FOOD PEOPLE EAT: THE ENERGY ECONOMICS OF INJERA AND WOT

Bereket Kebede

I. INTRODUCTION

Injera and *wot* are two very important traditional foods in Ethiopia. While *injera* is a round pancake, *wot* is a traditional Ethiopian stew. *Injera* and *wot* are consumed by millions of Ethiopians (both in urban and rural areas) being, in many cases, the most important food items. The two or three meals eaten a day are usually meals of *injera* and *wot*. Except for a small amount of *injera* and *wot* that is sold in hotels and in markets, these food items are largely produced and consumed inside households. A study of *injera* and *wot* will help much in understanding:

a) the nutritional status of a large proportion of the Ethiopian population;
b) the amount of labour energy expended in food preparation; and
c) issues related to fuel energy used in food preparation.

This paper tries to address these problems on the basis of data collected from a rural village between the towns of Debre Zeit and Mojo as part of a research project funded by the Swedish Agency for Research Co-operation with Developing Countries (SAREC) through the Institute of Development Research (IDR) of Addis Ababa University. The village, Sirbana Godeti by name, is about 15 km south-east of Debre Zeit and had 1,026 inhabitants living in 173 households as of February 1990. It is located in the Yerer and Kereyu *awraja* (in the formerly Ada *wereda*) which is well-known for its high quality *teff*. The proximity of the two relatively big urban centres (which serve as important markets for the peasants of the village), the high quality *teff* produced and sold by the peasants and the fact that the village is besides the major highway connecting Addis Ababa and Dire Dawa and the railway line linking the capital with Djibouti make the region definitely one of the richest rural areas of the country. It is part of the grain-plough culture, ox being the most important source of traction for ploughing.

Since ox is a more important constraint in farming compared to land, the number of oxen owned by the households in the village was taken as a criterion for dividing them into four different strata: those with no oxen (but may or may not have land) are the very poor (35.2 per cent); those with only one ox are the poor (11 per cent); those with a pair of oxen are the middle peasants (43.4 per cent); and those with more than a pair of oxen are the rich peasants (10.4 per cent). As a sample, twelve households were selected: two from the very poor, one from the poor, five from the middle and four from the rich.

A set of structured questionnaires were used to collect data. Of this two major questionnaires were administered to each household in the sample on a weekly basis all year round (from May 1990 to April 1991). One was used to record the amount of food items prepared in a week and the other to record labour expenditures in all types of activities (house work, agricultural and other activities). The information gathered in this way served as the basis for estimating the total amount of food prepared and the total labour expenditure in the village.

II. THE INPUT COEFFICIENTS

To determine the amount of material and labour, enumerators recorded inputs used in the preparation of a single *injera* and *dist*[1] of *wot* in each of the sample households. The average of each input for the sample was taken as the standard and this was further reduced to input coefficients for producing one *injera* or one *dist* of *wot*.

In Sirbana and Godeti, *injera* is made of *teff* flour most of the time. But in some instances, it is made of wheat, sorghum, or of a mix of these with *teff*. On the average, one *injera* contains 0.2 kg of flour and needs 0.22 litres of water for mixing the flour before baking it. On the other hand, the important ingredients in *wot* are red pepper, onions, *shiro* (peas/beans flour), oil, salt, spices and water. In the more affluent households and during major holidays among the less fortunate, meat and butter are also used. On the average, a *dist* of *wot* contains 0.065 litre of red pepper, 0.33 kg of *shiro*, 0.3 kg of onions, 0.045 kg of salt, 0.025 litres. of oil, 0.02 kg of spices and 1.7 litres of water.

But in addition to the materials that constitute *injera* and *wot*, "cultural energy" in the form of fuel and human labour is needed. This energy is not actually conserved inside *injera* and *wot* directly consumed by humans but "most is ultimately dissipated into the environment as heat, not transformed into harvestable energy" [Heichel: p.3].

In Sirbana and Godeti, *injera* and *wot* are prepared by using dung cakes, fuel-wood, twigs, collected dung and stalks of crops (maize, beans, etc.) as fuel. Only in around 10 per cent of the households is kerosine sometimes used for *wot* preparation (which is relatively high compared to other rural areas). Since almost all *injera* baking and *wot* cooking are made by using open fire stoves, the efficiency is as low as 8.5 per cent [CESEN 1986:45], implying that more than 90 per cent of the energy from fuel is not directly used for cooking (even though it may have supplementary functions like lighting, killing bugs, etc.).

