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INCOME AND FOOD CONSUMPTION:
REPORT TO THE GOVERNMENT OF SRI LANKA

By

Thomas T. Poleman

October 1973 No. 73-19

Department of Agricultural Economics
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
Cornell University, Ithaca, New York 14850

NEW YORK STATE COLLEGE OF AGRICULTURE AND LIFE SCIENCES
A STATUTORY COLLEGE OF THE STATE UNIVERSITY
CORNELL UNIVERSITY
ITHACA, NEW YORK 14850

DEPARTMENT OF
AGRICULTURAL ECONOMICS
WARREN HALL

3 October 1973

In The Call Girls Arthur Koestler made merry with those academics who exist on the fringe of the jet set while spanning the oceans between conference and conference. Similar sport could be had with that other element of peripatetic scholarship: those professors supplementing meager incomes between terms by rushing off to tropical climes and dispensing instant wisdom to unsuspecting natives. Funded by many--AID, FAO, the World Bank, the Foundations; the marks are almost endless--their characteristics are few: a permanent jet lag--when it's midnight in Ithaca, where worthwhile is it also so?--an upset stomach, and upon awakening that feeling of helpless uncertainty as to just where one is. Also identifiable is their wake: a worn-out and puzzled officialdom . . . and a Report. The point of it all, the latter arrives long after the perpetrator has flown. Briefly glanced at before being filed, it brings forth bemused memories but little else. Out of sight, out of mind. Lost forever.

Thus, even with the grace of God, went I. Sri Lanka it is now, but way back in 1971 it was still Ceylon, and I was determined to be the Consultant With A Difference. The terrain looked promising. Someone had been needed to insure that considerations of food and nutrition policy were duly considered in the drafting of the newest Five-Year Plan, but somehow the Plan got written before the someone arrived. And I was not without experience. One does not bat around the boondocks for a quarter century only to become the house Associate Professor in an inbred department without having acquired a certain flair for rejecting those facets of hoary tradition which warrant rejection.

It is for the Ceylonese to weigh the results. Certainly the internal problems were contained; a diet of Nuwara Eliya Stout and prime Australian filets saw to that. And where would one awake to the sounds of pounding surf and the bare-footed sloshing of tea-bearing servants across that which should not have come through the roof but did, than the Galle Face Hotel?1/

1/ Or do one's morning constitutional than along Galle Face Walk, "commenced," says the stone, "by Sir Henry Ward, 1856, completed 1859 and commended to his successors in the interest of the ladies and children of Colombo." Alas his more recent successors have ignored Sir Henry's call. The thing is crumbling, being pounded to pieces by that pounding surf. But not to worry. A PWD truck will soon appear, sand will be poured, and there it will remain until the next tide. If God did not love Sri Lanka, would he have put Paradise there?

Equally auspicious was the timing. No fly-by-night I: three months would be devoted to the task, divided equally into two periods six months apart. This division held the key to my plan. Since one always remembers best what one does himself, all I would have to do in order to have Great Impact would be to see what needed doing, con the locals into doing it while I was away, return and write up the results. But no Report for this kid. Whatever we discovered would be jointly written up and jointly published in a local journal, there to be read by all. Clever.

So I saw, returned, and wrote. But I did not con. One does not con in Ceylon. Either my friends did what I suggested because that was the way gentle people treat a guest, or because it seemed the reasonable thing to do. But do it they did and publish we did, and I am proud to have been associated with them.

But Report I did also and here it is just as it arrived on my desk yesterday. The ideas were mine, the figures are mine, but I do not claim all the interpretations and spellings. You decide which. Certainly I know how to spell my friends' names. Forget before filing.

Thomas T. Poleman

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REPORT

to the

GOVERNMENT OF SRI LANKA

on

INCOME AND FOOD CONSUMPTION

based on the work of

T. Poleman
Food and Nutrition Policy Consultant

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 1973

FAO. Report to the Government of Sri Lanka on Income and Food Consumption, based on the work of T. Poleman. Rome, 1973. 21 p. United Nations Development Programme [Report] No. TA 3198.

ABSTRACT

Two activities were initiated by the FAO consultant in food and nutrition policy that would facilitate taking nutritional considerations into account in planning food and nutrition policies. The first - to determine the extent to which the marginally adequate average picture suggested by the food balance sheet breaks down over the income spectrum and by economic sector - involved nutritional evaluation of the data collected from the national socio-economic survey conducted in 1969/70. The highest levels of food and nutrient intake were observed among households in the estate sector, followed by those in the rural areas, and the worst off were households in the urban areas. Data indicate the existence of pockets of malnutrition among the below R 200-599 per month income groups of the urban sector and among the lowest income group of the rural sector. Malnutrition may be more widespread in these two sectors. However, approximately 5 percent of the households in the estate sector may be overnourished. Since the below R 200 group comprises 43 percent of the population, it is recommended that data for this class be further refined for income and occupational groups. The Medical Research Institute should reorient its programme of food consumption surveys to focus on the question of food distribution within the household.

As unemployment and under-employment are considered the most important problems confronting the country, the second activity was to organize a pilot research project to investigate the employment generation potential of those types of agricultural diversification that can help locally to meet the food needs of the population. Associated in the project were the Medical Research Institute, the Department of Agriculture and the Faculties of Medicine and Agriculture of the University of Sri Lanka. The project was concerned with zero-grazing dairying. Preliminary results indicate the feasibility of carrying out such studies which would provide useful information to tackle the unemployment problem. It is therefore recommended that this type of research be continued - priority subjects would be land use in the Mahaweli Ganga Scheme and in the youth resettlement farms - and that the Government seek foreign assistance in conducting the studies.

FAO is greatly indebted to the many people who collaborated with the consultant during his assignments and who offered him their helpful advice and assistance, and especially to:

Mr. Godfrey Gunatillere	Additional Permanent Secretary Ministry of Planning
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Dr. E.S.G. Hettiaratchi	Senior Lecturer Department of Physiology Faculty of Medicine
Prof. R.R. Appadurai	Professor and Head Department of Animal Science Faculty of Agriculture
Dr. C.C. Mahendra	Chief Nutrition Department Medical Research Institute
Mr. S. Selvaratnam	Adviser Ministry of Planning and Employment
Miss F.R.A. Abeyawardene	Department of Agriculture
Mr. L. Fonseka	Head, Livestock and Farm Animals Department of Agriculture
Mr. I. Le Mercier	Sri Lanka Institute for Scientific and Industrial Research
Dr. G. Gunasekera	Ministry of Planning and Employment

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1. INTRODUCTION

In accordance with the request from the Government of Sri Lanka for assistance in considering nutritional aspects in the preparation and implementation of the five-year plan, the Food and Agriculture Organization through the United Nations Development Programme appointed Professor Thomas T. Poleman as consultant (food and nutrition policy). Professor Poleman divided his assignment into two phases so as to allow his local counterparts to carry out his suggestions immediately.

The consultant's initial terms of reference were broad, allowing him to identify and follow through on the more appropriate avenues of activity:

1. to review the food and nutrition situation in Sri Lanka in relation to the national plan;

2. to indicate the policies and programmes required to meet the food and nutrition needs of the people and to recommend the appropriate mechanisms for well coordinated implementation of food policies and programmes;

3. to recommend a plan of action for identifying the food and nutritional needs of the pre-school child, taking into account the national as well as international resources, including UNICEF and WFP, likely to be made available for this purpose.

