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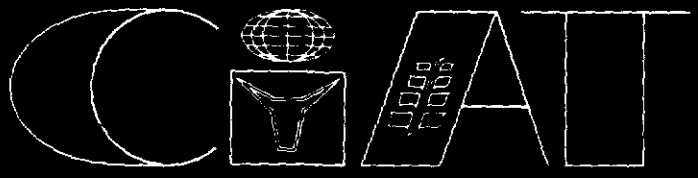

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ECONOMIC FACTORS, FOOD CONSUMPTION PATTERNS, AND NUTRITION IN CALI, 1982

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An important objective of agricultural research is to achieve increased food consumption and improved nutrition, especially among the poor. In order to assess how best to achieve this objective, it is necessary to have some understanding of the factors determining food consumption patterns and change in diets.

Individual preferences of consumers, that is, psychological attitudes towards different foods, interact with economic factors to determine food consumption. Whether people prefer red beans to black, or sirloin steaks to hamburg, or rice to maize, are important influences on what they eat. The ability to exercise preferences and eat the most highly preferred foods, though, is frequently constrained by economic circumstances. If income is low and prices of preferred foods high, food consumption habits have to be adapted accordingly.

As Latin American societies increasingly urbanize, and agriculture becomes ever more commercialized even among small farmers, what people eat in the region is mediated through the market. With the role of subsistence production of food declining in Latin America, food consumption patterns are strongly related to prices and incomes. The

central focus of this paper is to explore how economic factors-prices and incomes-affect food consumption in Cali, Colombia.

This paper examines food consumption patterns among household of different income levels in Cali. Particular attention is paid to bean consumption habits, but the relation between consumption and income is examined for cassava, rice, and beef, as well as for beans. Changes in Cali diet over the last decade are presented, and the influence of prices on changes in food consumption, is considered. Finally, the contribution of different foods to protein nutrition is analyzed.

Data

Survey interviews covering food expenditures, family characteristics, income, and bean consumption and preferences, were conducted with a sample of 186 housewives in Cali, Colombia, in August 1982. As is common in household survey, a two stage cluster sampling procedure was utilized (Solnim; Cochrane). In the first stage, a stratified random sample of neighborhoods was drawn. These neighborhoods were stratified into income categories based on the Colombian census. Then from these neighborhoods, households were randomly selected so that a 1/1000 sample was drawn from each income group as defined by the Colombian census. For the purpose of analysis, many of the results of the survey are presented by four income groups. Each strata contains roughly 25% of the surveyed households, ranked by reported per capita income. The results of this 1982 survey are frequently compared with those of a 1970 survey, also carried out by CIAT in Cali (Anderson & Londoño,undated) Both samples are divided into four income groups. These groups are similar in definition, and offer a fair basis for comparison.

Bean consumption

Housewives were interviewed about their family's bean consumption and purchase habits. In the vast majority of families the housewives are responsible for buying the beans, so they are clearly the appropriate subject for the interview (Table 1). Some differences exist by income level in the type of retail outlet in which beans are bought. The proportion of families buying beans in neighborhood shops is highest among the low income groups and declines steadily as income rises (Table 2). Purchases in "galerías" account for a third of bean purchases, except among the highest income group. Finally, supermarkets are a far more important source of beans for the highest income group than for lower income levels. Hence, there are some fairly marked differences by income group in where people buy beans. Any effort do assess bean market conditions by observing what happens at the retail level, must take into account these differences.

Frequency of buying beans also differs by income group (Table 3). Although across all income groups most people purchase beans in their weekly marketing, among the low income groups some people buy beans as they need them on a day to day basis. In contrast, purchase of beans on a bi-weekly basis is most common among the high income groups, who have least difficulty in financing stocks of food to be stored at home.

