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An Exercise in Nutrition Economics

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Major Sources of Calories, Proteins and Fats

Around the world, as people have exerted increasing pressure on their supply of land, they have at the same time tended to concentrate their food consumption on those crops which make the most efficient use of the land for converting the sun's energy to food "The trend for more and more people to be nourished by fewer and fewer plant and animal food sources has reached to point today where most of the world's population is absolutely dependent on a handful of species " (The four crops at the top of Figure 1 contribute more tonnage to the world total than the next 26 crops combined.) "This is a relatively recent phenomenon and was not characteristic of the traditional subsitence agricultures abandoned over the past few centuries "[1]

"Man once enjoyed a highly varied diet He has used for food several thousand species of plants and several hundred species of animals With the beginnings of agriculture there was a tendency to concentrate on the species that were more productive and the most rewarding in term of labor and capital invested "[2]

Like other people around the world who must be economical in their food consumption, Indonesians have had to select relatively few foods to supply the bulk of their calories, proteins, and fats Over half of the calories consumed in Indonesia come from rice (51 2 percent), almost half of the protein consumed comes from rice also (45 5 percent) Corn is the next most important supplier of calories and protein providing respectively 10 1 and 14 3 percent of the total

Coconuts in husk provide 34 percent of the fat in the Indonesian diet and coconut oil provides 23 percent Thus the coconut alone provides over half of the fat (57 percent) in the Indonesian diet

Table 1 shows the percentage of calories of calories, proteins and fats contributed by various food categories Both Table 1 and the data above are from the Food Balance Sheet for Indonesia, 1978

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[1] Harlan, Jack R , "The Plants and Animals that Nourish Man," Food and Agriculture, San Francisco, Freeman, 1976, p 57