The consultant arrived in Sri Lanka in early December 1971 and completed the first phase of his assignment by the end of January 1972. The second phase of his work took place from mid-June to mid-July 1972. He was attached to the Ministry of Planning and Employment, but in addition worked in close cooperation with the Department of Census and Statistics, the Medical Research Institute, the Department of Agriculture, and the Faculties of Agriculture and Medicine of the University of Sri Lanka. His other main contacts were CARE, the new MARGA Institute and the Sri Lanka Institute for Scientific and Industrial Research.

As the consultant did not arrive in Sri Lanka until after the five-year plan 1/ had been prepared, his efforts naturally focused on questions of implementation. Two avenues of inquiry were identified and agreed on as his principal areas of concern. One related to refining an understanding of the nutritional situation on the island; the other to linking nutrition considerations to alternative solutions for the island's pressing unemployment problem.

1/ Ministry of Planning and Employment. The Five-Year Plan, 1972-76. Government of Sri Lanka.

2. THE EFFECT OF INCOME ON NUTRITIONAL LEVELS

In making his review of the present food and nutrition situation, the consultant found a source of new evidence and concentrated his efforts towards assisting investigators in the Department of Census and Statistics and in the Nutrition Department of the Medical Research Institute in order to analyse it. For some time it has been evident that, on average, the food situation in Sri Lanka is marginally adequate. The food balance sheets prepared by the Department of Census and Statistics and others 1/ have long pointed to average availabilities of the order of 2 100-2 300 calories per person per day and of 40-50 grammes of protein. What has not been clear is the extent to which the picture breaks down by geographic areas, social groups, urban/rural areas and from one income class to another and within the feeding unit (family) itself. Primary attention was given to the last factor since income is the most important determinant of food consumption.

Previously, the chief evidence on the effect of income on food consumption was the 1953 and 1963 Surveys of Consumer Finances carried out by the Central Bank. Adequate up to a point, these surveys contained only expenditure data on foodstuffs. It is sometimes possible to infer quantities from expenditure data. With these surveys, however, the extrapolations were difficult.

From October 1969 to October 1970, the Department of Census and Statistics carried out an island-wide socio-economic survey among 9 700 households, so sampled as to be indicative of the full income range (Appendix 1). Among the data collected for each household were seven-day recall information on expenditures for, and quantities purchased of, no fewer than 111 food items.

At the time of the consultant's first visit, the results of this survey were just becoming available. He undertook therefore to assist in its nutritional evaluation.

The first step was to draw up a table of nutrient conversion factors appropriate to Sri Lanka. This table was prepared by the Medical Research Institute from food composition data from India 2/ and analyses of local foods, and the results are given as Appendix 2. Pending the availability of data on the analysis of most foods in Sri Lanka, it is recommended that these be employed by all government departments. However, caution should be observed in applying the figures for coconut which is an important item in the Sri Lankan diet. The figures for coconuts are based on an average kernel weight of 12 ounces. While this may not be an unreasonable figure and reflects the best thinking at the Medical Research Institute, the average size of coconuts can vary from year to year and different income groups may buy coconuts of different sizes. If, in fact, the several income classes purchase nuts of different sizes, the figures that follow could be off the mark by plus or minus 100 calories per person per day.

The conversion factors were applied to the survey data by the Department of Census and Statistics during the months, February to May 1970, between the consultant's visits. The results were analysed upon his return.

1/ FAO. Food Balance Sheets 1964-66 Average, Rome, 1971

2/ Aykroyd, W.R. The Nutritive Value of Indian Foods and the Planning of Satisfactory Diets. Sixth revised edition by C. Capalan and S.C. Balasubramanian.

Charts 1 to 4 summarize the main findings. A summary of *per caput* daily availabilities on an all-island, urban, rural and estate sector basis is presented in Appendix 3. On examining them it is important to bear in mind the distribution of incomes among the population. The survey reported that 43 percent of the households in Sri Lanka have incomes 1/ of less than R 200, 37 percent between R 200 and R 400, 12 percent between R 400 and R 600, 4 percent between R 600 and R 800, and 2 percent each for the classes of between R 800 and R 1 000 and over R 1 000. On applying several checks to the survey, it was found satisfactory both for internal and external consistency.

2.1 FOOD IN THE HOUSEHOLD BUDGET

Chart 1 shows the place of food in the Sri Lankan household budget. It is noteworthy in several respects. First of all, it brings out the overwhelming importance of food as an item of expenditure. Among households in the under R 200 class, fully two thirds of expenditures are for food and drink; if liquor is added, the percentage rises to 71 percent. The average figures for all households are similarly high: 55 to 61 percent, respectively.

This importance of food persists throughout the income spectrum. As income increases, it is to be expected that the relative magnitude of food expenditures will decline; a certain level of sufficiency in food consumption is reached beyond which, out of every further increase, a higher percentage is devoted to other goods and services. What is striking is the limited extent to which this familiar Engelian relationship operates. Not until the R 600 - 800 class is reached do food expenditures fall below 50 percent; that is, among only 8 percent of households.

Two factors help explain this pattern. One is that household income in Sri Lanka is to an appreciable extent a function of size. As Chart 1 shows, the under R 200 class averages five persons, whereas the figure rises to over seven in the R 400 - 600 class: more people, more income producers. This relationship, of course, does not carry through the full income range. The large size of upper income households clearly reflects the presence of servants.

The other explanation of the comparatively modest drop-off in the importance of food with rising income is that absolute *per caput* outlays for food are greater among the wealthier. Again, the all-island relationship is shown in Chart 1. In the lowest income class *per caput* monthly food expenditures average R 30, but increase steeply over the next two classes, to level out at about R 55 among the wealthy.

This suggests substantial changes (and improvements) in feeding habits take place as income rises.

2.2 THE EFFECT OF INCOME ON DIET

Chart 2 shows the apparent intake of calories. There is a progressive increase in intake as income rises, with the lowest income group having an average of 2 060 calories *per caput* per day, and the highest 2 640 calories. There are slight differences in the proportion of the different food groups in the diets of the various income classes but the main difference lies in the quantity; for example, among the

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1/ Rupees 6.36 = US$ 1, as at 1 March 1973.

lowest income group, consumption of most of the food groups, particularly cereals, oils and sugar is the lowest, which accounts for the smallest quantity of food consumed or the lowest calorie intake level. On the other hand, the highest income groups consume the most quantity of food, particularly cereals, oils, fruits and vegetables and all other food items. The consumption of the intermediate income groups progressively increases between these two extremes, while the variation in the proportion of foods included in the diet is negligible. Even the wealthiest continue to eat rationed rice, so that the basic nature of their meals is essentially the same as that of the less well to do.

Chart 3, which shows in detail the calorie contributions of the various food groups, further emphasizes the above findings. The consumption of milk and milk products rises with income, as does that of meat and fish, fruits and vegetables. Because these protective foods are modest in calorie content but (apart from fruits and vegetables) high in protein, the importance of these changes is better illustrated in Chart 4. This chart shows the contribution of the principal food groups to total protein availabilities. Consumption of milk and milk products rises particularly steeply. It should be noted, however, that the bulk of these improvements occurs after the R 400 threshold is crossed, that is, among only 20 percent of the population.

Chart 5 shows the daily consumption of animal and vegetable protein. The proportion of vegetable protein is as high as 85 percent among the lowest income groups, and this is progressively reduced to 81, 78, 77, 73 percent until it reaches only 69 percent for the highest income group. This reflects the improvement of the diets both qualitatively and quantitatively with an increase in income.

