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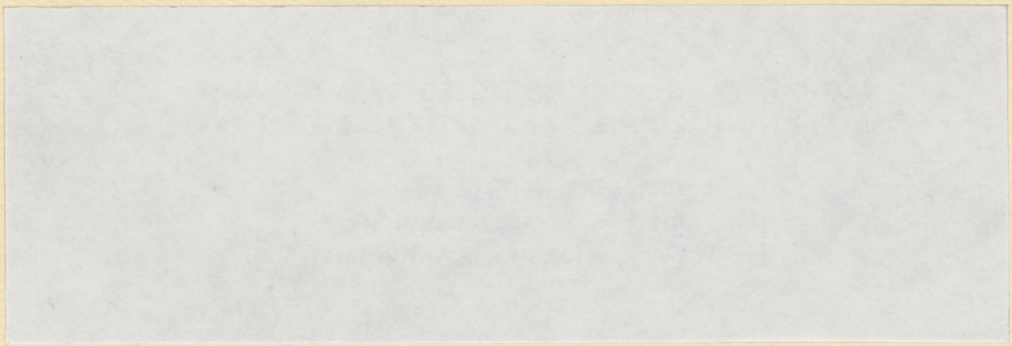

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INTRODUCTION:

To satisfy human food energy requirements is one of the basic needs of any society. The three energy sources are carbohydrates, lipids and proteins. However, protein has a special position in food requirements.

Studies have been conducted in various countries to investigate sources and levels of energy in the diet. The proportions of calories derived from carbohydrates, lipids and proteins have been used as measures of the nutritional status (F.A.O., 1968). Several results stressed that deficit in energy intake has significant health problems. Energy intake affects protein utilization and metabolism Deficiency in energy intake below the requirement results in a loss of body protein in the adult and reductions in growth rate of the young. Hence, adequacy of energy intake should have a first priority in food policies to secure dietary progein utilization efficiently.

Several international studies have shown the contribution of the three main energy nutrients (carbohydrates, fat and protein) to the total dietary energy intake according to landholding size and among agricultural zones. However, there is a lack of such studies

in Egypt. Therefore, this study was conducted as an attempt to identify the general trends of caloric consumption patterns according to different landholding sizes in five different zones in rural Egypt. Landholding size may be considered as a standard of living indicator. In addition agricultural zones include implicitly different socio-economic impacts on food consumption.

MATERIALS AND METHODS:

Agronomic Zones

This work was conducted in ten villages representing five different zones, as were used by Afaf and Shennawy (1981, 82). The five major zones were:

I - The Rice Zone

This zone is in the northern part of the Delta. The dominant cultivated crop is rice.

II - The Zone of Traditional Crops in Lower Egypt

This zone is located in the mid-Delta area. Traditional crops are cultivated in proportionate areas with no dominant crops. Major crops are maize, cotton, rice, berseem and wheat.

III - The Fruit and Vegetable Zone

This zone includes Qualubia, Giza and the villages near Cairo and Alexandria. The major cultivated crops in this zone are vegetables and fruit trees and non-traditional crops.

IV - The Traditional Crop Zone in Mid-Egypt

This zone is located in Middle Egypt. This is a traditional crop zone; these crops are cotton, wheat berseem and maize.

V - The Sugarcane Zone

This zone is located in Upper Egypt. The dominant cultivated crop is sugarcane.

Sample selection

A multi-stage stratified random sample was chosen. Financial and manpower limitations dictated limiting the sample size to 249 householders. Landholders were chosen randomly and were classified according to landholding size as follows: 1 feddan and less, more than 1 to 2 feddans, 2 to 3, 3 to 4, 4 to 5, and more than 5 feddans. Information was gathered concerning the food consumed by each family for a 24 hour period over six days in different times around the year. The average annual food consumed by the individual was obtained. The caloric content of each food was computed from food composition tables for use in the Middle East (1974).

For each landholding level in each zone the amounts for calories were calculated as provided by: a) carbohydrates, separating sugar from starch. b) Separated and unseparated lipids of animal and plant sources. c) Animal and plant protein. These values have then been expressed as percentages of the total caloric intakes.

The diet quality was estimated using two indicators. First, the quality was measured by the nutrition index used by Frederick Harbison (1973) which divides the average caloric intake per capita per day by the percentage of calories per capita per day from starches and cereals. Second, the protein quality was estimated using the method described by the FAO/WHO committee on protein requirements (1973), and the adjusted protein intake was obtained as proposed by Schmitt (1979).

