Nutrition Planning: Analysis of Some Policy Options

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Introduction

Pakistan's Development Perspective (1975-80) provides for an increase in private consumption at the rate of over 7 percent per annum and this implies a per capita increase of 4.2 percent per year. In order to examine the implication of these projections it is of interest to look at almost all aspects of the country's economic and socio-political structure.

This paper focuses primarily on just one part of the overall picture—namely some options that might be considered on the demand side of the economy. Ideally one would like to understand each individual's milieu and characteristics to try and project his future behaviour as a consumer with reasonable accuracy. In practice this is, of course, not feasible so that one must strive for a balance between a manageable amount of data and yet capture enough of the key features of market behaviour to produce meaningful results. These features should ideally reflect socio-economic status, and regional and seasonal variations. Largely because of the type of data readily available, this paper tends to emphasize the first class of features and for the most part ignores the other two.

Explanation of a large part of differences in consumer behaviour in Pakistan (and many other countries) may be attributed to two basic parameters: income level and urban-rural location. Consequently programmes aimed at changing per capita food intakes must give these parameters adequate consideration. Real income may be affected in either of two ways—at the input or the output side. On the input side, any policy which provides better purchasing power[1] for an individual may ultimately be reflected in improvement in his

[1]Purchasing power should be distinguished from employment *per se*. Current estimates are that unemployment levels in Pakistan are about 2 percent so that the problem is one of income, primarily. The large rural population with a high self-employed component together with the loose structure of the urban labour mrket does not readily "lend" itself to western style analysis of "unemployment" problems.

consumption bundle and may be nutritional status on the output side, policies which improve purchasing power of his present income will also be a gain to him. These latter may include provision of improved health or housing services besides the more obvious price subsidies or food grants. The urban-rural location is significant largely because urban dwellers typically have higher costs for housing and transportation, also wider purchasing opportunities, so that at equal income levels[2] the urban dweller has lower food intake.

The Development Perspective also aims at addressing directly the problem of malnutrition. Recent estimates suggest that 38.2 percent of the population has less than 95 percent of the required caloric intake. It is proposed to reduce this to 9 percent by 1980-81. This malnutrition problem may be viewed in three principal parts: (a) P.C.M. (protein-calorie malnutrition); (b) specific nutrient deficiencies; and (c) other related areas—public health, water supply, and sanitation. The first part may be addressed by the broad class of policies mentioned in the previous paragraph while the second part typically requires programmes which have a stronger target group orientation. This latter category might include goitre control in the sub-Himalayan region by suitable injections or iodization of salt. Similarly fortification of an appropriate carrier might be a suitable policy for elimination of vitamin A deficiency. The third part is also important and in fact may be the dominant consideration in some instances. However these issues are not considered in this paper.

A large comprehensive nutrition survey of Pakistan was carried out in 1965-1966. While the information contained is dated, it does provide a good indication of possible problem areas. This together with more recent data which include Household Income and Expenditure Surveys [4][3] and Food Balance Sheets provide a basis for preliminary policy considerations.

Some possible policy alternatives for addressing consumption and nutrition problems are now discussed. These are primarily concerned with the demand side. The cost effectiveness of a general food subsidy is analysed by a simple model and some of the salient parameters are identified. This is then extended to include some relevant variations due to regional, seasonal, and quality differences. Alternate schemes treated briefly are fortification, income transfers, and food stamp programmes.

Food Subsidies

One approach which is accepted in principle in Pakistan is to subsidize the price of foods. This analysis first proposes a simple model to focus on some of the issues involved.[4] The model uses a partial equilibrium analysis and does not include real welfare effects. However, it does allow one to focus on some of the issues involved in subsidizing foods:

Suppose one subsidizes a food x. There are five side effects to be considered:

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[2]For further discussion of this issue in Pakistan see [2].
[3]For a detailed analysis of much of this data see [3].
[4]This model is largely based on one proposed by [6].

(i) The fall in price will stimulate consumption of x by the rest of the population if their price elasticity of demand is negative.[5]

(ii) If the supply elasticity is positive then any increase in the marketed quantity will require a higher price for producers.