2.3 NUTRITIONAL IMPLICATIONS

Only a rough assessment of the evidence provided by the socio-economic survey is possible from the nutritional point of view. The Nutrition Department of the Medical Research Institute has estimated the national per caput requirement for Sri Lanka to be 2 100 calories and 45 grammes total protein (based on one gramme of protein per kilogramme of body weight). They are intended as rough guides and intentionally include a safety factor. In the absence of evidence on activity patterns, the principal determinant of calorie needs, they are probably as reasonable as presently can be set forth.

By these yardsticks 1/ at the national level, the observed intakes exceed energy requirement by some 165 calories and protein requirement by about 9 grammes per caput per day. These seem to present a favourable picture, but the margins may not be sufficiently large to allow for distribution and ensure the absence of pockets of under-nutrition and malnutrition in the country. As will be seen later, these levels do indicate the existence of these problems.

The most interesting finding is the progressive improvement of the energy and protein intakes when compared with allowances with an increase in per caput income of all the population groups studied, whether urban, rural or estate.

1/ Again it should be mentioned that the assessment is rough since energy and protein requirements should have been estimated for every group (such as urban, below R 200; rural, R 200-399; estate, R 400-599, etc.) and intake for each group compared with the respective estimated requirement, rather than utilizing the estimated national requirement figures for the comparisons.

2.3.1 Urban Sector

The highest intakes were observed among the population of the estate sector. In this group, the average energy intakes for all the income groups exceeded the estimated allowance. The average intake of the lowest income group (under R 200) exceeded requirement by 155 calories per caput per day and there was a progressive increase, reaching an average of about 1 000 calories at the R 600-799 group and further increasing to 1 700 calories for the R 1 000 and over group. The estate sector comprises 11 percent of the total households and, since observed intakes exceeded the estimated requirement by as much as 380 calories per caput per day even among the R 400-599 group, it would seem that there is over-consumption among 5 percent of the households in this sector.

Protein intakes also showed a picture of adequacy ranging from 54 grammes for under R 200 to 114.9 grammes per caput per day among the highest income groups, R 1 000 and over. However, the observed intake levels up to R 400-599 (54-60 grammes) may be insufficient to allow for inequalities of distribution.

2.3.2 Rural Areas

Next to the estate sector are the population groups in the rural areas. The average intake among the lowest income groups (below R 200) exceeded estimated requirements but, due to inequalities of food distribution, some under-nutrition among this group is indicated. Again, there was a progressive increase in the energy intakes, exceeding the requirement by about 500 calories and about 800 calories per caput per day for the groups R 600-699 and R 1 000 and over, respectively. Protein intakes were also observed to be adequate in all the income groups, although the levels may not be high enough to take care of distribution problems and the level reached for the highest income group was just about half that of those living in the estates.

2.3.3 Urban Groups

Food and nutrient intakes were lowest in the urban areas. Among the lowest income group, average calorie intakes were only 1 900 as compared with the estimated requirement of 2 100, a shortage of 200 calories per caput per day. This situation indicates considerable under-nutrition among these low income groups in the urban areas. Intakes continue to be below requirements (by 33 calories) in the next income group (R 200-399) and under-nourishment may exist even among the next group (R 400-599), where intakes exceed allowance by about 100 calories per caput per day. The average intake of the urban areas exceeded requirements by only 61 calories per caput per day as compared to 325 and 155 for the estate and rural sectors, respectively. Protein intakes were also the lowest in the urban areas. Intakes among the lowest income groups were below estimated requirements, and the level for all the income groups may not be sufficiently high to allow for inequitable distribution. The average protein intake level for the urban and rural population is about 52 grammes as compared with the 62 grammes of the estate sector.

2.4 RECOMMENDATIONS FOR FURTHER WORK

The foregoing assessment indicates under-nourishment among the three lowest income groups of the urban sector, and among the below R 200 group and possibly the R 200-399 group of the rural sector. Protein intakes are also low among these groups. These findings give an indication of the population groups who would deserve priority of attention for nutrition intervention programmes such as feeding or food distribution programmes.

As 43 percent of the population fall within the less than R 200 group, however, it is recommended that further analysis be undertaken. The Department of Census and Statistics can break down more finely its data for the under R 200 income class. This would be comparatively easy to do. In the Estate Sector, income could be taken as the distinction, with breakdowns of R 100, R 125, R 150 and R 175 recommended. In the Urban and Rural Sectors, occupation might be a more meaningful categorization.

The second line of research relates to the Nutrition Department of the Medical Research Institute. Studies should be initiated to determine the calorie requirements of occupational groups in the low income classes so that calorie needs can be set with greater confidence. And work is urgently needed on the determination of the distribution of food within the household.

For the marginally adequate picture conveyed by either the food balance sheet or the survey to be valid, it must be assumed that food is divided proportionately among all members of the household. Apparent adequacy of animal protein would be pure illusion if the bulk of the meat and fish is eaten by the father. The pre-school child is presumed to be the most nutritionally vulnerable person in the country. The survey tells us nothing about what he eats.

Hitherto the three nutritional surveys the Medical Research Institute carries out each year have measured only household food consumption. It is recommended that in the future the number of surveys be greatly expanded and that they focus on the question of distribution of food stuffs within the family.

3. LINKING EMPLOYMENT TO AGRICULTURAL DEVELOPMENT

LABOUR UTILIZATION IN AGRICULTURE

The five-year plan linking employment to agricultural development rightly sees employment as the country's most urgent problem. Sri Lanka has today probably the highest rate of overt and disguised unemployment of any developing country. The problem is particularly acute among the young, many of them highly educated. It would not be an over-simplification to say that if all the unemployed were given adequate work, most food problems would take care of themselves.

The plan calls for the creation of 800 000 new jobs during the five years, 300 000 of them to be in agriculture. How this is to be done was not spelled out. Nor can it be. It is just not known what effect changes in the input/investment will have on employment - what the labour use elasticities are of alternative agricultural investment strategies.

The reason for this situation is simple. Research in the field of farm management has traditionally aimed not at maximizing the factors of production but the returns to them. To have done otherwise would have been irrelevant until very recently. Only within the past few years has the importance been recognized of imposing full-employment constraints on the formulation of agricultural planning models.

Yet another reason for ignorance has been the difficulty of quantifying the inputs of labour that go into farming. Traditionally this has involved use of the time-motion technique, a technique quite appropriate to industry but not to agriculture. In effect, the investigator has to spend virtually all his time with one subject throughout the agricultural cycle - a very expensive sample is to be surveyed. The result is that very little is known about how even the paddy farmer divides his day.

All this is now a thing of the past. Thanks to recent technological breakthroughs, it is now considered possible to measure human energy expenditure without directly following the subject.

The methodology builds on indirect calorimetry, the fact that heart rate and oxygen consumption are linearly related for each individual over most of his activity range, and small heart rate monitoring devices - known as SAMI's (Socially Acceptable Monitory Instruments) - that can be carried in the subject's pocket. So that Sri Lankan investigators could have an opportunity to work with this equipment and to begin building up a pool of data indicating the employment generation potential associated with those types of agricultural diversification that could help locally to meet the nutritional needs of the population, the consultant brought together a group of senior scientists and arranged to have equipment made available to them for a short-term trial project. This took place during the consultant's second visit.

The protocol for this experiment is given as Appendix 4. The study focused on zero-grazing dairying in the mid-country. Here substantial areas of either bush or low-yielding rubber or tea are available for planting to perennial grasses. Work by the University and the Agriculture Department indicates the grass Pusa Giant Napier highly suitable for this environment and, if properly fertilized, capable of being a "balanced" feed for dairy animals.