Different types of fuel are used for baking *injera*: dung cakes, stalks of different crops, wood, twigs, etc. On the average, 1,594 Kcal of fuel is needed for an *injera*. Cooking one *dist* of *wot*, on the other hand, needs fuel equivalent to 2.0 kg of dung cakes and 1.2 kg of twigs. In energy units this equals to 10,800 Kcal of fuel. In addition to the fact that these figures are averages, there could be variations in amount of fuel use depending on the following:

a) Type of fuel: Since different materials have different energy contents, the amount of fuel needed for the same purpose differs. The availability of different types of fuel changes depending on the seasons. For instance, households will have abundant agri-residue in the harvesting season.

b) Utensil efficiencies: If some households use more energy-efficient cooking utensils, the energy needed to do something could be less. For instance, people using metal *dist* for *wot* cooking need less amount of fuel than those using clay ones.

c) Moisture content: The moisture content of the same type of fuel may differ among households and in different seasons. For instance, richer households with many heads of cattle can prepare more dung cakes than poorer ones, and may have a longer period of time for drying them. Hence, the moisture content of their dung cakes could be lower, and more useful energy can be derived. In addition, the moisture content of some fuels will differ in the dry and wet seasons.

Labour expended in *injera* and *wot* preparation is the other form of cultural energy. The direct labour requirements in *injera* preparation are for mixing the flour and baking the *injera*. While mixing the flour for one *injera* needs 0.3 minutes, baking it requires 4 minutes. The total average labour energy needed for *injera* preparation is 6.87 Kcal.[2] In contrast, a *dist* of *wot* requires 74 minutes of labour which translates to 111 Kcal of labour energy.[3]

III. TOTAL INPUTS AND OUTPUTS AND SEASONAL VARIATION

To estimate the total amount of *injera* and *wot* prepared by all households in the village in a year, the sample stratum averages were calculated and then multiplied by the total number of households in each stratum. And by using the input coefficients described above, the amount of total inputs that are required to produce them were estimated. The total amounts of *injera* and *wot* produced and the corresponding amounts of inputs needed are summarised in Tables 1 and 2.

Table 1: Estimated Total Injera Baked and Total Inputs Used by Strata
(May 1990 to April 1991)

	Very poor	Poor	Middle	Rich	Total
1) *Injera* (no.)	74,969	47,595	478,950	118,278	719,792
2) Amount of flour (kg)	14,994	9,519	95,790	23,656	143,959
3) Amount of water (litres)	16,493	10,470	105,369	26,021	158,353
4) Fuel (Mcal)	119,501	75,866	763,446	188,535	1,147,348
5) Labour for mixing flour (Mcal)	65.2	41.4	416.7	102.9	626.2
6) Labour for baking (Mcal)	449.8	285.6	2,873.7	709.7	4,318.8

Table 2: Estimated Amount of Wot Cooked and Total Inputs Used) by Strata (May 1990 to April 1991)

	Very poor	Poor	Middle	Rich	Total
1) *Wot* in the year (*dist*)	15,433	10,906	50,700	13,806	90,845
2) Red pepper (kg)	1,031	709	3,296	897	5,905
3) Onions (kg)	4,630	3,272	15,210	4,142	27,254
4) *Shiro* (kg)	5,093	3,599	16,731	4,556	299,979
5) Salt (kg)	694	491	2,282	621	4,088
6) Spice (kg)	309	218	1,014	276	1,817
7) Oil (litres)	386	273	1,268	345	2,272
8) Water (litres)	26,236	18,540	86,190	23,470	154,436
9) Fuel (Mcal)	166,676	117,785	547,560	149,105	981,126
10) Labour (Mcal)	1,713	1,211	5,628	1,532	10,084

As can be observed from the two tables, the preparation of *injera* and *wot* in the households is a task that consumes a large amount of material and energy. For instance, the preparation of *injera* and *wot* in the year required more than 1,400 quintals of flour, more than 400,000 litres of water, more than 2 million Mcal of fuel and more than 15,000 Mcal of labour in the village. Imagining the total amount of material and energy in *injera* and *wot* preparation in the whole country will obviously give us a picture of a gigantic "sector" greater than many an industry.