(iii) Substitution effects may be significant.[6]

(iv) The reallocation of resources will produce changes in welfare.

(v) If the price of that food falls then real income of its consumer increases thereby inducing more purchases of other foods. Here only one food is considered. So the analysis ignores this effect.

Now suppose it is desired to intervene to try and increase the intake of the food x by some segment of the population. Without loss of generality it will be assumed that the food is wheat and the segment under consideration is a target group. This may typically be those suffering from subnutrition.

Before the intervention, let the price of wheat be p and let the average consumption per capita of the target group[7] members be q_1 and that of the whole population, q. If the total population is P and there is a fraction α of them in the target group, then the wheat consumption by the target group, before intervention, Q_1, is:

$$Q_1 = \alpha q P.$$

Let the objective of the proposed intervention be to raise the per capita consumption of the target group by $\triangle q_1$ per capita by lowering the price to all consumers. Thus the percentage change q_1' ($=\triangle q_1/q_1$) should satisfy the relation:

$$q_1' = (\bar{n}_{p1} - \theta_1 n_{y1})\, p' = n_{p1} p'$$

where $\bar{n}_{p1}$, n_{y1}, are the price and income elasticities of wheat for group 1, θ_1 is the income share of group 1 spent on wheat, and p' is the percentage change in the wheat price (negative). To achieve the objective one needs to induce a price change $\triangle p$ given by:

$$\triangle p = p q_1' / (\bar{n}_{p1} - \theta_1 n_{y1}) = p q_1' / n_{p1}.$$

This price change requires consideration of a number of effects. These include increased consumption by the nontarget group because of the fall in price, and a shortfall in production unless the price to producers is increased sufficiently.

The percentage increase by the whole population q' due to the price change $\triangle p$ is given by:

$$q' = (\bar{n}_p - \theta n_y)\, p' = n_p p'.$$

[5]For most foods in Pakistan this is true. However, the demand for salt (of interest because of consideration as a carrier) is relatively inelastic while in urban areas even wheat has income elasticity close to zero among higher income groups.

[6]Substitution between sugar (desi and refined) and *gur* and *shakkar* is one of the more obvious.

[7]Subscript 1 is used on variables which refer to the target group, and dropped for variables referring to the whole population.

The total increase in demand $\triangle Q$ is then given by:

$$\triangle Q = \triangle q P.$$

If the supply elasticity is ε then the percentage increase in price p_s' required to generate this additional output is obtained from:

$$q' = \varepsilon p_s'.$$

Note that equilibrium between supply and demand requires $\varepsilon \triangle p_s = n_p \triangle p$. Because of the divergence between the required higher producer price and the lower consumption price, a direct subsidy S is required given by:

$$S = (Q + \triangle Q) \ (\triangle p + \triangle p_s) = (Q + \triangle Q) \quad (1 + \frac{np}{\varepsilon}) \triangle p.$$

The subsidy per unit of food S_2 is given by:

$$S_2 = (1 + \frac{n_p}{\varepsilon}) \triangle p = (1 + \frac{n_p}{\varepsilon}) \frac{q'}{n_p}.$$

There will also be an administrative cost D.

The increased intake by the *target* group, $\triangle Q_1$, is:

$$\triangle Q_1 = (\alpha \triangle q_1) P.$$

It is to be noted that $Q + \triangle Q$ may be written in the form:

$$Pq \left[1 + \frac{\triangle q}{q} \right] = Pq \left[1 + n_p \frac{\triangle p}{p} \right] = Pq \left[1 + \frac{n_p}{n_{p_1}} q' \right].$$

Thus the total subsidy cost S is given by:

$$S = \triangle Pq \left[1 + \frac{n_p}{n_{p1}} q' \right] \left[1 + \frac{n_p}{\varepsilon} \right].$$

The cost per capita of the target group per unit increased intake by that group is given by s_1:

$$s_1 = \frac{\triangle pq}{\alpha \triangle q_1} \left[1 + \frac{n_p}{n_{p1}} q_1' \right] \left[1 + \frac{n_p}{\varepsilon} \right] + \frac{D}{\triangle q_1 \alpha P}$$

$$= p \frac{Q}{n_{p1} Q_1} \left[1 + \frac{n_p}{n_{p1}} q_1' \right] \left[1 + \frac{n_p}{\varepsilon} \right] + \frac{D}{\triangle q_1 \alpha P}$$

where the final term reflects administrative costs.