Involved in the study were the Nutrition Department of the Medical Research Institute, the Agriculture Department, the Faculties of Agriculture and Medicine of the University, and the Ministry of Planning and Employment. In addition to determining labour utilization (the Agriculture Department and University Agriculture Faculty), the Medical Research Institute Nutrition Department and the Agricultural Extension Service carried out a nutritional survey, and the University Medical Faculty did work on energy expenditure.

The nutrition survey focused on the individual and gave valuable experience to the Medical Research Institute team in working with alternative means of sampling the individual. And as the unit of energy expenditure was measured by the Medical Faculty, valuable insights were also obtained on the question of determining accurate food requirement data for the country.

The full results of the project will not be available for several months. The four different research teams worked in harmony, each complementing the other. Preliminary assessment suggests that the system of zero-grazing dairying is second only to tea in its use of labour per acre. For a 50-acre unit under Pusa Giant Napier, it would appear that 20 men can find employment, in association with 50 milkers and an equal number of follower stock.

2 RECOMMENDATIONS

It is recommended that continuance of this cooperative effort be encouraged and focus in subsequent projects on other logical diversification alternatives. The list is endless, but land use in the Manaweli Ganga irrigation zone and in the youth resettlement projects are obvious priority items. It is recommended that the Government continue the studies and, if necessary, request international assistance for this purpose.

Appendix 1

SOCIO-ECONOMIC SURVEY 1969/70 - SAMPLED AND ESTIMATED HOUSEHOLDS BY SECTOR AND INCOME CLASS

		All Island	Urban Sector	Rural Sector	Estate Sector
Under R 200	S 1/	3 694	845	1 615	1 234
	E 2/	892 270	72 085	668 453	151 732
R 200–400	S	3 653	1 597	1 391	665
	E	789 658	136 055	570 789	82 814
R 400–600	S	1 242	722	441	79
	E	251 132	61 570	179 295	9 766
R 600–800	S	487	336	136	15
	E	86 913	28 860	56 088	1 965
R 800–1 000	S	248	205	40	3
	E	34 358	17 495	16 536	327
Above R 1 000	S	370	332	34	4
	E	42 407	27 850	14 022	535
All classes	S	9 694	4 037	3 657	2 000
	E	2 096 737	343 915	1 505 683	247 139

1/ Sampled.

2/ Estimate totals.

Appendix 2

NUTRIENT CONVERSION FACTORS FOR SRI LANKA

	Edible portion (percent)	Calories	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Vit.A (i.u.)	Vit.B (mg)
		(per 100 g edible portion)						
1. CEREALS								
Rationed rice	100	345	6.8	0.5	10	3.1	0	0.06
Unrationed rice	100	349	6.5	0.4	9	4.0	0	0.09
Wheat flour	100	348	11.0	0.9	23	2.5	43	0.07
Bread	100	245	7.8	0.7	11	1.1	-	-
Kurakken	100	328	7.3	1.3	344	17.4	70	0.10
Maize dry	100	342	11.1	3.6	10	2.0	1 500	0.10
2. NUTS								
Coconut	100	444	4.5	41.6	10	1.7	0	0.10
Ground nut	70	349	26.7	40.1	50	1.6	63	0.30
Gingelly seeds	100	563	18.3	43.3	1 450	10.5	100	0.11
3. OILS AND FATS								
Cocunut oil	100	900	-	100	-	-	-	-
Gingelly oil	100	900	-	100	-	-	-	-
Butter	100	720	-	81.0	18	-	3 200	-
Margarine	100	770	-	85.4	3	0.3	1 998	-
4. SUGARS								
White sugar	100	398	-	-	12	-	-	-
Jaggery	100	340	0.4	0.2	80	-	-	-
5. YAMS								
Potatoes	95	97	1.6	0.1	10	0.7	40	0.01
Sweet potato	85	120	1.2	0.3	20	0.8	10	0.04
Manioc	85	157	0.7	0.2	50	0.9	-	0.10
Yam ordinary	85	111	1.4	0.1	60	-	130	-
6. VEGETABLES, LEAFY								
Kankun	70	31	2.8	-	109	3.6	3 824	0.05
Mukunuwonna	70	84	5.6	-	200	16.0	3 060	0.08
Getukola	70	49	3.8	-	210	9.4	2 760	0.05
Sarana	70	21	1.4	-	52	0.9	2 480	0.05
Thampala	70	20	3.8	-	200	3.5	9 200	0.03
Nivithi	70	21	1.7	-	108	2.4	9 300	0.07
Kehila leaves	70	21	1.8	-	200	2.4	1 780	0.03
7. VEGETABLES SEASONAL								
Jak tender	80	51	2.6	0.3	30	1.7	0	0.11
Jak seeds	80	133	6.6	0.4	50	1.5	17	0.11
Bread fruit	70	95	1.4	0.4	32	1.1	9	-
Drumstick	83	26	2.5	0.1	30	5.3	184	0.07
8. UPCOUNTRY VEGETABLES								
Tomatoes	100	20	0.9	0.2	48	0.4	585	0.06
Cabbage	88	27	1.8	0.1	39	0.8	2 000	0.03
Carrots	95	48	0.9	0.2	80	2.2	3 150	0.02
Beetroot	85	43	1.7	0.1	200	1.0	-	0.09
Radish	99	17	0.7	0.1	50	0.4	5	0.02
Beans	90	35	2.1	-	63	1.4	151	0.11
Leeks	50	77	1.8	0.1	50	2.3	30	-
9. VEGETABLE FRUIT								
Ash-plaintain	58	64	1.4	0.2	10	0.6	50	0.02
Brinjals	91	24	1.4	0.3	18	0.9	124	0.11
Bandakkas	84	35	1.9	0.2	10	1.5	88	0.10
Cucumber	83	13	0.4	0.1	10	0.8	-	0.01
Ash pumpkin	67	10	0.4	0.1	10	0.7	-	0.01
Snake gourd	98	18	0.5	0.3	50	1.6	-	0.06
Wattakeh	82	17	0.5	0.3	50	1.6	-	0.06
Bitter gourd	97	25	1.6	0.2	20	1.8	210	0.06
Red pumpkin	79	25	1.6	0.2	20	0.7	210	0.09
Kohila yams	96	25	1.4	0.1	20	0.7	84	0.04