RESULTS AND DISCUSSION:

Food consumption according to zones

Average consumption of various foods condensed in ten groups in the five zones is shown in Table 1. The data indicate that there are differences in consumption of different foods, yet these differences are not consistent for the five zones. Table 1 shows:

(1) the mean consumption levels for grain and its products' group ranged from 468 kg/person/year in zone 5 to 213 kg/person/year in zone 2. This shows us that consumption of this group in zone 5 is more than doubled that in zone 2.

(2) The highest level of consumption of the starchy food group was found in zone 1 (rice zone), and it was about 23.8 kg/person/year; while the lowest was in zones 4 and 5, and it was about 7 kg/person/year.

(3) Average consumption levels for the legume group ranged from 27.6 kg/person/year in zone 5 in Upper Egypt to 11.7 kg/person/year in zone 2 in the mid-Delta.

(4) The mean intake for the milk and its products of foods ranged from 31.8 kg/person/year in zone 1 to 22.4 kg/person/year in zone 4.

(5) The mean intake of meat and poultry was the highest in zone 2, while it was the lowest in zone 5.

(6) The average intake of fish ranged from 29.4 kg in zone 1 to 1.1 kg in zone 4. The highest intake of fish in the rice zone might be related to the breeding of fish in drainage canals of rice fields. In addition, the people in northern Delta prefer to consume fish and rice together.

Table 1. Annual Per Capita Consumption of Food Groups According to Different Zones. (kg)

Zones	Cereal & its products	Starchy foods	Legumes	Milk & its products	Meat and poultry	Fish	Eggs	Vegetables and Fruits	Sugar and Sacharides	Lipids
1	280.8	23.8	15.6	31.8	25.4	29.5	6.4	134.2	25.6	16.1
2	213.2	22.9	11.7	31.3	34.2	4.7	4.7	115.6	28.7	19.8
3	252.9	21.3	18.6	22.9	29.9	27.4	7.6	142.6	20.8	21.2
4	273.4	7.3	25.4	22.4	19.2	1.1	3.4	95.7	24.2	21.9
5	463.1	6.9	27.6	25.4	13.9	3.3	3.1	108.-	28.6	10.7
Grand Mean	270.8	20.1	17.2	28.4	26.8	18.6	5.7	125.5	25.3	18.2

(7) Consumption of eggs differed slightly among the zones.

(8) The highest consumption of vegetables and fruits was found in zone 3 (143 kg) while the lowest was in zone 4 (95 kg). The high consumption in zone 3 is due to the fact that this is the zone where fruits and vegetables are the major crops.

(9) The average consumption of sugar ranged from around 28 kg in zone 2 and 5 to around 20 kg in zone 3. The high consumption of sugar might be related to the high consumption of sweets and drinks. In addition, sugarcane is the major crop in zone 5.

(10) Consumption of lipids is high in zone 4 and 3, followed by zone 2, while consumption of lipids is relatively low in zone 1 and this might be related to food habits as the people like to consume grilled fish. The lowest consumption of lipids is found in zone 5. This might be due to the habits of consuming large amounts of cereals and sweets. In addition the people believe that consumption of lipids must be reduced because of the warm and hot weather around the year.

In general the results are in agreement with previous studies (Afaf and others, 1982; Nawar, 1974).

(11) The comparison between results of the family budget survey (1974/1975) and the food consumption survey (1981/1982) indicate that the per capita intakes of different food commodities found by the second survey were about 1.5 times for cereals and starchy foods, 1.9 times for legumes, 3.5 times for dairy products, 2.9 times for meat and poultry, 4.2 times for fish, 3.2 times for eggs, 3.6 times for vegetables and fruits, 1.9 for sugar and sacharides, and 2.3 times

for fat and oils of the figures of the first survey (1974/1975).

The family budget survey included landless persons, who are of a lower income level, and non-food producers. Thus, their consumption levels are expected to be lower then those of landholders to whom the consumption survey (1981/1982) was confined.

To show the effect of the zone on the consumption pattern of each food group, a one way analysis of variance was used. The F-test was used for testing the hypothesis that there is no difference between zones with respect to food consumption patterns.