This model allows us to compare some of the salient features of cost effectiveness for a food subsidy programme. The cost effectiveness per unit increased consumption of a given food by the undernourished group may be analysed by *joint consideration* of all terms in the above equation. (Again note that the analysis refers only to the subsidized food.) To get some feeling for this equation we shall discuss each term separately. Ideal (low-cost) candidates for subsidy should have the following seven properties:

(a) Low p, current unit market price,

(b) High $\dfrac{Q_1}{Q}$, fraction of the food consumed by undernourished groups,

(c) High n_{p1}, elasticity of demand by undernourished groups,

(d) Low q_1', percentage increase in group's intake,

(e) Low $\dfrac{n_p}{n_{p1}}$, ratio of average elasticity to the group elasticity,

(f) Low $\dfrac{n_p}{\varepsilon}$, ratio of demand to supply elasticities for the whole economy, and

(g) Low $\dfrac{D}{\triangle q_1 \alpha P}$, administrative costs.

Each of these is now discussed.

(a) *Low p*—The analysis will first be done in terms of a normalized p. One should have current prices per unit and also the nutrient content per unit of food.

(b) *High* Q_1 / Q — A high value of this ratio implies that before the subsidy programme begins, the undernourished already consume a relatively high fraction of the food. To analyse this parameter one must view the distribution of food consumption by income group. To do this we digress slightly and introduce the concept of intensity of consumption.

The intensity of consumption parameter μ_{ij} is defined by the ratio:

$$\mu_{ij} = \frac{q_{ij}}{n_i}$$

where q_{ij} is the fraction of total consumption, by quantity, of food j by income group i, and n_i is the fraction of population in income group i.

As before, urban and rural populations are treated separately. The μ_{ij} parameter gives a convenient measure of the relative preference by income class for various foods. Thus a food consumed by all groups in similar amounts would yield values for $\mu_{ij} = 1$. When $\mu_{ij} > 1$ this indicates a certain predilection for that food by that group. The implications are obvious for policies which seek to focus on particular groups. Some estimates are given in Tables 1 and 2 for urban and rural groups. Among the foods listed one observes a wide range of values. For urban groups the foods most favoured relatively by the lower income classes are unrefined sugar (*gur*, etc.), gram, wheat, and beef, while high income groups tend to consume a relatively larger share of mutton, ghee and butter, refined sugar, and milk. There are too noticeably different patterns between urban and rural populations across income classes. These are for unrefined sugar and vegetable oil. Traditionally most rural classes consume relatively large shares of their sugar intake in the many unrefined forms so perhaps it is not too surprising to find somewhat uniform patterns across income groups here. However, the vegetable oil consumption in rural areas seems to follow a different pattern from the urban areas. The rural poor consume an above average amount of vegetable oil compared to other rural dwellers. From an expenditure standpoint, vegetable oil assumes an even more significant role, relatively speaking, in the budget of the poor. The ghee situation is a perplexing one and in recent years has become an even bigger problem. The situation is considered further in the production section but at this stage it is sufficient to observe that ghee and vegetable ghee form an important component of most peoples' consumption basket but particularly vegetable ghee is favoured by the poor.

When other factors are equal, the relatively high μ_{ij} parameters would be attractive for policies focussing on the appropriate income groups. Thus as one may use the Gini coefficient to compare income distribution one could have a food equality coefficient, F_D, to compare the relative merits of different foods as vehicles for focusing policy. This could be based on the area ratio as indicated in Fig. 1. Three foods are sketched $f_d(i)$, $i = 1, 2, 3$. For each of these the food equality coefficient F_D is less than, equal to, and greater than one, respectively, corresponding to the degree that food is favoured by the poor. These are roughly rich persons' equalitarian, and poor persons' foods. For Pakistan, the ordering of some F_D values is given in Table 3. Note the high position of wheat and gram and the somewhat low ranking of milk which does not support those who sometimes propose it as a vehicle for nutrition programmes aimed at low income groups.