In addition, most of the inputs (fuel, water, labour, etc.) are not either sold and bought at the market or taken care of in a national income accounting system. Hence, the usually quoted national income and per capita figures can not be very reliable in showing the overall economic profile of households as long as they ignore a large amount of flow of materials and energy in housework (which includes the preparation of *injera* and *wot*).

To examine seasonal variations in *injera* and *wot* preparation, coefficients of variation for *injera* and *wot* prepared by each sample household in each month were calculated, and except for one, all the coefficients were below 45 per cent. This shows that the preparation of *injera* and *wot* does not vary very much with the seasons, implying that at peak agricultural seasons when women help in agricultural activities they basically take extra burden without any respite in housework.

IV. NUTRITIONAL VALUE OF INJERA AND WOT

To estimate the nutritional value of *injera* and *wot*, the input coefficients for the materials that constitute them were used. The amount of each ingredient was multiplied by its energy content and the results were summed giving the total energy from an *injera* and a *dist* of *wot*. It was found that there is 669 Kcal of energy per *injera* and 2,884 Kcal per *dist* of *wot*[4]. By using these energy contents the total and per capita amount of energy that can be derived from all the *injera* and *wot* prepared in the village were computed (see Table 3).

Table 3: The Total and Daily per Capita Energy from Injera and Wot by Stratum

	Very poor	Poor	Middle	Rich	Total
1) Total energy from *injera* (Mcal)	50,154	31,841	320,418	79,128	481,541
2) Energy from *injera* per capita per day (Kcal)	446	739	1,929	1,495	1,286
3) Total energy from *wot* (Mcal)	28,026	19,805	92,071	25,072	164,974
4) Energy from *wot* per capita per day (Kcal)	249	460	554	473	441
5) Eaergy from *injera* and *wot* per capita per day (Kcal)	695	1,199	2,483	1,968	1,727

If we take total energy from *injera* and *wot* by stratum, by far the largest part is in the middle peasant households (66.5 per cent for *injera* and 55.8 per cent for *wot*). Not only is the total energy the highest in the middle peasant households but, as can be seen Table 2, the per capita daily food energy from *injera* and *wot* is also the highest in this stratum.

An important fact that can be observed from the daily per capita food energy is the fact that generally the richer the peasant household, the higher the energy it gets from *injera* and *wot*. The exception is the case of the middle and rich peasant households; the former get more eenergy than the latter. This may be due to the following reasons:

a) Scale economies enjoyed by the rich peasant households. Since the average household size of the rich (eight members) is greater than those of the middle (six members), wastage of food may have been minimized in rich households. For example, remnants from the table can be more fully utilized in a household with more number of people.

b) Preference of rich peasants for other types of food. If all the foods that are consumed are considered, the per capita food energy for the rich may be greater than the middle peasants.

If 2,500 Kcal/person is assumed as the average required daily intake of food energy, 69 per cent of this requirement is covered by *injera* and *wot* for all households in the village. This ratio is as low as 28 per cent for the very poor and as high as 99 per cent[5] for the middle peasants. The corresponding figures are 48 per cent and 79 per cent for the poor and the rich households respectively. Since the probability that very poor and poor households covering 72 per cent and 52 per cent of their food needs by other food items is remote, they most probably are undernourished.

But the above figures must be handled cautiously. They are rough figures that only indicate the general picture. If we take the average "requirement" per person per day, we can't have any single figure that accurately reflects the energy requirement for people because:

a) It is highly dependent on age and sex;
b) It depends on the amount of labour expended in work (working more needs more energy);
c) Some people may be adapted to low levels of food intake and their real daily requirements are below the usually assumed (even though they would face a greater risk of disease, infections, etc.);
d) Individuals differ in their physiological characteristics. For example, individuals have different capacities of storing and releasing energy from fat [Longhurst and Payne 1981:48]. Those that are more capable of storing fat will have the advantage of storing relatively more energy in their bodies to be used in periods of deficit. Hence, their energy requirement could be lower.

The figures in Table 3 tell us the average per capita food energy available for all members of households in different strata. But the distribution of food within the household may favour some and disfavour others. If men are favoured, energy intake of women and children among poor households will be very low.

> Maldistribution of food supplies within households may be at least as serious as that between income levels. Children and pregnant and nursing women who have the greatest nutritinnal needs in proportion to their sizes, are often left the smallest portions of food [Ehrlich, et al.,1977:303].

To identify this variation the food consumption behaviour of households must be studied.