Similarly, differences exist by income group in the frequency of bean consumption, with the poorest families eating beans an average of 3.2 times per week, and the high income families eating beans only 2.2 times per week (Table 4). Moreover, the quantity of dry beans consumed per capita (excluding white beans and beans bought when still green), is relatively constant across income groups. In consequence, the poor eat an average of 56 grams of beans per serving, while the high income group eats an average of 82 grams/serving. Thus, the poor are stretching out their bean consumption, in part by simply eating smaller portions, and in part by preparing beans mixed with potatoes and plantains, which thickens broth while maintaining the appearance and taste of beans. As incomes rise, people achieve greater diversity in their diet and eat

beans less frequently, but their overall consumption remains constant because the amount of consumed per serving increases.

Bean consumption in Cali can be grouped conveniently into three categories: dry beans, all the red and red mottled types as well as black beans; white beans, "blanquillo", which are not commonly recognized as beans (frijol) but are considered by consumers to be a different product; and green beans. The latter are seed of the common red varieties, harvested before physiological maturity. Dry beans comprise the bulk of bean consumption, but white and green beans are also quite important (Table 5). Consumption of these three types of beans is relatively constant across income groups.

Among legumes, beans hold the major market share in Cali (Table 6). Although this is true in all income groups, beans have a relatively greater market share among low income groups. The increasing market share for peas is probably due principally to greater consumption of fresh peas as a vegetable among the relatively well to do. The consumption of peas and lentils is much greater in the high income groups (Table 7). In Cali total legume consumption does appear to rise with increasing income, but bean consumption remains constant. Lower price or improved quality factors might enable beans to compete for a share of the rise in legume consumption that occurs with increased incomes, but consumers may be expressing a desire for a more diversified diet, varying the traditional staple legume of Colombia, beans, with other legumes.

Not only does diversity exist among different grain legumes in the diet, but also there exists a number of bean varieties which are important in Cali (Table 8). Red beans clearly dominate the market, but there are five major varieties of reds that are commonly consumed. (here red beans refer to beans that are red when cooked). These five reds occupy over 60% of the total bean market: Calima holds 26.4% of the market, Rojo Americano 13.3%; and Mortiño 12.7%. Fresh or green beans, a high proportion of which are Calima beans, have 19.0% of the

market. White beans are also quite important with 16.4% of the market, but black beans account for only 2.4%.

Among the red bean varieties, important differences exist in prices. These price differences are hypothesized to be related to differences in quality characteristics of the varieties such as size, cooking time, and broth thickness. Laboratory tests of these traits were conducted by the Nutritional Quality Laboratory at CIAT for the five principal red seed types found in the Cali market. Cooking time and broth thickness were found to have no statistically significant relation to price. Most consumers in Cali use pressure cookers, so cooking time is not a major factor, while many consumers add plantains or potatoes to the beans in order to thicken the broth, making the inherent broth thickness of the beans themselves a not especially important quality factor. In contrast seed size was found to be strongly related to price in a linear regression equation.

$$(1)\quad y = 26.05 + 0.45\ x \qquad R^2 = .96$$

where, y = retail price, and x = weight in grams of 100 seeds. This equation indicates quite clearly that, in the Cali market, given an acceptably red color, seed size is the principal determinant of price.

Since size is the main discriminating factor in terms of consumer preference for red beans in Cali, red beans were grouped into two categories: high quality, high price, preferred, large seeds, and low quality, low price less preferred small seeded varieties (Table 9). The cheaper small reds are consumed primarily in the low income groups, with consumption declining as income rises. The more expensive large reds play a very small role in bean consumption among the poor, but their importance rises as income increases. From this it is clear that product differentiation exists among red beans by size in the Cali market. Thus, consumption functions are estimated for the two type of beans.

In the estimated functions, household expenditures on beans are dependent on total family income, number of family members, and a dummy variable for regional origin of the family. People from the Antioquian region of Colombia are known, among other things, for being great consumers of beans. In the Cali sample, families in which either the housewife or her husband comes from Antioquia, have much higher average consumption of red beans than families that do not come from Antioquia, except within the highest income group (Table 10).