(c) *High* n_{pl}—High elasticity of demand among low income groups is desirable because then a small drop in price will induce a relatively large response in consumption. Some values for compensated price elasticities (n_{pl}) are given in Table 4.[8] When one allows for the income effect, the price elasticities are increased. This is true in particular for cereals which represent a large income share. However the low values for cereals suggest that price adjustment may not in fact be a very suitable approach for achieving increased intake.

(d) *Low* q_1'—The lower the percentage increase sought the lower the value of s_1. As one seeks a greater increase, the per unit costs rise due to the proportionately larger subsidy costs.

[8]At the extreme end of the income spectrum elasticities are much higher (about 1.0 for staples!) so that these individuals may benefit even more than the lowest 40 percent.

Table 1

Intensity of Consumption by Urban Income Group and Commodity (1970-71)

Income Group %	Wheat	Rice	Gram	Milk	Ghee and Butter	Veg. Oil	Mutton	Beef	Sugar Refined	Sugar Other
0—40	1.05	.81	1.09	.80	.60	.90	.30	.98	.75	1.45
40—80	1.00	1.05	.99	1.02	1.00	1.00	.87	1.09	1.04	.77
80—100	.09	1.30	.86	1.45	1.80	1.20	3.50	.78	1.42	.56

Source: Estimated from Household Income and Expenditure Survey 1970-71 [4].

Note: Intensity $= \mu_{ij} = \dfrac{\text{fraction of total consumption, by quantity, of food } j \text{ by income group } i}{\text{fraction of population in income group } i}$

Table 2

Intensity of Consumption by Rural Income Group and Commodity (1970-71)

Income Group %	Wheat	Rice	Gram	Milk	Ghee and Butter	Veg. Oil	Mutton	Beef	Sugar Refined	Sugar Other
0—40	.98	.78	1.04	.74	.80	1.15	.56	.92	.77	.98
40—80	.99	1.07	.98	1.09	1.07	.87	.89	.99	.99	1.01
80—100	1.06	1.30	.96	1.30	1.26	.96	2.1	1.18	1.48	1.02

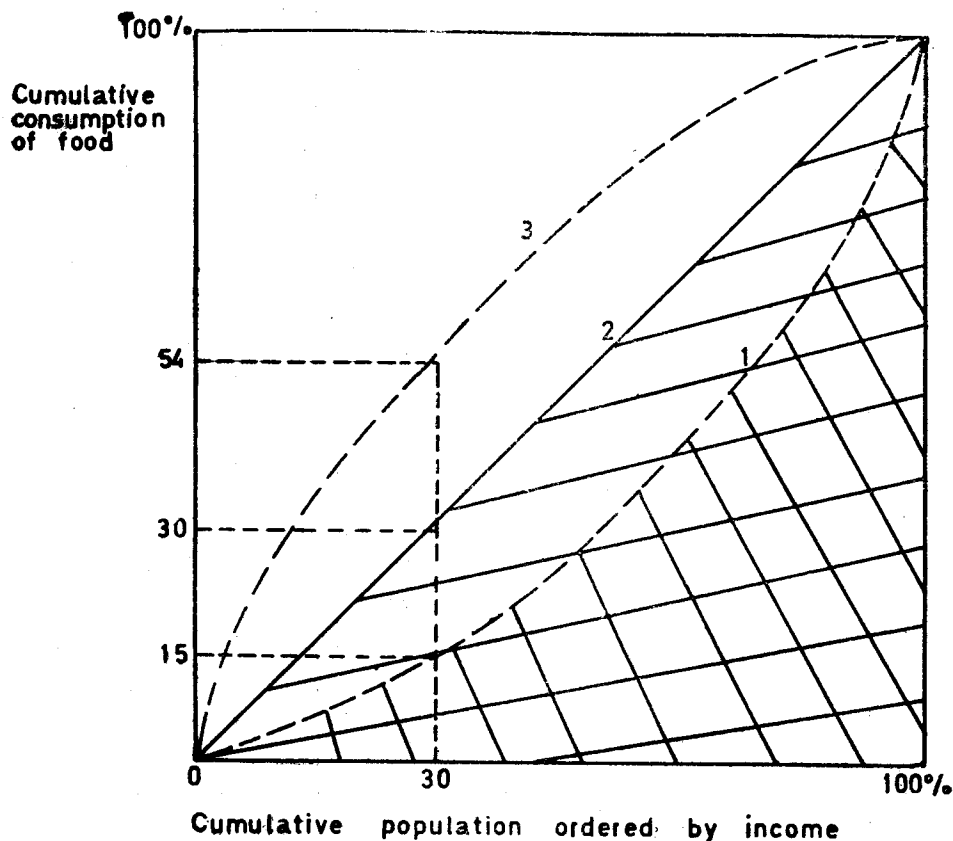*Source* : See Table 1.