	Edible portion (percent)	Calories	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Vit.A (i.u.)	Vit.B (mg)
		(per 100 g edible portion)						
10. FRUITS	74							
Plaintains	74	104	1.1	0.1	10	0.5	124	0.17
Papaws	75	32	0.6	0.1	17	-	1 110	0.25
Pineapple	60	46	0.4	0.1	23	1.2	30	0.12
Oranges	66	53	0.9	0.3	50	0.1	326	0.06
Mangoes	85	51	0.6	0.1	10	0.3	4 800	0.05
11. PULSES								
Dhali	100	343	25.1	0.7	69	4.8	450	0.49
Green gram	100	348	24.5	1.2	75	8.5	83	0.15
Cow pea	100	327	24.6	0.7	79	11.0	60	0.48
12. MEATS								
Beef	77	114	22.6	2.6	10	0.8	18	1.47
Mutton	74	118	21.4	3.6	150	2.5	31	1.70
Pork	82	371	14.0	35.0	30	2.2	-	0.09
Poultry	67	109	25.9	0.6	25	2.1	-	1.46
13. FISH								
Large fresh fish	65	155	19.1	7.8	357	4.4	26	0.5
Small fresh fish	60	106	20.7	2.2	357	6.3	26	0.3
Sprats ried	73	245	50.7	4	1 095	2.8	270	0.1
Dried fish	73	245	50.7	4	179	2.1	49	0.2
Preserved fish	100	204	42.2	3.0	179	2.1	49	0.2
Canned fish	100	172	21.0	9.8	67	1.0	98	0.5
14. MILK AND MILK PRODUCTS								
Fresh milk	100	67	3.2	4.1	120	0.2	174	0.2
Milk powder	100	496	25.8	26.7	950	0.6	1 400	0.8
Milk foods	100	496	25.8	26.7	950	0.6	1 400	0.8
Condensed Sweetened milk	100	317	7.3	8.4	273	-	430	0.4
Eggs (1)	88	173	13.3	13.3	60	2.1	1 200	0.2
15. BEVERAGES								
Tea		38	9.8	-	32	-	-	1.0
Coffee		46	4.5	-	56	-	-	1.0
Mineral water (aerated)		nk	-	-	-	-	-	-
16. LIQUOR								
Toddy coconut sweet		59	0.2	-	10	1.3	-	-
" " fermented		30	0.1	0.3	8	1.1	-	-
Arfaek "		210	-	-	-	-	-	-
17. Betel Leaves		44	3.1	0.8	230	7.0	9 600	0.03
Aredamut		248	4.9	4.4	50	1.5	5	-
(Chew of betel (1 leaf and piece of arecanut)	(leaf) nut	25	0.6	0.4	18	0.5	586	-
18. CONDIMENTS								
Dried chillies	100	246	15.9	6.2	160	2.3	576	0.43
Green chillies	90	29	2.9	0.6	30	1.2	292	0.39
Red onions	100	59	1.8	0.1	40	1.2	25	0.02
Bombay onions	100	49	1.2	-	180	0.7	-	0.01
Pepper dry	95	304	11.5	6.8	460	16.5	1 800	0.14
Garlic dry	85	145	6.3	0.1	30	1.3	0	0.23
Cummin seed	100	356	18.7	15.0	1 080	31.0	870	0.36
Mustard	100	541	22.0	39.7	490	17.9	270	-
Mathe seed	100	333	26.2	5.8	160	14.1	160	0.29
Coriander	100	288	14.1	16.1	630	17.9	1 570	0.35
Idmes	77	59	1.5	1.0	90	0.3	-	-
Tamarind	100	285	3.1	0.1	170	10.9	100	0.07
Maldive fish	100	204	42.2	3.9	179	2.1	49	0.2

Appendix 1

SOCIO-ECONOMIC SURVEY 1969/70 - APPARENT PER CAPUT DAILY NUTRIENT INTAKES, BY INCOME GROUPS

Income groups 1/		Cereals		Roots & tubers		Sugar		Oils & oil bearing nuts		Pulses		Fruits & vegetables		Meat & fish		Milk & milk prod.		Liquor & beverages		Betel & arecanut		Condiments		Total	
		Calories (No.)	Protein (g)	Calories (No.)	Protein (g)	Calories (No.)	Protein (g)	Calories (No.)	Protein (g)	Calories (No.)	Protein (g)	Calories (No.)	Protein (g)	Calories (No.)	Protein (g)	Calories (No.)	Protein (g)	Calories (No.)	Protein (g)	Calories (No.)	Protein (g)	Calories (No.)	Protein (g)	Calories (No.)	Protein (g)
Below 200	U	1 030	23.2	14	0.1	181	-	442	3.4	38	2.9	24	0.9	45	8.1	23	1.2	9	0.3	36	-	59	3.2	1 902	43.3
	R	1 055	23.5	45	0.3	165	0.1	462	3.9	44	3.6	26	0.8	33	6.2	14	0.7	11	0.4	90	2.1	53	2.9	2 099	46.5
	E	1 212	26.8	16	-	149	-	480	3.4	84	6.0	25	1.0	37	6.8	36	1.9	20	0.6	130	3.0	68	3.4	2 255	54.2
	T	1 118	24.5	37	0.1	166	0.1	463	3.7	50	3.7	24	0.8	34	6.4	18	0.9	15	0.4	92	2.1	52	4.7	2 064	47.4
200-399	U	1 110	24.9	14	0.1	210	-	467	3.6	43	3.1	31	1.0	50	8.6	40	2.3	13	0.3	29	.6	61	3.5	2 067	47.7
	R	1 264	17.4	31	0.2	208	0.1	508	4.0	50	3.7	33	1.1	50	8.8	30	1.5	14	0.4	79	1.9	59	3.3	2 326	52.5
	E	1 349	31.8	14	0.1	559	-	248	3.1	66	6.2	24	0.9	37	6.7	44	5.4	20	0.5	110	2.5	67	3.4	2 411	62.3
	T	1 238	27.2	26	0.2	203	0.1	494	3.9	52	3.8	30	0.9	48	8.6	33	1.6	14	0.4	74	1.7	59	3.6	2 272	54.0
400-599	U	1 150	25.9	15	0.1	234	0.1	518	3.9	49	3.6	41	0.3	62	9.5	59	2.9	12	0.3	21	0.5	69	3.8	2 230	51.9
	R	1 339	29.0	25	0.2	243	0.1	505	3.9	54	4.0	43	1.3	62	9.8	46	2.4	20	0.4	67	1.5	63	3.4	2 467	56.0
	E	1 325	30.3	19	0.2	197	0.1	478	3.0	89	6.4	35	1.6	43	7.5	47	2.8	14	0.5	80	1.8	68	3.5	2 479	59.9
	T	1 288	28.2	23	0.2	239	0.1	540	4.2	55	4.0	41	1.3	61	9.8	51	2.5	18	0.4	56	1.3	65	6.6	2 437	58.6
600-799	U	1 194	26.8	15	0.1	242	0.1	552	4.1	45	3.3	49	1.7	64	10.6	75	3.7	15	0.3	18	0.4	71	3.8	2 340	54.8
	R	1 349	29.5	21	0.2	258	0.1	585	4.8	58	4.2	48	1.4	62	10.1	69	3.7	20	0.4	66	1.3	63	3.3	2 598	59.0
	E	1 420	32.3	21	0.2	250	0.2	729	5.0	112	8.1	54	1.9	66	11.1	97	5.0	21	0.8	87	2.0	97	5.0	3 077	75.6
	T	1 300	28.6	18	0.2	252	0.1	577	4.5	55	3.9	47	1.4	62	10.4	71	3.7	18	0.4	46	1.6	65	6.6	2 512	60.8
800-999	U	1 208	26.9	16	0.2	251	0.1	586	4.5	51	3.7	58	1.8	72	11.4	107	5.5	14	0.3	13	0.3	75	4.4	2 451	59.1
	R	1 296	28.4	23	0.2	255	0.3	593	4.6	64	4.6	63	1.8	65	10.6	86	4.5	11	0.4	55	1.3	70	3.6	2 582	60.1
	E	1 245	29.4	9	0.2	278	-	818	4.5	69	5.0	80	2.5	59	10.2	176	9.3	10	1.2	-	-	120	6.7	3 195	79.7
	T	1 282	27.4	20	0.1	253	0.2	594	4.5	58	4.2	59	1.7	69	10.9	97	5.0	12	0.4	34	0.8	71	7.0	2 540	62.2
000 and over	U	1 144	26.9	17	0.2	268	0.1	624	4.3	51	3.7	170	2.1	89	14.1	132	6.8	15	0.4	9	0.2	78	4.5	2 496	62.6
	R	1 405	29.9	22	0.3	278	0.1	711	5.5	76	5.6	71	1.9	73	12.6	88	4.6	19	0.5	49	1.1	86	5.3	2 889	67.4
	E	1 333	31.6	28	0.5	400	-	781	4.7	71	5.2	113	2.0	185	30.5	361	17.9	13	1.1	19	0.4	104	9.2	3 808	114.9
	T	1 246	37.3	19	0.2	273	0.2	655	4.7	61	4.4	98	2.1	84	13.5	118	6.2	16	0.4	24	0.5	80	6.7	2 641	66.0
all groups	U	1 122	25.2	14	0.1	221	0.1	504	3.8	45	3.2	39	2.7	57	9.8	57	2.8	12	0.3	25	0.6	66	4.2	2 162	52.2
	R	1 217	27.0	35	0.3	201	0.1	505	4.1	49	3.6	33	1.0	46	8.1	29	1.5	14	0.4	79	1.9	58	3.2	2 268	51.2
	E	1 334	31.6	16	0.1	157	-	472	3.2	85	6.2	26	3.0	38	6.9	42	2.1	20	0.6	118	2.7	68	3.5	2 426	61.6
	T	1 221	26.9	29	0.2	200	0.1	501	4.0	52	3.8	32	1.0	47	8.5	35	1.7	14	0.4	74	1.7	59	5.5	2 264	53.8