The test of significance showed that out of the six major food groups there is only one group where the zone does not significantly affect the consumption pattern. It is, surprisingly, the meat group (meat and poultry)! The other five groups which are affected by the zone are milk and milk products group, legumes, cereals, fat and oils, and starchy foods.

Consumption in relation to landholding size

Table 2 presents the consumption pattern of food groups according to landholding size of all the sample.

The data indicate that in most cases the increase in annual per capita consumption does not show a consistent pattern with the increase in landholding size. However the results illustrate that people with small landholding size consume more grains and less meat and poultry than those with large farms. Also Table 2 shows that families on small landholding sizes consume fewer eggs than larger farm holders.

Table 2. Annual Per Capita Consumption of Food Groups According to Landholding Size (kg.)

Landholding Size in Feddans	Cereal and its products	Starchy food	Legumes	Milk and its products	Meat and Poultry	Fish	Eggs	Vegetables and Fruits	Sugar and Sacharides	Lipids
1 feddan and less	282.0	17.2	21.1	29.8	17.3	14.0	3.4	119.4	22.6	17.2
1 ---2	284.6	22.9	18.7	26.8	22.0	19.0	3.8	113.1	20.8	16.9
2 ---3	285.6	23.4	17.2	25.5	27.0	18.0	4.2	146.0	23.1	18.6
3 ---4	214.4	17.1	17.9	28.6	22.9	21.0	7.0	127.8	23.3	17.5
4 ---5	220.2	13.5	12.6	25.1	34.8	19.0	6.0	93.4	26.0	17.7
more than 5 feddans	232.1	22.3	10.6	26.1	38.0	19.0	7.0	127.0	24.0	18.0

To test the hypothesis that landholding size does not affect food consumption patterns in rural areas a one way analysis of variance was used and F-ratio was applied with respect to the six mentioned food groups: Here the results are quite different from the zone effects. Farm size has a significant effect on the consumption of legumes, meat group and starchy foods. However, there is no significant difference in the consumption of milk and milk products, cereals, or fats and oils according to farm size.

Caloric intake and dietary energy sources

The data in Table 3 present the pattern of consumption of the main energy source, which include carbohydrates, lipids, and proteins. Average intakes of these nutrients differed in the five zones. The highest intakes of total carbohydrates and proteins are found in zone 5, while the lowest intakes are found in zone 2. The highest intakes of animal protein and separated total and animal fats are found in zone 4.

Distribution of families according to adequacy of caloric and protein intakes

The data in Table 4 indicate that the majority of the people (83.8 %) consume more calories (81.5 %) and protein (95.6 %) than the requirements. This could be attributed to nutrition unawareness leading to overnutrition which is a step to malnourishment. People consuming adequate amounts of nutrients represent only 6.0 % and 2.8 % in calories and protein, respectively, which is considered a very small proportion of the people. Low intakes of calories and

Table 3. Average Daily Consumption of Main Energy Sources.

Items	Zone 1	2	3	4	5	Mean
Carbohydrates (gm)						
Sugar	48.5	61.0	32.7	50.0	88.3	56.1
Starch	557.3	396.3	436.0	505.3	788.7	536.7
Total	605.8	457.3	468.7	555.3	877.0	592.8
Proteins (gm)						
Animal	29.5	19.6	27.6	30.0	23.4	26.0
Plant	85.5	62.2	79.1	82.3	145.3	90.9
Total	115.0	81.8	106.7	112.3	168.7	116.9
Lipids (gm)						
Total	78.6	80.8	104.5	84.0	91.3	87.8
1-Separated						
Animal	21.0	24.0	19.5	52.0	29.0	15.9
Plant	25.0	9.5	55.0	19.0	1.0	29.1
Total	46.0	33.5	44.5	71.0	30.0	45.0
2-Unseparated						
Animal	19.3	10.5	16.9	11.0	20.9	27.8
Plant	13.3	36.8	43.1	2.0	40.4	15.0
Total	32.6	47.3	60.0	13.0	61.3	42.8

Table 4. Distribution of Families According to Level of Intake Related to Requirement in Different Landholding Classes