Note: See Table 1

Figure 1
Distribution of food by income class

Note: Each food is represented by a separate curve. Curves 1, 2, and 3 represent foods favou-
red by high income, "equalitarian," and low income groups. The figure indicates,
for example, that the lowest 30 percent of the population by income, consume 15, 30,
and 54 percent of total consumption of foods, 1, 2, and 3. Food Equality Coefficient
F_D=ratio of cross hatched to shaded area.

Table 3

Ordering of Foods by Food Equality Coefficient for Urban and Rural Populations (1970-71)

F_D[1]	Urban	Rural
10	Sugar (unrefined)	Vegetable oil
9	Gram	Gram
8	Wheat	Sugar (Unrefined)
7	Beef	Wheat
6	Vegetable oil	Beef
5	Rice	Ghee and butter
4	Milk	Rice
3	Sugar (refined)	Milk
2	Ghee and butter	Sugar (refined)
1	Mutton	Mutton

Note: [1]High numbers correspond to low F_D – foods highly favoured by low income groups.

Table 4

Own Price Elasticities for Urban and Rural Low Income Groups (0 – 40 *percent of Income Class*)

Commodity	Elasticities	
	Urban	Rural
Wheat	— .031	— .23
Rice	— .113	— .22
Pulses	— .386	— .28
Milk	— .254	— 1.26
Butter	— .256	— .48
Ghee	— 1.72	— 1.15
Vegetable Ghee	— 2.16	— .43
Mutton	— 1.54	— 1.35
Beef	— .92	— .73
Vegetable	— .36	— .08
Sugar	— .18	— .37

Note: These estimates are obtained by first computing expenditure elasticities using Household, Income, and Expenditure Surveys 1968-1972 [4]. The approach first proposed by Frisch, R. is then used to derive the price elasticities. For a theoretical discussion of this link see [7].

(e) *Low* n_p/n_{pl}—This means it is desirable that the low income group should respond to a price variation (drop for a subsidy) more than the population at large. Some estimates are given in Table 5.

(f) *Low* n_p/ε —Here one would like to have a highly elastic supply (i.e., $\varepsilon \rightarrow \infty$). Thus foods like wheat or rice for which the economy may be viewed as open are good but mutton is not. However this ratio (particularly ε) would depend on the extent to which world markets are allowed to interact.

(g) *Low* $D / (\alpha \triangle q_1 P)$ — Administrative costs per unit per capita of the target group would tend to be low as $\triangle q_1$ and the number of people in the target group increases. Thus the administrative costs of a general subsidy programme tend to be lower than one which seeks to benefit only specific members of the population. This later kind would generally require some form of means test which tends to be expensive and difficult to administer.

Table 5

Estimate of Price Elasticity Ratio[1] for Rural Low Income Group

Food	Price Elasticity Ratio
Wheat	.76
Rice	.15
Pulses	.67
Milk	.25
Butter	.77
Ghee	.50
Vegetable Ghee	—1.00[2]
Mutton	.83
Beef	.23
Vegetable	3.58
Sugar	1.67

Source: Based on Household, Income and Expenditure data, 1968-1972 [4].

Notes: [1]The price elasticity ratio is (η_p/η_{pl}) where η_p is for the population at large and η_{pl} is for the low income rural group (0—40)

[2]This value, based on the assumption of a free market in this food, is questionable.