1/ U = urban, R = rural, E = estate, T = all island total.

Appendix 4

CO-OPERATIVE STUDY OF LABOUR UTILIZATION IN AN ANIMAL PROTEIN PRODUCTION SYSTEM: ZERO-GRAZING DAIRYING IN THE MID-COUNTRY

1. Objectives:

a) To compare the relative production and employment potential of two systems of dairy farming in the Mid-Country, Wet Zone of Sri Lanka.

System 1: Extensive Method - Pasture Grazing

System 2: Intensive Method - Zero Grazing

System 1 will not be studied in this case since the inputs, man-hours, carrying capacities, etc. are well known.

System 2 will be studied in detail.

b) To determine the dietary intakes of dairy workers and their families and relate these to energy demands; to experiment with alternative methods of collecting food consumption data for individuals.

c) To estimate energy requirements of rural labourers by monitoring vital values; to experiment with new methods for establishing calorie requirements for Sri Lankan conditions.

The study is to be carried out at Government Dairy, Undugoda, where all the animals are presently on a Zero-Grazing System. The herd consists of purebred Ayrshires. (The farm manager is Mr. Dayaratne.)

2. Participants:

1. Univeristy of Sri Lanka
2. Department of Agriculture
3. Ministry of Planning and Employment
4. Medical Research Institute
5. UNDP

3. Experimental procedure:

a) Zero grazing production and labour trial (Pusa Giant Napier):

To be carried out by the Agriculture Department (Mr. L. Fonseka) and the University Agriculture Faculty (Prof. R.R. Appadurai). Twenty cows will b required for the study. The number of followers required for a 20-cow uni will also be taken into account. The herd composition will therefore be a follows:

Cows in milk	-	20
Cows-dry	-	6
Heifers 2 - 3 years	-	6
Heifers 1 - 2 years	-	8
Heifers up to 1 year	-	8
		48

Labour

Milkers	-	2
Calf keepers	-	2
Grass cutters	-	4
Total		8

All animals will be fed cut fodder (Pusa Giant Napier). The quantities of grass supplied and the quantities left over will be recorded daily. Cutting of grass should ideally be at 30-day intervals but, in this experiment, the fodder fed is likely to be between 40 - 55 days old. To compensate for the decline in feeding value the rations given below will be fed. Samples will be taken of both grass and concentrates for proximate analysis.

Ten cows in the trial will be fed the normal farm ration - grass + 5 lb concentrat for maintenance + ½ lb per pint of milk. This will be the control. The other ten cows will be fed no concentrates for maintenance, but will be given ¼ lb of concentrates for every pint of milk - i.e. half the present production ration. Grass will be fed ad lib. Milk recording will be carried out as usual on a daily basis. Butterfat tests should be carried out daily.

b) Nutrition survey:

To be carried out by Medical Research Institute Nutrition Department (Dr. B.V. de Mel and Dr. C.C. Mahendra) and Agricultural Extension Service Miss F.R. Abeyawardene).

Diet survey. On the families of the workers under investigation, with particular reference to calories and protein:

1. Family unit survey
2. Distribution of food within the family by analysis of duplicate samples of cooked food.

Nutritional assessment:

Of all members of family:

1. Anthropometry - heights, weights, skinfold thickness, etc. A regular check will be kept on the weights of the workers during the 15-day study period.
2. Clinical assessment for nutritional deficiency signs.
3. Biochemical investigations.

The data obtained should give an indication of the calorie intakes and how they relate with calorie expenditure as determined by use of the SAMI's.

It is hoped to perfect a reliable method of assessing the distribution of food within the family on the basis of this investigation.

The study will also reveal the extent of malnutrition in the sample families - particularly protein-calorie deficiency, nutritional anaemias, and goitre.

c) Energy measurement and calorie input enquiry:

To be carried out by University Medical Faculty (Dr. E.S.G. Hettiaratchi) and UNDP Consultant, Ministry of Planning and Employment (Dr. T.T. Poleman).

Experiments will build on indirect calorimetry, the oxygen/heart rate linkage, and SAMI heart rate and/temperative monitoring devices. Ten workers to be calibrated. All will wear HR/3 instruments during working days. Three each dry will also wear ambient and skin temperature SAMI's and tape recorders (24 hours) to ascertain effect of heat stress on the oxygen/heart rate relationship.

Data should yield insights into labour costs of various dairying operations and lay the foundation for establishment of new food allowance recommendations for Sri Lankan conditions.

CHART I. CEYLON SOCIO-ECONOMIC SURVEY 1969/70: PERCENT OF TOTAL EXPENDITURE SPENT ON FOOD, PER CAPITA MONTHLY FOOD OUTLAYS AND HOUSEHOLD SIZE, BY INCOME CLASS