[2] Ibid

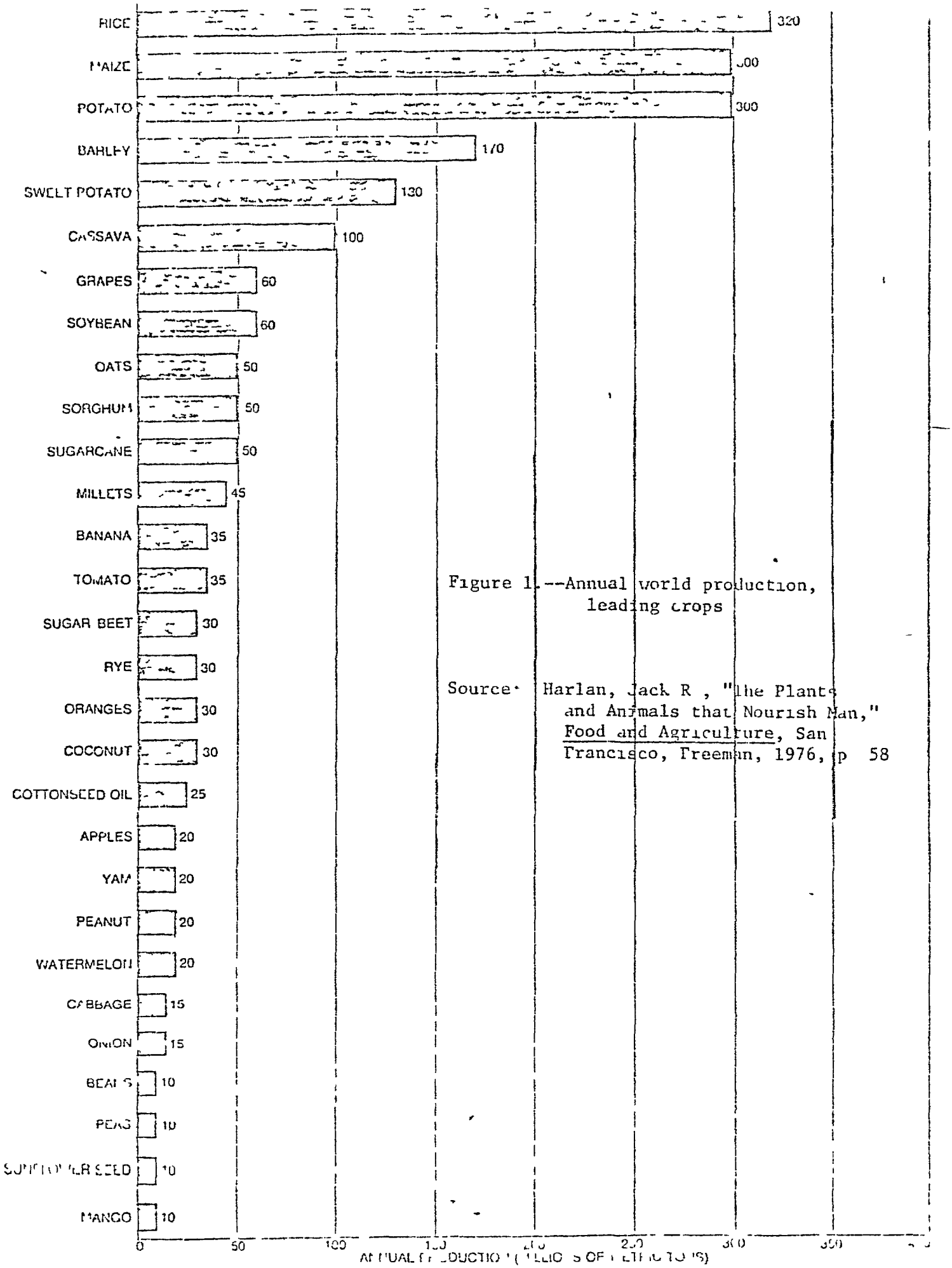

Figure 1.--Annual world production, leading crops

Source: Harlan, Jack R., "The Plants and Animals that Nourish Man," Food and Agriculture, San Francisco, Freeman, 1976, p. 58

Table 1 Precentage of calories, proteins and fats from various sources, Indonesian diet, 1978

Commodity	Calories	Proteins	Fats
Cereals	66	67	18
Starchy roots	10	4	7
Sugar	5	.2	06
Pulses, Nuts, oil seeds	11	17	46
Fruits	1	6	3
Vegetables	4	1	2
Meat	8	2	3
Eggs	2	6	6
Milk	3	8	7
Fish	7	6	1
Oil and fats	5	-	29
Total	100	100	100

Source Food Balance Sheet in Indonesia, 1978, Agricultural Statistics

Calculating the Cost of Calories, Protein, Fat

High levels of efficiency of resource use in food production tend to be reflected in low price per kilocalorie or per gram of protein or fat We can get an idea of the relative efficiency of resource use in producing various plant and animal foods (use of capital, labor, and energy from the sun, for e g) by examining the cost per kilocalorie, per gram of protein and per gram of fat Three examples will get you started on this

Cost per kilo calorie

$$\frac{\text{Price per 100 grams}}{\text{Kilocalories per 100 grams food}} = \text{Cost per kilocalorie}$$

Calculation for Avocado

$$\frac{\text{Price in Rps per 100 grams}}{\text{Kcl per 100 grams}} = \frac{23\ 25}{167} = 0\ 139$$

Cost per gram of protein

$$\frac{\text{Price per 100 grams}}{\text{Grams protein per 100 grams food}} = \text{Cost per gram of protein}$$

Calculation for Avocado

$$\frac{23\ 25}{2\ 1} = 11\ 07$$

Cost per gram of fat

$$\frac{\text{Price per 100 grams}}{\text{Grams fat per 100 grams food}} = \text{Cost per gram of fat}$$

Calculation for Avocado

$$\frac{23\ 25}{16\ 4} = 1\ 417$$

Perform the above 3 calculations for the foods listed in Table 2.

Table 2 - Calculating the cost of one kilocalorie, one gram of protein and one gram of fat, Indonesia, using prices paid by farmers, East Java, November, 1981