Another important point is that the food energies indicated are amounts that are *available* for households. They are not *absorbed* amounts of food energy. The amount of food that actually absorbed is very much influenced by the incidence of diseases.

> Food that is consumed may be malabsorbed due to functional problems and rapid transit time in the gastro-intestinal tract. The child may also suffer from catabolic losses induced by infection. Through fever and other mechanisms, infection may cause body tissues to be broken down, sequestered, and excreted [Chowdhury, et al. 1981:52].

Injera and *wot* are not usually suitable food items for small children affecting their nutrition, growth and development.

> After weaning, small children in poor countries are often fed starchy, bulky foods that fill them up without supplying enough calories, protein, and other nutrients to maintain health. Poor nutrition can lead to loss of appetite, further reducing their food intakes (Ehrlich, et al. 1977:303].

All these factors affect the nutritional value of *injera* and *wot*.

V. SOME REFLECTIONS

1) As indicated above, *injera* and *wot* preparation in particular and housework in general use a large amount of the society's material, energy and labour resources. These activities basically are not recorded in traditional national income accounting systems. Since both the livelihood of the people and other economic activities depend on housework activities, it is very important to know the input coefficients. To introduce labour- and energy-saving strategies, it is imperative to know these coefficients. For example, how much fuel energy can be saved by fuel saving strategies can be known only if the present input coefficients are known. Are these strategies worth trying? Can they save a large amount of energy? Is the nutritional status of farmers a constraint to their agricultural activities? How much food do they consume? Do the peasant households have "surplus" labour that can be expended on new tasks without affecting their livelihood? All these and similar questions could be answered only if we know the input coefficients of both agricultural and housework activities. Hence, material and input coefficients in all housework activities must be knowwn to promote comprehensive rural development programmes.

2) As the energy households get from *injera* and *wot* indicates, poor people are most probably severely undernourished. Hence, nutrition improvement programmes must concentrate on the poor to get better results with a relatively smaller amount of resources. Our use of the number of oxen owned by households seems to be a suitable way of classifying peasant households in the grain-plough culture into different wealth strata and isolating those which may face undernutrition.

3) Women are dominant in *injera* and *wot* preparation and other housework activities. If researchers are interested to know about the economic role of the rural woman, they should concentrate on the household economy. The more important economic aspects of the gender issue can be examined within the household economy, which, in turn, is embedded in the overall peasant production and consumption system.

4) Studying the economics of household activities will also help to indirectly estimate agricultural output. Agricultural output reported by the peasants themselves or documented by tax-collecting authorities are usually underestimated or inaccurate. Estimates of agricultural output by taking average yield of farmland also is not precise because it does not reflect wide variations in yield that may exist. If coefficients in food preparation are known the agricultural output needed as input can be determined. If reserves and sales are added to that, most probably, it would give us a more accurate estimate of total agricultural output than other methods.

NOTES

1. *Dist* is a cooking ulensil lhal is made nf clay (the traditinnal *dist)* or metal. It is similar tn the cassernle.

2. We assumed mixing flnur requires a similar amount of energy as washing cloth (2.9 Kcal/min) and we took "energy for preparing meals" (1.5 Kcal/min) as the energy for baking *injera*. The energy requirements are from Haswell (1981, appendix).

3. We took the "energy for preparing meals" mentioned above as the energy needed for *wot* cooking. Since when women cook they also do some complementary tasks, "joint products" usually must have been "produced" with *wot*.

4. Since 0.2 kg nf flour is needed to produce an *injera* and if the energy content of cereals (3,346 Kcal/kg [CESEN1986]) is taken as the energy content of the flour, then we will have 669 Kcal of energy in an *injera*. A *dist* of *wot* contains 0.065 kg of red pepper, 0.33 kg of *shiro* (peas/beans) and 0.4 kg of other energy giving materials. If the energy contents of 1,115 Kcal/kg and 3,465 Kcal/kg (ibid.) are taken for red pepper and *shiro* and if the average energy content of lhe rest is assumed to be 1,500 Kcal/kg, the energy content of a *dist* of *wot* will be 1,816 Kcal.

5. This surprisingly high figure for middle peasant households may be due to:

   a) high level of wastage in food preparation and consumption, and/or

   h) the age structure of the middle peasant households. If most of the members of these households are able-bodied people actively participating in heavy physical tasks, the average "requirement" for the middle households may be well above 2,500 Kcal/day.

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