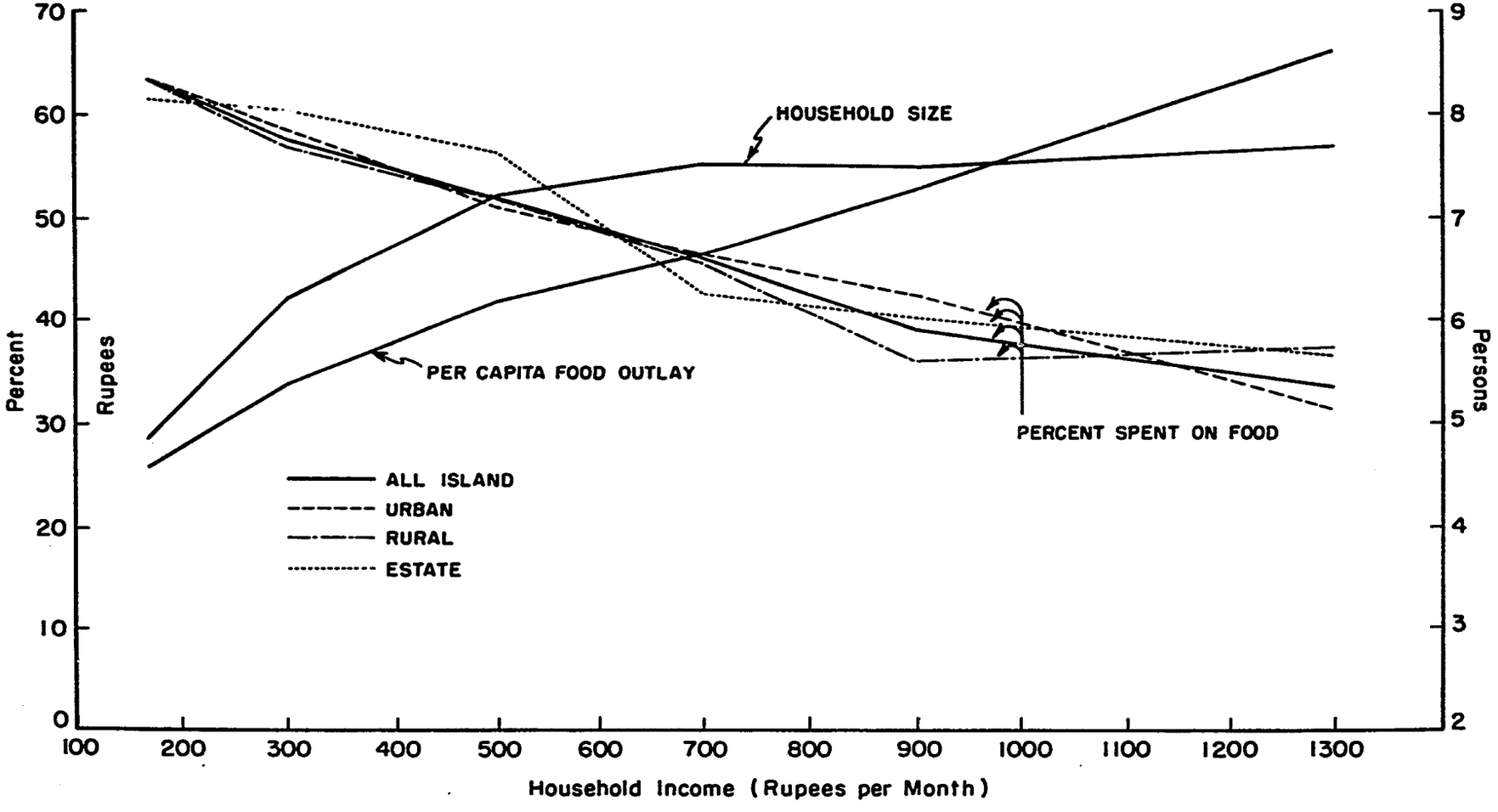

CHART 2. CEYLON SOCIO-ECONOMIC SURVEY 1969/70: APPARENT PER CAPITA DAILY CALORIE CONSUMPTION, BY MAJOR FOOD ITEMS AND INCOME CLASS

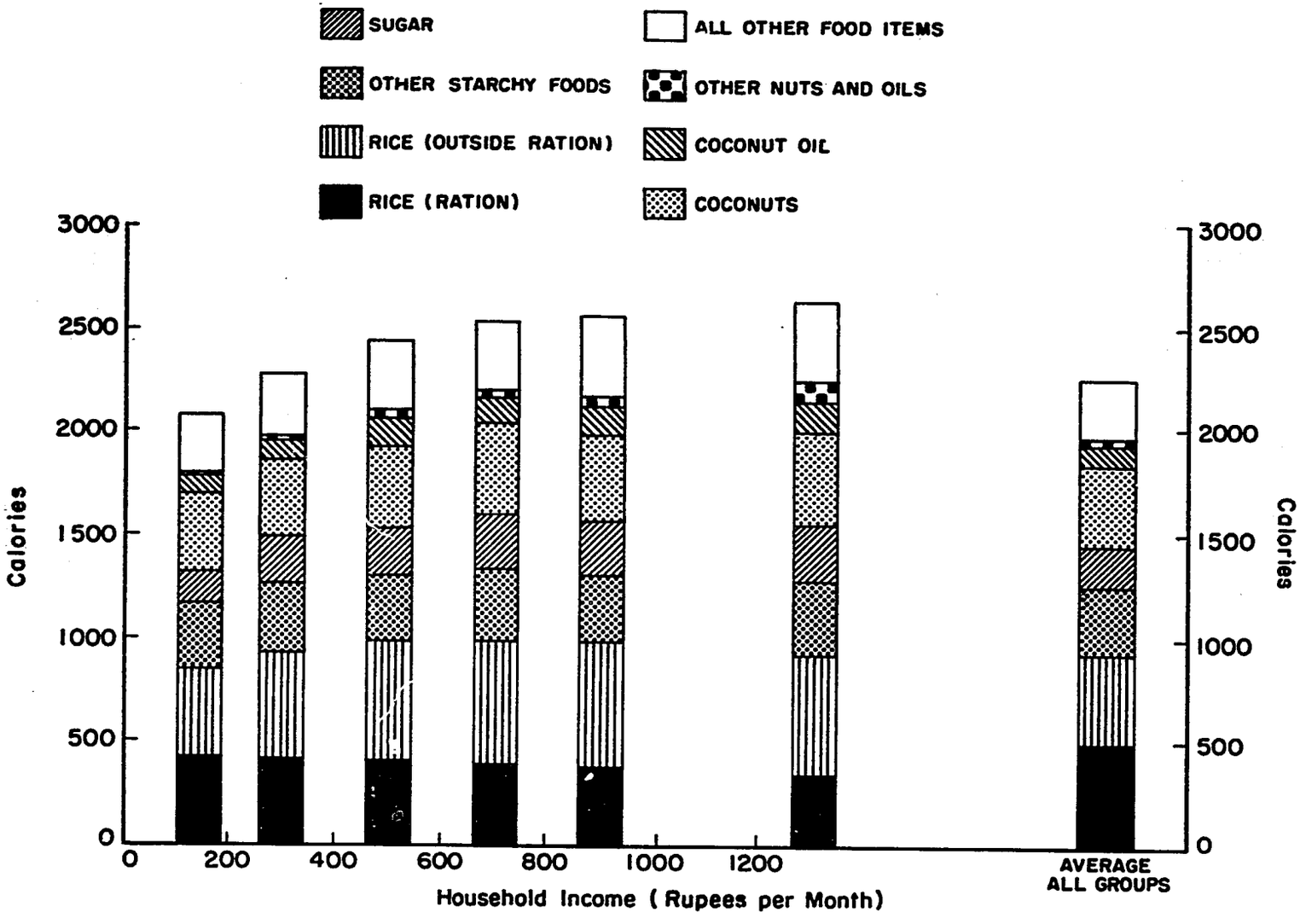

CHART 3. CEYLON SOCIO-ECONOMIC SURVEY 1969/70: APPARENT PER CAPITA DAILY CALORIE CONSUMPTION, BY FOOD GROUPS AND INCOME CLASS

