aimed at ensuring the rural population’s direct access to food. If due precautions are taken, milk can be directly consumed in the rural zones where it is produced, without having necessarily to be processed; it is thus a livestock activity option with potential to have an impact not only on income and employment generation but also on local nutrition indicators.

Farm credit is a major instrument that may be used for encouraging producers to invest on improving quality. But it is necessary to allocate resources on the basis of local diagnostic of the most pressing needs of the countries and their different regions. Credit for products with little representativeness, directed at small producers for subsistence production, tends to have little effectiveness, particularly if allocated to products that require technology that is unavailable for such products and their producers. Cereals, grains, and animal husbandry are subsectors that have positive impact on growth; if well used, farm credit may contribute to their strengthening.

Incentive through credit policies aimed at sustainable production of quality foods is one of the essential instruments for the achievement of the objectives addressed by this paper. In Brazil, the government introduced a Low Carbon Agriculture Program, to encourage conversion to techniques with a lower potential of environmental impact (with potential to reduce carbon dioxide emissions). But the program’s planning underestimated the actions aimed at its implementation, such as the provision of technical indicators to be taken into account in projects submitted for securing credit, and the involvement of the banks in releasing resources.

Incentives must be created to permeate the entire value chain, or to act upon its separate links, all to incorporate objectives associated not only with increased, efficient production but also with the production of foods of high nutritional value, which are secure and safe for human health. In principle, market incentives would be more efficient, but in poor, developing countries, the consumer market is not in a position to have access to such foods at prices that make possible this transformation by the market.

In keeping with up with this growing food production trend in Latin America, it is important that governments invest on transport, storage, and irrigation infrastructure and above all on research and technology. Some foods, for example, of local or regional importance are rarely the object of research (such as those involving genetically modified organisms), although they could be essential for ensuring a proper supply in the future. The changeover to higher sanitary and environmental production standards will depend not only on awareness but also on financial and structural support, so that the knowledge that permeates the chains may reach the rural communities and farmers in an accessible form.

Production pulverization, so important from a rural social standpoint, raises the sanitary risks associated with agriculture and livestock and transmission, entailing risks to public health; more specifically oriented actions by the government are thus necessary.

It is necessary to stress the role of Research and Development in this diagnostic and in respect of the recommendations presented here. FAO (2011) cites the Beintema and Elliott (2009) study that shows that the growth rate of R&D in agriculture by geographical region dropped from 8.5 percent in 1976-1981 to less than 2.0 percent between 1981 and 1991 and less than 1.0 percent in the 1991-2000 period. These figures are reflected in the slower growth pace of productivity and may have serious consequences, including the hampering of the competitiveness of sectors that now stand out on international markets. Research must meet the needs not only of export products but also of products that can ensure better nutrition for rural populations and that are of local and regional commercial importance.

Government incentives along the entire value chain are important and may be reflected in regulations and in an organized, transparent institutional environment that provides support to private sector investments as well. It is necessary to mitigate the market failures toward private investment.

Incorporation of existing technology and continuing investment on research and technology are essential for improving food production without expanding the agricultural area. To ensure that the knowledge acquired reach the production end, it is essential to review the coordination of extension services in Latin America and the Caribbean.

To possess information is not enough; it must be disseminated along the chain among both private and public agents, and be used in decision-making. One of the greatest challenges even for rich countries is to improve communication between public agents and the research and technological development sector. In Latin America, the importance of rural extension services has been underestimated, although they could be made consistent with public health services to bring to producers the knowledge acquired, together with an already integrated concept of the problems to be addressed. Rural extension is possibly one of the instruments with the greatest potential to raise animal production in Latin American and Caribbean countries and to reduce rural poverty in the short- and the medium-run.

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