The equations were estimated in several functional forms, of which the inverse provided the best fit (Table 11). Income elasticities of demand calculated from these equations show that small red beans are an inferior good at all income levels, that is their consumption, drops with rising income (Table 12). However, large red beans have a fairly high elasticity of demand among the poor, indicating that consumption of large reds will increase fairly rapidly among the poor as their incomes increase. Among the highest income group, though, there is little further growth in large bean consumption as incomes rise. These results indicate a fairly weak demand for small seeded red beans, but a stronger demand for large seeded red beans, especially among low and middle income groups.

Some changes in the consumption of grain legumes can be noted by comparing the data of this 1982 with those of a 1970 survey also conducted in Cali (Table 13). Among the highest income group, consumption of beans, peas, and lentils all appear to have declined, while among the lower income groups, grain legume consumption has generally risen. Thus, in 1970 bean consumption rose fairly consistently with increasing income. By 1982, rising consumption of beans among the poor led to essentially constant consumption across income classes. Lentil and pea consumption continues to be greater among high income groups, in 1982 as in 1970, even though consumption rose among the lower income groups while it declined among the highest income group.

Changes in food consumption

Not only do there appear to be changes in the consumption of beans and other legumes between 1970 and 1982, but significant changes have occurred in other commodities, for example in cassava and potatoes. In the 1970 survey cassava consumption was very high within the low income group, 35.6 kg/capita/yr. (Table 13). Moreover, cassava was very much a food of the poor at this time, with consumption highest in the low income group, and lowest in the high income groups. By 1982 this pattern had been reversed. Cassava consumption dropped dramatically in the three lowest income groups, and consumption was now lowest among the poorest income group, 8.3 kg/capita/yr.

At the same time there also appears to have occurred some shifts in potato consumption. While potato consumption was relatively constant across income groups at about 30 kg/capita in 1970, in 1982 it was about 50-60 kg/capita. However, given the sharp drop in cassava consumption in the two lowest income groups, total root and tuber consumption remained constant in these strata, with the rise in potato consumption almost exactly substituting for the fall in cassava consumption.

Changes have occurred in the consumption of cereals (Table 14). In 1970 rice consumption was about 30-32 kg/capita. For the three lowest income groups, and their intake of rice rose slightly to about 36-38 kg/capita. More dramatic changes took place in maize. Like cassava, in 1970 maize was principally a food for the poor and its consumption was lowest among the high income group. Like cassava, by 1982 a dramatic decline in maize consumption had occurred in all but the highest income group. While maize consumption was falling, consumption of wheat products increased substantially.

Some shifts in the consumption of meats can also be observed. Although there appears to be little change in the consumption of beef, per capita pork consumption has plunged in all income groups, and chicken consumption has soared in all income groups.

In sum, then, cassava, maize and pork consumption have declined dramatically in Cali since 1970. Consumption of beef, beans and rice has changed relatively little, with perhaps some slight tendency to increase. Rapid growth in the consumption of chicken, wheat products, and potatoes has occurred. The sources of these changes can to a large extent be understood by comparing changes in consumption with change in prices (Table 14). Here, a very clear relationship can be noted. Those products whose prices have risen most, have had major declines in consumption (cassava, maize, and pork). Those products whose price in constant pesos have fallen or risen least (chicken, wheat, potatoes), have had the greatest increases in consumption.

Although consumers have preferences which affect their food consumption patterns, prices are clearly an extremely powerful influence on food consumption. Cassava has been displaced by potatoes from the diets of the poor because of changes in relative prices. Similarly chicken has substituted for pork, and wheat has substituted for maize, all due principally to changes in prices. Since prices can cause such major shifts in food consumption, the potential impact of new agricultural production technologies which alter relative prices, should be obvious.

However, relative prices are not the sole economic factor that exerts influence on food consumption patterns. As was seen above in the consumption functions estimated for beans, income is also an important determinant of what people eat. To examine this relationship, consumption functions have been estimated for the CIAT commodities-rice, beef and cassava, and provisional results are presented here (Table 15).