Landholding Classes	Zone	No. of Families	Calories			Protein		
			Less	adequate	more	Less	adequate	more
One feddan and less	I	18	1	1	16	-	1	17
	II	16	7	1	8	1	-	15
	III	16	2	-	14	1	-	15
	IV	6	-	-	6	-	-	6
	V	8	-	-	8	-	-	8
		64	10	2	52	2	1	61
> 1 - 2	I	18	-	-	18	-	-	18
	II	13	4	2	7	-	2	11
	III	13	-	1	12	-	1	12
	IV	11	1	-	10	-	-	11
	V	4	2	-	2	1	1	2
		59	7	3	49	1	4	54
> 2 - 3	I	16	-	-	18	-	-	16
	II	16	7	3	6	-	-	16
	III	9	1	-	8	1	-	8
	IV	7	1	-	6	-	-	7
	V	3	1	-	2	-	1	2
		51	10	3	28	1	1	49
> 3 - 4	I	13	-	2	11	-	-	13
	II	4	2	-	2	-	-	4
	III	3	-	1	2	-	-	3
	IV	3	-	-	3	-	-	3
	V	-	-	-	-	-	-	-
		23	2	3	18	-	-	23
> 4 - 5	I	8	-	-	8	-	-	8
	II	2	-	-	2	-	-	2
	III	4	-	-	4	-	-	4
	IV	1	-	-	1	-	-	1
	V	-	-	-	-	-	-	-
		15	-	-	15	-	-	15
> 5	I	27	1	2	24	-	-	27
	II	4	1	2	1	-	1	3
	III	4	-	-	4	-	-	4
	IV	2	-	-	2	-	-	2
	V	-	-	-	-	-	-	-
		37	2	4	31	-	1	36
Total		249	31	15	203	4	7	238

protein are found among 12.5 % and 1.6 %, respectively. Except for a few cases these intakes are found among the people with small landholdings.

Sources of energy and nutrition index

The share of nutrients in energy supply is shown in Table 5. The data indicate that there are differences in the share of carbohydrates, lipids, and proteins among the zones. In general carbohydrates, lipids and proteins furnished 64.8 %, 22.4 % and 12.8 %, respectively. These values are in agreement with previous studies (Francois, 1968; Perisse, et.al., 1969; Passmore, et. al., 1979; and Nawar, 1979).

Calories derived from carbohydrates ranged from 3507 calories in zone 5 to 1829 calories in zone 2.

In general consumption of both starch and sugar is the highest in zone 5 and the lowest in zones 2 and 3, respectively. This might be due to the fact that sugarcane is the major crop in zone 5 while vegetables and fruits are the major crops in zone 3.

Calories derived from total lipids differed among the five zones ranging from 918 calories (28.3 %) in zone 3 to 707 calories (19.9 %) in zone 1. The highest consumption of animal fat was found in zone 4 (606 calories), while the lowest (310 calories) was found in zone 2. On the other hand the highest and lowest levels of plant fat intakes was found in zones 3 and 4, respectively. The amount of calories derived from total proteins ranged from 676 calories (13.5 %) in zone 5 to 333 calories (11.6 %) in zone 2. The highest consumption of animal protein was found in zone 4, while the lowest was in zone 5.

Table 5. Pattern of Calories Intake and Nutrition - Index

Zone	Carbohydrates						Lipids						Protein						Total		
	Sugar		Starch		Total		Animal		Plant		Total		Animal		Plant		Total		Calories	% of Requirement	Nutrition Index
	Calories	%	Calories	%	Calories	%	Calories	%	Calories	%	Calories	%	Calories	%	Calories	%	Calories	%			
1	194	5.3	2229	62.3	2423	67.6	363	10.1	344	9.8	707	19.9	118	3.2	340	9.3	488	12.5	3589	119.6	57.6
2	244	8.2	1585	55.1	1829	63.3	310	10.6	417	14.5	727	25.1	105	3.7	229	7.9	333	11.6	2889	96.3	52.4
3	131	4.0	1760	54.8	1891	58.3	327	10.1	591	18.2	91.8	28.3	110	3.4	435	10.0	435	13.4	3245	108.2	59.2
4	200	5.8	2021	59.0	2221	64.8	606	17.6	151	4.5	757	22.1	120	3.5	450	9.6	450	13.1	3428	114.3	58.1
5	353	7.0	3154	63.0	3507	70.1	450	9.5	372	7.5	822	16.4	93	1.7	676	11.6	676	13.5	5005	166.8	79.4
Mean	224.4	6.1	2149.8	58.8	2374.2	64.8	411.2	11.6	375	10.9	786.2	22.4	109.2	3.1	361.4	9.7	476.4	12.8	3631.2	121.0	61.3

However, the proportion of calories derived from plant protein was the highest in zone 5 (583 calories) and the lowest in zone 2 (229 calories).