Commodity	Price per 100 grams	Kcl per 100 grams	cost per kcl	Grams prot per 100 grams	Cost per gram prot	Grams fat per 100 grams	Cost per gram fat	Percent of Calorie from this source
Staples								
Rice Milled	25 23	366	--	6 4	--	8	--	51 2
Maize, Ground Yellow	13 64	355	--	9 2	--	3 9	--	10 1
Cassava, Sweet, Raw	3 69	138	--	1 0	--	4	--	8 2
Cassava, Sweet	8 43	357	--	1 3	--	5	--	2
Wheat, flour, White	25 12	364	--	10 5	--	1 0	--	1 7
Refined sugar, White	52 63	385	--	0	--	0		3 2
Sweet Potatoes	4 46	114	--	1 7	--	4		1 4
Nut and Legumes								
Coconuts in husk (meat only)	34 93	312	--	3 2	--	28 2	--	7 3
Soy beans	40 18	403	--	34 1	--	17 7	--	2 2
Groundnuts (shelled)	66 53	564	--	26 0	--	47 5	--	1 6
Fruits								
Bananas	23 80	85	--	1 1	--	2	--	6
Avocado	23 25*	167	.139	2 1	11 07	16 4	1 42	04
Oranges	61 21**	40	--	1 3	--	3	--	04
Papayas	87 69	39	--	6	--	1	--	04
Vegetables								
Chilli	56 30	45	--	3 0	--	2	--	2
Potatoes	28 22	76	--	2 1	--	1	--	1
Cabbage	18 80	24	--	1 3	--	2	--	04
Onions	87.28	38	--	1 5	--	1	--	04
Cucumbers	14.28	14	--	6	--	1	--	-
Tomatoes	14 04	22	--	1 1	--	2	--	-
Animal Products								
Marine fish, Large Dried	55 30	87	--	14 7	--	2 7	--	5
Condensed milk	102 27	321	--	8 1	--	8 7	--	3
Cattle meat	210 39	179	--	20 7	--	10 0	--	2
Pig meat (not used)	--	308	--	15 7	--	26 7	--	2
Cow milk	27 01	66	--	3 5	--	3 7	--	04
Hens eggs	1094 00	163	--	12 9	--	11 5	--	08
Duck eggs	1016 00	188	--	13 2	--	13 2	--	08
Oil								
Copra oil	38 70	883	--	0	--	99 9	--	3 9

Table 2 data sources

1 Except as otherwise noted, prices are from " Statistik Harga yang Diterima dan yang Dibayar Petani untuk biaya Produksi Pertanian dan Kebutuhan Rumah Tangga Dan Jawa - Madura dan beberapa Propinsi Luar Jawa, "
Biro Pusat Statistik, Jakarta, Indonesia, Desember, 1981, (in process)

2 *Extrapolated from verage 1978 village price for West Java

3 **Price received by farmers in East Java

4 Nutrition information Composition of foods, Agricultural Handbook No 8, Agricultural Research Service, US Dept of Ag , revised December 1963 and Food Composition Tables for use in East Asia, US Dept of HEW, NIH December, 1972

Percent of calories from this source, (Column 9) calculated from Food Balance Sheet for Indonesia, Central Bureau of Statistics, Agricultural Statistics, Jakarta, 1978 Data is for 1978

Preliminary analysis of the results of your calculations

Scan your table to find the cheapest source of calories, based on the prices given What food provides the cheapest source of calories in Indonesia?

_____

What food provides the cheapest source of protein? _____

The cheapest source of fat? _____.

Another Approach to Nutrition Economics

You have just made some important calculations and observations in the field of nutrition economics Another approach to nutrition economics would be to look at the amount of calories, protein and fat that could be purchased with, say, Rs 100 The formulas for such calculations are given below·

$$\frac{\text{Kilocalories per 100 grams}}{\text{Rs per 100 grams}} \times 100 = \text{Kilocalories per Rs 100}$$

$$\frac{\text{Grams protein per 100 grams}}{\text{Rs per 100 grams}} \times 100 = \text{Grams protein per Rs 100}$$

$$\frac{\text{Grams fat per 100 grams}}{\text{Rs per 100 grams}} \times 100 = \text{Grams fat per Rs 100}$$

Assume that rice costs Rs 11 39 per 100 grams Calculate how many kilocalories, grams of protein and grams of fat you buy if you spend Rs 100 on rice

Commodity	Price per 100 grams	Kcl per 100 grams	Kcl pur by Rs 100	Grams Prot per 100 grams	Grams Prot pur by Rs 100	Grams fat per 100 grams	Grams fat pur by Rs 100
Rice	11 39	363	_____	10.5	_____	1 0	_____

Note that when you spend Rs 100 purchasing rice you not only get 3819 kilocalories but unavoidably you also get 92 grams of protein and 9 grams of fat whether you want the protein and fat or not

On Table 2 find the three cheapest sources of calories Enter the names of these foods on the top of Table 3, listing the cheapest source first Copy the cost per kcl for each of these three foods

Now on Table 2 find the three cheapest sources of protein and enter these foods, together with their price per gram of protein, on Table 3 List the cheapest source first

Now find the three cheapest sources of fat and list them, cheapest source first, with their fat price per grams on Table 3

For comparison purposes, copy the cost per kcl , cost per gram of protein and cost per gram of fat for rice, cabbage and beef to Table 3, at the bottom

For each commodity listed on Table 3, calculate the amount of kilocalories, grams of protein and grams of fat you would purchase by spending Rs 100 on that commodity Use the formulas from on page 7

Indonesians eat a lot of rice If an Indonesian spent Rs 100 on maize instead of rice how many more kilocalories, grams of protein and grams of fat would he buy with that Rs 100?