Equations were estimated for each product in a variety of functional forms, and the models with the best fit were chosen for each product (rice and cassava log inverse; beef semi-log). In the cases of rice and beef fairly good fits were obtained, but the R^2 in the cassava equation is quite low. From these equations the income elasticity of demand is computed for each product for each income group (Table 16).

The elasticities for rice are quite low, indicating that people in Cali are very near saturation with respect to rice consumption. With growing incomes, rice consumption should not be expected to increase. In Cali, it is very near a maximum in per capita consumption, and future market growth for rice will come almost solely from increasing population.

The income elasticities of demand for beef are fairly large compared to the other food products. Although these provisional estimated elasticities are not quite so high as others reported for beef, still the demand for beef is strong compared to other food products. The cassava model suggests that there is little tendency for consumption to rise with increased income, and this is relatively consistent with average per capita consumption levels by income group (Table 13), which show essentially constant consumption across income groups 2, 3 and 4. Nevertheless, the cassava equation is not sufficiently powerful to permit the drawing of categorical conclusions.

The results presented here clearly indicate the importance of prices and incomes in understanding changes in food consumption. Major shifts have indeed occurred in the Cali diet, and these are strongly associated with changes in prices.

Protein Nutrition

Nutrition is a critical concern in the planning and evaluation of agricultural research in low income countries. Since beans are of particular interest in this study, some preliminary findings from the food survey with respect to protein nutrition will be presented here. Additional work on analysis of calories is currently underway. Average nutritional requirements are estimated for each income group for both 1970 and 1982 based on the average age composition of the family in each income group and age specific protein requirements. Due to differences in the proportion of adults to children between income groups and between years, the protein requirements varies (Table 17).

Both the 1970 and the 1982 surveys show quite adequate average protein nutrition in the two upper income groups. In both years there appears to be a shortage of protein in the average diet in the lowest income group. Although some improvement in protein intake compared to requirements does seem to have occurred in the lowest income group, the available data indicate that among the poor inadequate nutrition remains a problem. In the second income group, average nutritional requirements are almost met by average diets in both 1970 and 1982. Since there is some variation in consumption around the group average, some members of group 2 probably have significant protein problems, while others do not.

Among those in the lowest income group who are most exposed to protein malnutrition, there have been some major changes in the composition of their protein intake. In 1970, maize was the leading source of protein in the diet of the poor in Cali, contributing 22.5% of total protein (Table 18). As a result of the sharp fall in maize consumption, by 1982 it provided -- 7.7% of total protein in the diet of the poor. Beef, rice, and beans are the next three most important sources of protein in the diets of the poor, and were the top three protein sources for the poor in 1982. They were all somewhat more important sources of protein in 1982 than they had been in 1970. The protein contribution of wheat products and chicken both rose quite dramatically in this period, while that of pork fell precipitously.

Prices are an important explanatory factor in changing patterns of nutrition. When maize was the leading source of protein in 1970, it was also by far the cheapest source of protein (Table 19). In 1982 it remained a fairly cheap source of protein, but it was no longer such an outstanding protein bargain as it had been, and its importance declined. Both in 1970 and in 1982, beans was a very cheap form of protein, and consequently was a major contributor to protein nutrition. Lentils, which were a relatively more expensive form of protein than beans in 1970, had achieved price competitiveness with beans by 1982.

Beef occupied a prominent position in both periods, even though it was always a fairly expensive form of protein. It was the cheapest meat

protein in 1970, by in 1982 chicken was the cheapest meat protein. These price changes, along with those observed in pork and eggs, are very consistent with changes in the relative role of different foods in protein nutrition. Foods, like maize and pork, that lose ground in their price competitiveness, can face rapidly declining markets. In this context, the increasing price competitiveness of chicken meat compared to beef, could lead to a long run erosion in the market dominance that beef currently enjoys in the meat sub-sector.

Similarly, among legumes, beans face competition with lentils. As the relative price of lentils has fallen, its market share in the legume sub-sector has risen. Preferences do afford some protection to preferred foods. Beef remains the major meat, and the leading protein source, even among the poor, despite its fairly high price compared to other protein sources.