The total caloric intake ranged from 5005 calories (166.8 % of requirement) to 2889 calories (96.3 % of requirement) in zone 2. Except for zone 2, all the population have dietary intake above normal requirements. These findings are in agreement with those reported by Soliman (1982). These results indicate that the people consume more food than they actually need.

It is known that excess of energy in the body, whether derived from dietary carbohydrate, fat, or protein, is stored as fat within the body. Excessive fat deposits leads to overweight and obesity. (Obesity not only is unattractive, but also is a serious health hazard). It increases susceptibility to a number of diseases, among which are gallbladder disease, diabetes, hypertension, and possibly coronary disease.

Although the data in Table 5 shows that the proportions of calories derived from carbohydrates, lipids, and proteins are acceptable, there is a need to reduce the caloric intake. There should be a proportionately greater reduction in foods containing concentrated energy sources, especially those having predominantly saturated fatty acids. It is advisable that only about 10 % of the calories come from poly-unsaturated fatty acids.

The nutritional index results showed that the highest nutrition was that of zone 5 (79.4), while the lowest was in zone 2 (52.4). The average nutrition index was 61.3. Harbison (1973) reported values of

100 for the USA, 93 for Canada, 78 for UK, 66 for West Germany, 55 for Argentina, 36 for Yugoslavia, 22 for Kenya and 18 for India. This index to some extent takes into account both quantity and quality. Quantity is measured by the caloric intake, while the adjustment of calories from starches and cereals measures the proportion of food from food groups judged lowest in qualitatively adjusted protein content.

Sources of energy and nutrition index according to landholding size

The data in Table 6 present the patterns of consuming energy sources according to landholding size. The results show that consumption is not consistent with landholding size within the zone as mentioned earlier. Yet there are differences among the zones at the same landholding size. Nutrition index figures followed the same trend.

Protein quality

Protein quality was studied because the efficiency of utilization depends on protein quality, which reflects the protein and its constituents of amino acids in addition to other factors. The method proposed by FAO/WHO (1973) was used for evaluations.

The amino acid pattern of egg protein was used as a standard. The data in Table 7 reveal that the first limiting amino acid is total sulfur - amino acids, except in the first zone where trytophan is the first limiting. The second limiting amino acid is TSAA, theonine, or lysine. These results are in agreement with earlier studies (Nawar, 1979; Afaf and others, 1982).

Table 6. Pattern of Calories Intake and Nutrition Index According to Landholding Size