Some estimates of the combined effect of all (excluding administrative costs) of the above influences are obtained for increasing consumption of various foods by 10 percent among low income groups—those in the bottom 40 percent of urban and rural income classes. These are given in Table 6. Rather sweeping assumptions are made about supply elasticities. If one is dependent on domestic production then values for ε should only be about .1 to .2 for cereals and pulses but adequate import availability may justify the higher values chosen. Much of vegetable ghee is imported so that the assumption of $n_p/\varepsilon \rightarrow 0$ in this instance may be reasonable.

Table 6

Estimate of the Effects of a 10 percent Increase in Low Income Group Consumption by Commodity[1]

Food	Q/Q_1	$n_{p1}{}^2$	$1+\dfrac{n_p}{n_{p1}}q_i{}'$	$1+\dfrac{n^3}{\varepsilon}$	S_1/p	p^4	$S_1{}^5$	$S_2{}^6$
Wheat	2.5	— .21	1.07	1.22	15.54	1.62[7]	25.2	0.94
Rice	3.16	— .20	1.01	1.05	16.76	2.31	38.7	1.21
Pulses	2.37	— .33	1.07	1.29	9.91	2.38	23.6	0.93
Milk	3.29	—1.01	1.03	1.50	5.03	3.00	15.1	0.45
V. Ghee	2.45	— .86	.90	1.00	2.57	26.00[8]	66.8	3.02
Beef	2.66	— .78	1.02	1.26	4.38	7.00	30.7	1.13
Mutton	5.21	—1.40	1.08	2.72	10.93	12.50	136.6	2.43

Notes: [1]Administrative costs are not included. The low income group consists of the lower 40 percent of urban and rural population.

[2]n_{p1} is weighted average of urban and rural low income groups for uncompensated elasticity.

[3]The value of ε is chosen equal to 1 except for vegetable ghee where n/ε is set to zero.

[4]Karachi prices, rupees per seer (2.06 lb.), June 1975 [5].

[5]S_1 is the cost per unit increased intake by the low income group per capita.

[6]S_2 actual subsidy per unit of food: rupees/seer.

[7]Wheat flour.

[8]Estimate.

It appears that three factors tend to dominate in establishing the per unit cost, s_i, for a given commodity: (a) the price per unit of that commodity, (b) the elasticity of demand by the low income group, and (c) the intensity of demand among that group. Because of the low elasticities for cereals, changes in price to all consumers to achieve higher intakes by the low income groups is quite expensive. Middle income groups (40-80 percent) tend to have elasticities of the same order so that they also benefit to about the same extent as the low income group. If they are also considered part of the target group then the effective cost (s_1/p) becomes roughly halved. At the extreme low end of the economic spectrum one could expect higher elasticities for cereals but if the target group is say 40 percent of the population, then trying to achieve an higher intake of cereals by adjusting price is not particularly cost effective.

A little reflection could indicate the reason behind this. It seems that people first try to satisfy their basic caloric needs as cheaply as possible. This is typically by cereal intake. To insure survival they must be reasonably close to their needs so that additional income will be used only to a samll degree (as reflected in low elasticities) to increase quantity of cereal intake. Much of the increase in income goes to other foods, or higher qualities, or other basic needs.

The cost estimates given for this type of subsidy programme do not reflect many factors. The whole supply side is not considered. Thus the general

equilibrium effects of the programme on the economy should be evaluated. In particular, a producer subsidy increases farm income and demand. If much of the increased demand is met by the larger producers, part of the subsidy might be defrayed by higher tax receipts. Also, if food is domestically produced, then farmers (producers) and those involved in transportation and distribution will also benefit both from the increased volume and higher prices. If the additional food is to be imported, then effects on balance of payments must be evaluated.

The whole supply side merits careful analysis but for the moment we return to the programme *per se*. For making comparisons with other programmes the actual implementation and administrative cost should be included. Cost may be reduced by appropriate targeting of the programme. This may be done in three ways:

(a) Regional variations—Foods which have lower local costs (due to transportation differentials for example) should be given higher weight in the choice process. In the North West Frontier Province pulses follow a different consumption pattern and might be an efficient protein source in this region.

(b) Seasonal Variations—Before harvest time is a particularly trying period for the poor. Again, modification of the programme to reflect his "enforced" change in consumption patterns would be desirable.