Still, competition from cheap substitutes, can be disasterous for a product. Cassava, for example, was a very cheap calorie source in 1970, but its rising price led to its displacement in the market by 1982 (Table 20).

Table 1. Family member purchasing beans, Cali, 1982.

	Income			
	Group 1	Group 2	Group 3	Group 4
Housewife	83	75	91	75
Husband	9	18	2	15
Both	2	0	5	2
Other	6	7	2	8

Table 2 Place of purchase of beans, Cali, 1982

	Income			
	Group 1	Group 2	Group 3	Group 4
Shop	36	29	17	4
Market	32	31	33	13
Supermarket	23	29	42	70
Other	9	11	8	13

Table 3. Frequency of purchase of beans, Cali, 1982.

	Income			
	Group 1	Group 2	Group 3	Group 4
Daily	17	11	4	0
Weekly	59	56	70	49
Twice monthly	22	31	14	44
Monthly	2	2	12	8

Table 4. Frequency of consumption of beans, Cali, 1982

	Income			
	Group 1	Group 2	Group 3	Group 4
Frequency (Times/week)	3.2	2.9	2.6	2.2
Quantity (kg/cap./yr.)	6.5	7.8	6.5	6.3
Quantity/Serving (gms./cap. serving)	56	75	71	82

Table 5. Bean consumption, Cali, 1982.(kg/cap./yr.)

	Income				
	Group 1	Group 2	Group 3	Group 4	Total
Dry beans	6.5	7.8	6.5	6.3	6.8
White beans	1.6	2.1	1.7	1.5	1.7
Green beans	1.3	1.5	1.4	1.6	1.4
TOTAL	9.4	11.3	9.6	9.4	10.0

Table 6. Market share of legumes, Cali, 1982.

	Income			
	Group 1 (%)	Group 2 (%)	Group 3 (%)	Group 4 (%)
Beans	61	61	52	45
Lentils	21	19	23	23
Peas	15	16	20	23
Chick peas	3	4	6	9

Table 7. Consumption of grain legumes, Cali, 1982. (kg/cap./yr.)

	Income			
	Group 1	Group 2	Group 3	Group 4
Beans	9.4	11.3	9.6	9.4
Lentils	3.3	3.4	4.2	4.8
Peas	2.3	2.9	3.7	4.7
Chick peas	0.4	0.7	1.1	1.8
TOTAL	15.4	18.3	18.6	20.7

Table 8. Market shares by bean variety, Cali.

Variety	Market share (%)	Grain Type
Calima	26.4	Red mottled
Caraota	2.4	Small black
Cargamanto	3.8	Large cream, mottled red
Blanquillo	16.4	White
Mortiño	12.7	Large red, mottled
Radical	5.6	Red
Rojo Americano	13.3	Small red
Verde	19.0	Immature Green

Table 9. Consumption of red beans by seed size, Cali, 1982. (% of total bean consumption)

	Small and medium reds	Large reds
Income Group 1	47.2	13.0
Income Group 2	44.8	18.8
Income Group 3	30.8	30.0
Income Group 4	29.6	32.0

Table 10. Bean consumption by family origin, Cali, 1982 (kg/cap./yr.)

	Paisa	Non-Paisa
Income Group	9.3	6.1
Income Group 2	13.6	5.4
Income Group 3	9.2	5.9
Income Group 4	6.7	6.5
Average	9.8	6.0

Table 11. Consumption functions for beans, Cali, 1982.

	Small reds	Large reds
Intercept	2220	5280
Income	60×10^{-7}	-44×10^{-7}
	(0.57)	(-2.64)
Family size	779	183
	(5.22)	(1.16)
Paisa	3031	597
	(3.61)	(0.75)
R^2	.28	.19

"t" ratios in parentheses.

Table 12. Income elasticities of demand for beans, Cali, 1982.

Income Group	Small reds	Large reds
1	-.09	.64
2	-.06	.49
3	-.08	.46
4	-.04	.13

Table 13. Changes in food consumption, Cali 1970 y 1982. (kg/cap./yr.)