Landholding Size	Carbohydrates: Sugar Calories	%	Starch Calories	%	Total	%	Lipids: Total	%	Proteins: Animal Calories	%	Plant Calories	%	Total	%	Total Calories	Nutrition Index
Feddan & less	220	6.0	2150	64.0	2370	70	622	18	104	3	316	9	420	12	3412	51.0
1 - 2	216	6.0	2174	60.0	2390	66	681	19	116	3	434	12	550	15	3621	60.0
2 - 3	188	5.0	2335	62.0	2523	67	768	21	112	3	350	9	462	12	3753	61.0
3 - 4	200	5.0	2319	62.0	2519	67	784	21	146	3	321	9	467	12	3770	61.0
4 - 5	160	5.0	2090	62.0	2250	67	716	21	112	3	308	9	420	12	3386	55.0
5	180	5.0	2304	64.0	2484	69	672	19	120	4	315	8	436	12	3592	56.0
Mean	194	5.3	2229	62.3	2423	67.6	707	19.9	118	3.2	340	9.3	458	12.5	3589	57.3
Feddan & less	252	9.0	1445	56.0	1697	65	585	23	92	4	220	8	319	12	2594	46.0
1 - 2	244	8.0	1812	62.0	2056	70	540	18	84	3	262	9	346	12	2942	47.0
2 - 3	272	9.0	1795	59.0	2067	68	626	20	84	3	288	9	372	12	3065	52.0
3 - 4	228	7.0	1766	57.0	1994	64	788	25	96	3	252	8	348	11	3130	55.0
4 - 5	280	9.0	1361	43.0	1641	52	1134	38	136	4	170	6	306	10	3081	72.0
5	188	7.0	1328	54.0	1516	61	689	27	136	5	176	7	312	12	2517	47.0
Mean	244	8.2	1585	55.2	1829	63.3	727	25.1	105	3.7	229	7.8	333	11.5	2889	53.2
Feddan & less	140	5.0	2015	72.0	2191	77	438	15	64	2	305	10	369	12	2962	41.0
1 - 2	144	4.0	1803	49.0	1947	53	1297	35	96	3	339	9	435	12	3679	75.0
2 - 3	152	4.0	1927	77.0	1879	81	952	13	108	3	359	11	467	14	3298	43.0
3 - 4	140	5.0	1418	51.0	1558	56	931	32	120	2	279	10	399	12	2888	57.0
4 - 5	104	3.0	2155	61.0	2259	64	828	24	80	2	355	10	435	12	3522	58.0
5	104	3.0	1345	44.0	1449	47	1169	37	192	6	313	10	505	16	3123	71.0
Mean	131	4.0	1777	59.0	1881	63.0	936	26.0	116	3.0	325	10.0	435	13	3245	57.5
Feddan & less	288	9.0	1529	54.0	1777	63	692	25.0	52	2	285	10	337	12	2806	52.0
1 - 2	268	5.0	3880	73.0	4148	78	802	13.3	156	3	337	6	493	9	5343	57.0
2 - 3	212	6.0	2047	58.0	2259	64	836	24.0	96	3	326	9	422	12	3517	61.0
3 - 4	248	7.0	1849	52.0	2097	59	930	27.0	188	5	297	8	485	13	3562	69.0
4 - 5	116	5.0	1108	50.0	1224	55	676	31.0	148	6	160	8	308	14	2202	44.0
5	108	3.0	1711	64.0	1819	67	658	21.0	80	3	576	18	656	21	3133	49.0
Mean	200	5.8	2021	58.5	2221	64.3	766	23.5	120	3.6	396	9.8	450	13.5	3428	55.3
Feddan & less	344	7.0	3157	62.0	3501	69	905	18	60	1	589	12	649	13	5055	82.0
1 - 2	260	6.0	2590	63.0	3850	69	749	18	84	2	465	11	549	13	4184	66.0
2 - 3	456	8.0	3716	64.0	4172	72	811	14	126	2	694	12	830	14	8813	91.0
3 - 4	-		-		-		-		-		-		-		-	
4 - 5	-		-		-		-		-		-		-		-	
5	-		-		-		-		-		-		-		-	
Mean	353	7.0	3154	63.0	3507	70	822	16.6	93	1.7	583	11.6	676	13.3	5017	89.0

Table 7. Amino Acid Scores and Adjusted Protein Intake

	Amino Acid Score (%)				Limiting Amino Acids		Protein intake	
Zone	Lysine	Threonine	TSAA	Tryptophan	First	Second	Actual	Adjusted
1	58.3	74.4	54.0	40.8	Tryp	TSAA	115.0	46.9
2	63.8	55.0	52.3	86.3	TSAA	Thr	96.0	43.9
3	65.1	67.1	55.4	80.7	TSAA	Lys	106.7	57.9
4	60.6	56.0	46.1	75.4	TSAA	Thr	112.3	50.0
5	51.9	54.1	42.5	73.5	TSAA	Lys	168.7	72.4
Mean	59.9	61.3	50.1	71.3	TSAA	Lys	119.7	54.2

Protein intake

The results in Table 7 demonstrate that the average protein intake varies from 168.7 gm in zone 5 to 96.0 gm in zone 2. Similar results were reported by Soliman (1982). While almost all zones seem to have an abundance in regard to average protein intake, the surpluses may not be real, once variations in protein quality among food types are considered. In addition, estimation of requirements are based on good quality protein. Therefore, there must be consideration to allow for poor utilization of the proteins from a mixed diet as compared with a diet containing good quality protein. Also there must be adjustment in protein requirements to meet added needs to deal with stress, infection, etc.

Qualitatively adjusted protein intake was estimated (Table 7) using the chemical score as was proposed by Schmitt (1979) to show an approximation of the probable utilization efficiency of the protein consumed. The data in Table 7 reveal that there is a great difference between actual and adjusted protein intakes in all zones.