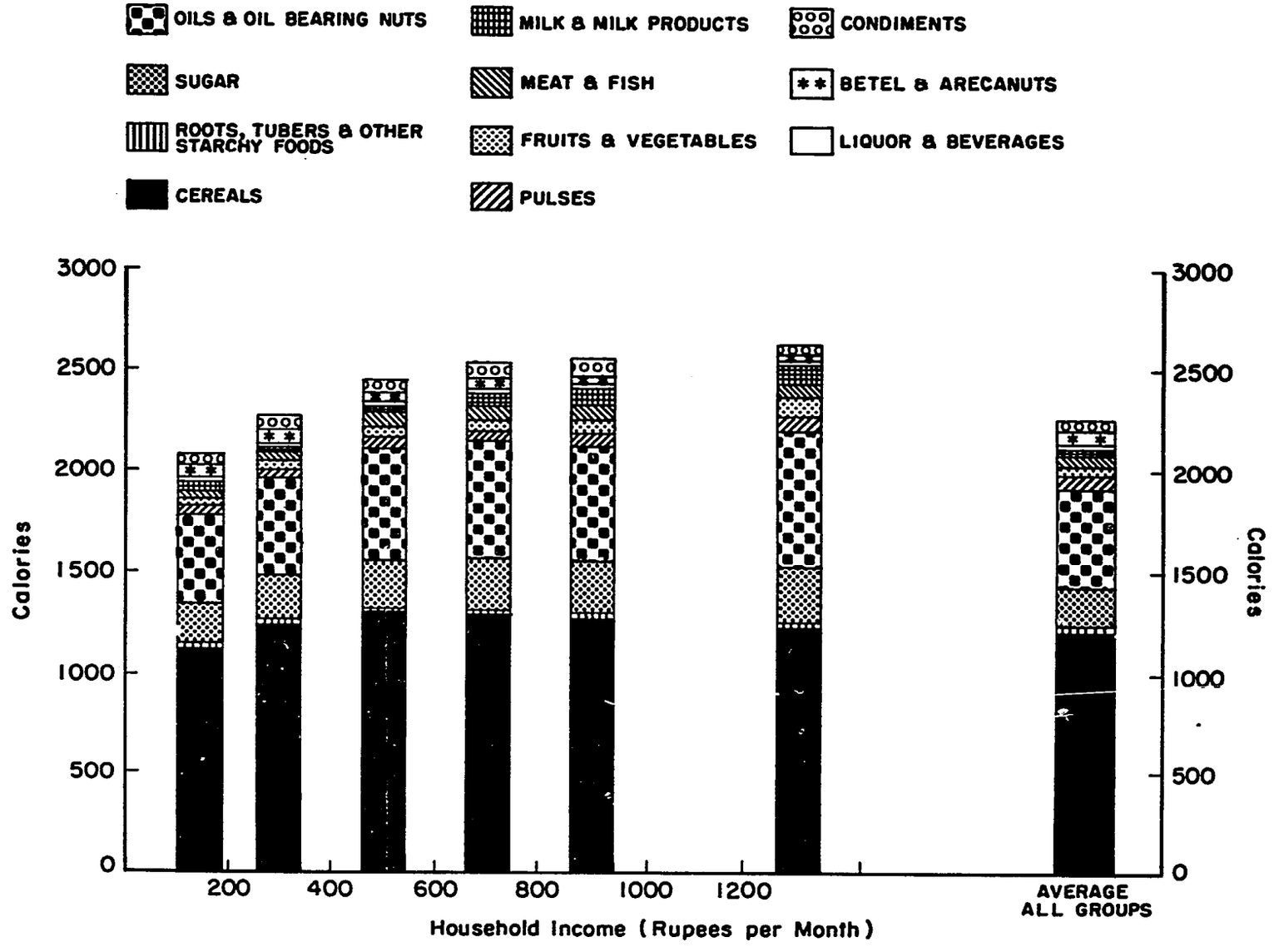

CHART 4. CEYLON SOCIO-ECONOMIC SURVEY 1969/70: APPARENT PER CAPITA PROTEIN CONSUMPTION, BY FOOD GROUPS AND INCOME CLASS

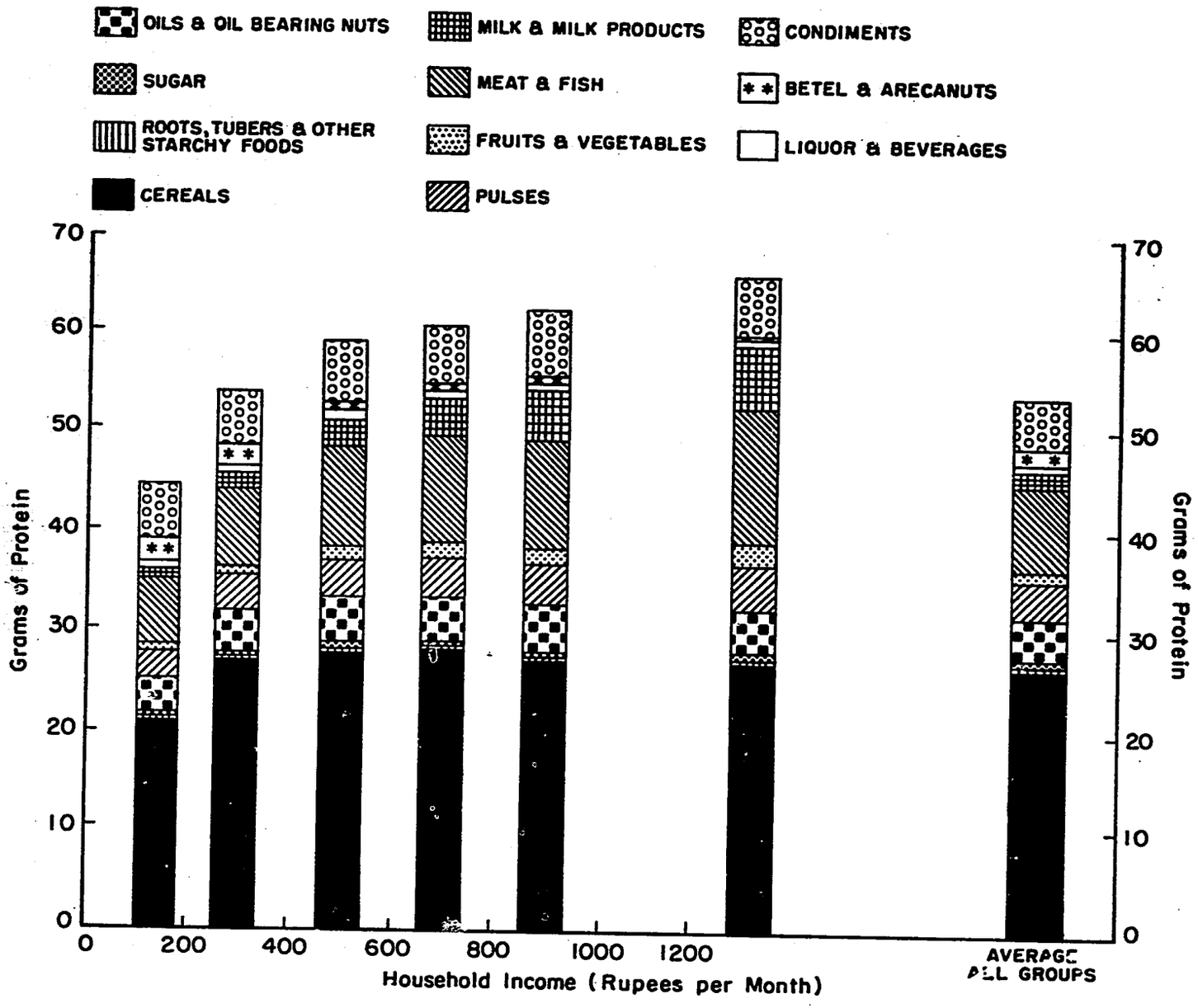

CHART 5. CEYLON SOCIO-ECONOMIC SURVEY 1969/70: APPARENT PER CAPITA DAILY ANIMAL AND VEGETABLE PROTEIN CONSUMPTION, BY INCOME CLASS