		Income			
		Group 1	Group 2	Group 3	Group 4
Cassava	1970	35.6	31.6	25.0	17.6
	1982	8.3	15.4	15.0	14.2
Potato	1970	27.0	30.9	26.4	29.3
	1982	56.3	51.8	60.0	60.4
Rice	1970	30.4	32.9	33.1	38.2
	1982	37.4	38.7	38.2	36.2
Maize	1970	30.4	34.7	35.4	13.0
	1982	11.4	12.5	10.0	9.7
Wheat	1970	6.3	7.7	9.6	10.9
	1982	13.5	17.4	17.9	27.8
Beef	1970	13.3	20.6	30.1	38.2
	1982	15.4	21.7	32.9	39.5
Pork	1970	3.3	6.7	7.3	16.6
	1982	1.0	3.3	4.0	8.6
Chicken	1970	0.1	0.5	1.1	5.4
	1982	3.1	5.4	5.9	11.6

Table 14. Changes in real retail price and average per capita consumption, 1970-1982, Cali.

	Change in price 1970-82 (%)	Change in consumption 1970-82 (%)
Chicken	-12	267
Wheat	-10	109
Potato	3	104
Beans	25	16
Rice	36	13
Beef	54	0
Pork	93	-51
Maize	162	-61
Cassava	191	-53

SOURCE: Andersen and Londoño; DANE; 1982 survey.

Table 15. Consumption functions for rice, beef and cassava, Cali, 1982.

	Rice	Beef	Cassava
Intercept	8.23	-257137	7.37
Income	-15100	23085	-36333
	(1.38)	(9.22)	(-1.57)
Family size	0.12	10783	0.05
	(8.37)	(2.96)	(1.83)
R^2	.33	.41	.05

"t" ratios in parenthesis.

Rice and cassava equations are specified in log inverse form, while that beef is in the semi-log form.

Table 16. Estimated income elasticities of demand for rice, beef and cassava, Cali, 1982.

Income	Rice	Beef	Cassava
Group 1	.10	.59	.24
Group 2	.07	.53	.16
Group 3	.05	.45	.13
Group 4	.03	.42	.07

Table 17. Average protein intake and requirements, 1970 and 1982, Cali. (grms/cap./day)

	1970			1982		
Income	Requirement	Intake	Intake/ requirement	Requirement	Intake	Intake/ requirement
Group 1	50.9	35.2	0.69	53.1	41.3	0.78
Group 2	49.1	46.9	0.96	52.8	51.3	0.97
Group 3	50.9	56.7	1.25	52.0	61.5	1.18
Group 4	52.3	70.7	1.35	54.0	76.0	1.41

SOURCE: Bienestar Familiar; 1982 and 1970 survey data

Table 18. Leading sources of protein in the average diet of the lowest income group, 1970 and 1982, Cali.

	1970 (%)	1982 (%)
Maize	22.5	7.7
Beef	18.3	19.4
Rice	15.9	17.8
Beans	11.9	14.7
Wheat	5.4	10.4
Eggs	4.1	7.9
Pork	3.1	0.9
Chicken	0.2	4.4

Table 19. Price per gram protein, edible portion of major foods, Cali. (1970 pesos).

	1970	1982
Maize	0.02	0.05
Beans	0.03	0.04
Rice	0.04	0.06
Lentils	0.05	0.04
Wheat	0.05	0.05
Eggs	0.07	0.08
Beef	0.11	0.17
Pork	0.12	0.23
Chicken	0.14	0.13

Table 20. Price per 100 calories edible portion of major foods, Cali. (1970 pesos)

	1970	1982
Maize	0.6	1.5
Rice	1.0	1.3
Cassava	1.3	3.6
Plantain	1.6	1.9
Wheat	1.8	1.6
Beans	2.4	3.0
Lentils	3.4	2.4
Beef	3.2	5.0
Potatoes	3.3	3.4