_____ Kilocalories

_____ Grams of protein

_____ Grams of fat

Indonesians import a lot of rice If they imported Rs 100 worth of wheat instead of Rs 100 worth of rice, how many more kilocalories, grams of protein and grams of fat would they import?

_____ Kilocalories

_____ Grams of protein

_____ Grams of fat

If an Indonesian spent 100 Rs on Maize instead of on beef, how many more kilocalories, grams of protein and grams of fat would he buy?

_____ Kilocalories

_____ Grams of protein

_____ Grams of fat

Table 3 --Calculating the amount purchased by spending Rs 100, Selected Foods, Indonesia, 1978

Category ranked

Commodity	Cost per kcl	Cost per gram prot	Cost per gram fat	Amount purchased by spending Rs 100		
				Kcl	grams prot	grams fat
Cheapest source of calories						
1						
2						
3						
Cheapest sources of protein						
1						
2						
3						
Cheapest sources of fat						
1						
2						
3						
Comparison commodities						
Rice						
Cabbage						
Beef						

The following quotes by Dixon and Sinaga are of interest here

"Most Indonesians do not choose the 'lowest cost diet' which in this example would be heavily corn based Consumers seem willing to pay a heavy premium for their rice based diet "[1]

On the international market, "wheat grain usually sells for less than half the price of medium quality rice and, even with milling costs and conversion factors, should be available at prices competitive with rice in Indonesia Although no wheat is grown in Indonesia and all wheat needs are met by imports, wheat is traded internationally in very large quantities (70 to 80 million tons per year) and Indonesia's imports of about one million metric tons per year are only a small share In comparison, Indonesia's share of the world trade in rice is often 20% to 30% of the total and therefore Indonesian rice purchases can have important influences on the world rice trade and the traded price "[2]

Further calculations

The 1978 food balance sheet for Indonesia gives per capita daily consumptions as follows Kcl 2417, grams protein 48, and grams fat 47 F A O/WHO recommendations adjusted for Indonesians, wastage, and "protein score" suggest a minimum of 2100 calories and 46 grams of protein [3]

Now prepare another table, similar to Table 3, except in this new Table (Table 4), calculate the cost of 2100 kilocalories from each food, the cost of 50 grams of protein from each food, and the cost of 50 grams of fat from each food These amounts of kilocalories, protein and fat are close to the minimum daily requirements for the average Indonesian diet

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[1] Dixon, John A , and Sinaga, Rudolf, "Food Consumption Patterns in Indonesia," Paper presented at the Third Asian Congres of Nutrition, October 6-10, 1980, Jakarta, p 23

[2] Dixon and Sinaga, op cit , p 26

[3] Dixon and Sinaga, op cit , p 4-5.

Table 4 --Calculating the cost of approximate minimum daily requirements of kilocalories, proteins and fat from various foods, Indonesia, 1978

Category ranked

Commodity	Cost per kcl	Cost per gram prot	Cost per gram fat	Cost per 2100 Kcl	Cost per 50 grams prot	Cost per 50 grams fat
Cheapest sources of calories						
1						
2						
3						
Cheapest sources of protein						
1						
2						
3						
Cheapest sources of fat						
1						
2						
3						
Comparison commodities						
Rice						
Cabbage						
Beef						
Wheat flour (if it doesn't show up above)						

Further analysis of the results of your calculations

On the basis of the prices used in the above calculations

Since cassava is the cheapest source of calories should we recommend cassava as the staple food of the poor?

_____Yes _____No Why?_____

Soybeans furnish a cheaper source of protein than maize Would it make sence to suggest to poor people that they eat soybeans instead of maize?

_____Yes _____No Explain_____

_____

If you spent only enough on maize to supply your protein for one day would you have, at the same time, bought enough calories for the day? _____

If you spent only enough on maize to supply your calories for a day would you have bought enough protein for the day? _____

What two foods would provide the least-cost combination of calories, protein, and fat in the Indonesian diet?

_____ and _____

Why didn't you list cassava? _____

Why didn't you list soybeans? _____

Why not list maize alone? _____

What would be the daily cost of a diet of maize and copra oil (only approximately)? _____ Rice and oil? _____

On the basis of what you have learned in this exercise what would you say about the rationality of the Indonesians regarding food consumption? (More than one response may be appropriate.)

_____ Completely rational

_____ Completely irrational

_____ Reasonable rational

_____ Certainly more rational than the Americans!