Protein quality and protein intake according to landholding size

Table 8 demonstrates that protein quality and protein intake did not differ consistently with landholding size within the zone. However, differences among the zones at each landholding size were obvious.

Table 8. Amino Acid Scores and Adjusted Protein Intake According to Landholding Size

Landholding Size in Feddans	Amino Acid Scores %				Limiting Amino acids		Protein Intake	
	Lysine	Threonine	TSAA	Tryptophon	First	Second	Actual (gm)	Adjusted (gm)
Zone 1								
< 1 Feddan & less	52.8	69.3	48.4	37.4	Try	TSAA	105	39.3
1>2 > 1 - 2	60.9	73.7	54.3	40.1	Try	TSAA	138	55.4
2>3 > 2 - 3	60.3	74.8	55.4	38.9	Try	TSAA	116	45.1
3>4 > 3 - 4	58.7	75.5	52.7	40.9	Try	TSAA	117	47.9
4>5 > 4 - 5	55.4	76.3	56.9	42.1	Try	Lys	105	44.2
>5 > 5	61.7	76.9	56.2	45.6	Try	TSAA	109	49.7
Mean	58.3	74.4	54.0	40.8	Try	TSAA	115	46.9
Zone 2								
<1 Feddan & less	62.5	29.0	64.0	92.5	Thr	Lys	78	22.9
1>2 >1 - 2	48.5	50.0	40.5	81.0	TSAA	Lys	87	35.2
2>3 >2 - 3	55.5	54.5	44.5	85.5	TSAA	Thr	93	41.4
3>4 >3 - 4	62.5	69.0	50.5	93.5	TSAA	Thr	87	43.9
4>5 >4 - 5	72.0	64.0	55.0	72.0	TSAA	Thr	153	84.2
>5 > 5	81.5	70.5	59.0	93.0	TSAA	Thr	78	35.6
Mean	63.8	55.0	52.3	86.3	TSAA	Thr	96	43.9
Zone 3								
<1 Feddan & less	59.2	67.3	54.9	95.9	TSAA	Lys	93	51.1
1>2 >1 - 2	59.9	66.9	51.8	89.0	TSAA	Lys	109	51.5
2>3 >2 - 3	66.4	66.5	52.3	62.1	TSAA	Try	117	61.2
3>4 >3 - 4	79.9	77.4	64.3	81.2	TSAA	Thr	85	54.7
4>5 >4 - 5	57.7	63.6	52.3	73.7	TSAA	Lys	109	57.0
>5 > 5	67.5	60.6	56.8	82.5	TSAA	Thr	127	72.1
Mean	65.1	67.1	55.4	80.7	TSAA	Lysine	106.7	57.9
Zone 4								
<1 Feddan & less	61.9	62.7	43.9	73.1	TSAA	Lys	84	36.9
1>2 >1 - 2	58.7	58.8	45.3	85.6	TSAA	Lys	123	55.7
2>3 >2 - 3	71.5	68.4	58.4	73.2	TSAA	Thr	105	61.3
3>4 >3 - 4	48.8	57.0	44.6	85.3	TSAA	Lys	121	54.0
4>5 >4 - 5	87.6	68.6	53.0	85.9	TSAA	Thr	77	40.8
>5 > 5	35.7	38.5	31.4	49.1	TSAA	Lys	164	51.5
Mean	60.6	56.0	46.1	75.4	TSAA	Thr	112.3	50.0
Zone 5								
<1 Feddan & less	44.8	49.3	38.8	88.9	TSAA	Lys	162	62.9
1>2 >1 - 2	47.2	51.1	42.2	39.3	TSAA	Lys	137	57.8
2>3 >2 - 3	63.8	62.0	46.6	92.4	TSAA	Thr	207	96.5
3>4 >3 - 4	-	-	-	-	-	-	-	-
4>5 >4 - 5	-	-	-	-	-	-	-	-
>5 > 5	-	-	-	-	-	-	-	-
Mean	51.9	54.1	42.5	73.5	TSAA	Lysine	168.7	72.4

CONCLUSIONS

In general, nutrition education programs are needed to teach people why it is important and how to choose a balanced diet that meets body needs for different population groups using the available local resources.

Studies concerning landless workers are also needed. Food subsidies should be taken also into consideration. Studies concerned with the nutritional status are needed to have a precise picture of the people's health and work efficiency on one hand and the suitability of food intake on the other hand.

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