(c) Quality effects—Recent analysis indicates that as income increases, consumers show a strong tendency to purchase higher priced varieties of foods. This offers certain possibilities for focussing programmes by subsidising only low price varieties.

For beef the approach might be to limit the price of "cheaper cuts" (varieties favoured by the poor) and let producers make appropriate profits by increasing the price of other cuts. A lot of beef production is simply a complement to energy power needs or milk production, so that, allowing the price of some cuts to rise to market clearing levels would effectively reduce these power costs. Currently all beef prices are held to about Rs. 7.50 per seer. This policy would need careful investigation of where each income group's supply comes from in order to account for different unit prices, as in many areas people traditionally do not choose different cuts. Yet prices paid for beef in 1971-72 [4] indicate variations of as much as 3 to 1 in unit costs.

To improve cost-effectiveness of wheat subsidies, one might consider subsidies to lower priced varieties only. One mechanism would be that shops should have adequate supplies of lowest priced varieties on hand. Failing this, they could be required to sell the next higher priced variety at the bottom price. This would entail essentially monpoly control by government over the complete supply system. In addition, one needs to evaluate a number of general equilibrium effects, including the impact on processing, transportation, and distribution.

An estimate of cost-effectiveness by focussing can be obtained by considering the parameter Q/Q_1. If one could focus completely, i.e., by checking

that the only ones getting the susidized food belong to the target group then Q/Q_i would approach 1. However, the administrative costs rise sharply either because of the need for special outlets or some type of certification scheme. Thus one might consider some form of means test or a medical test. This latter might be done in conjunction with the Mother and Child Health centres. Similarly the gains obtained by subsidizing only at certain seasons involve costs.

A nutrition programme is primarily directed towards nutrition goals and yet people do not "demand" nutrients. Changes in nutrient intake are effected by changes in food intake. So far, we have analysed the cost per unit of increasing the intake of a given food by the low income group. This may now be converted to change in nutrient intake. Let a unit of food contain the following quantities of nutrients, t_i:

$$t_i = (t_{i1}, \ t_{i2}, \ \ldots, \ t_{ik})$$

where t_{ij} is the number of units of nutrient j in one unit of food i. The cost per unit of increasing a nutrient j in the intake of the low income group by subsidizing food i is given by:

$$S_{ij} = \frac{p_i Q}{t_{ij} n_{p1} Q_1} \left[1 + q_i' \frac{n_p}{np_1} \right] \left[1 + \frac{n_p}{\varepsilon} \right].$$

Some typical cost estimates are given in Table 7 using 1975 prices. Again, wheat seems to be one of the better commodities to use to increase nutrient intake but pulses certainly warrant consideration for both calories and protein.

Table 7

Cost Estimates Increased Nutrient Intake by General Food Subsidy

Food	Commodity Price (Rupees/ 100 grms.)	s_1/100 grms.	Increased nutrient[1] in Low Income Group per rupee		
			Calories	Protein (grms.)	Calcium (mgs.)
Wheat	.17	2.78	131	3.6	31.4
Rice	.25	4.14	86	1.7	5.8
Pulses	.25	2.52	143	8.4	56
Milk	.32	1.62	35	2.0	72
V. Ghee	2.78	7.15	49	0.2	0.2
Beef	.75	3.28	39	7.0	4.9
Mutton	1.34	14.6	14	1.3	10.1

Note: [1]Nutrient content is based on values given by [1].

Food Fortification

The intake of many nutrients many be increased by fortifying a suitable carrier. If this is technically feasible and a suitable point of intervention may be devised, e.g., for salt or sugar if there are only a few supply sources, then one should compare costs. Thus if the cost of fortifying a unit of food i is v_{ij} per unit of nutrient j, and if the low income group consumes Q_1/Q of that food, then the cost per unit of nutrient delivered to the group is c_{ij}:

$$c_{ij} = v_{ij}Q/Q_1.$$

This then serves as a basis for comparison with the direct subsidy approach. For example to "deliver" calcium a direct subsidy to wheat costs 3.03 rupees per 100 mgs. while the fortification approach would cost 2.50 v_{ij} where v_{ij} is the cost of adding 100 mgs. to a unit (100 gms.) of wheat. A typical estimate for v_{ij} is about 1 percent of the price. So that, if calcium deficiency alone is the problem, a fortification programme is considerably more cost effective.

Income Transfer

Income transfer may also be used to increase nutrient intake. This method is particularly desirable if a large share of the income increase goes to purchasing additional nutrients. Some estimates of "expenditure elasticities for nutrients" are given in Table 8.

Table 8

Expenditure Elasticities for Nutrients

Nutrient Expenditure Elasticity	Calories	Animal Protein	Veg. Protein
All income groups	.24	.63	.15
Rural low income groups	.41	2.41	.24

If we consider average per capita caloric intake of the low income rural group as 2000 per day, than a 1 percent expenditure increase will produce an increase of about 8.2 calories per day or about 250 calories per month. This would cost about 0.50 rupees per month at 1974-75 expenditure levels. These were of the order 50 rupees per capita per month for low income rural groups. This may be compared with the direct subsidy approach where a similar increase via general wheat subsidy would cost 250/131 = 1.91 rupees per capita per month (using 1974 wheat flour retail prices). This does not include administrative costs.

Again, if the programme can be focussed towards the more deserving groups, income supplement may be a far more cost effective way to increase nutrient intake. In urban areas focussing may be done by a ration shop

system. In rural areas it is some what more difficult. One approach to focussing is to use some form of food coupon system. Since food coupons can only be used for food they induce the consumers to increase food intake. There are many schemes which may be adopted, but usually food coupons would require some form of means test. This would be difficult to implement in urban areas but one possibility that merits consideration is to use ownership of land as a criterion for rural areas. Currently, ration shops tend to be more readily available in urban areas so a food coupon system might serve as a suitable complement for rural areas. Another practical problem which seems to arise with ration shops is that users often complain about adulteration of supplies, incidence of vermin, etc. If people had coupons which could be traded at any outlet, they could exercise some discretion in making purchases.

Conclusion

A number of policy alternatives are proposed for consumption and nutrition planning. Before implementing any of these one must adequately weight the relevant institutional and socio-political factors. The analysis addressed in this paper is primarily economic and even this should be extended to include general equilibrium effects. Moreover, it should be stressed that the analysis relies heavily on estimates. The following four observations may be made:

(1) For a general food subsidy, the better foods are wheat, rice, and pulses, but the costs are quite high largely due to the low elasticities for these foods.

(2) Focussing on a target group will lower the food costs of a programme but the administrative costs will rise.

(3) For increasing caloric intake, a straight income supplement to low income groups achieves at least the same cost effectiveness as a wheat subsidy. The relative administrative costs need to be considered.

(4) Food coupons warrant consideration as a means to reach the rural landless poor and also to introduce an element of competition. This latter might be a means to reducing some of the abuses of ration shops.

A general equilibrium framework would give a better indication of any large scale subsidy programme. In particular, the increased effective demand generates a feedback effect which produces more income earning opportunities and also may generate additional government revenue to help defray part of the cost.

References

1. Chughtai, M.I.D. and A. Waheed Khan. *Nutritive Value of Food-Stuffs and Planning of Satisfactory Diets in Pakistan.* (Lahore: Punjab University. 1960).

2. McCarthy, F.D. *Nutrition, Food and Prices in Pakistan.* (Cambridge, Mass: Discussion Paper No. 4. M.I.T., International Nutrition Planning Programme).

3. Naseem, S.M. "Mass Poverty in Pakistan: Some Preliminary Findings". *The Pakistan Development Review.* Vol. XII, No. 4. Winter 1973.

4. Pakistan. Statistics Division. *Household Income and Expenditure Surveys 1968-1972.*

5. Pakistan. Statistics Division. *Key Economic Indicators.* November 1975.

6. Reutlinger and Selowsky. *Malnutrition and Poverty: Magnitude and Target Group-Oriented Policies.* (Mimeographed). (Washington: World Bank. April 1975).

7. Sato, K. "Additive Utility Functions for Double-Log Consumer Demand Functions." *Journal of Political Economy.* January-February 1972.