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# Investigation of factors affecting consumers' bread wastage

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**The aim of this paper is to investigate factors affecting bread wastage. We applied the Ordered Logit Model to cross-sectional data of Iranian households. Households were divided into three groups based on their measures of bread wastage. The results indicate that the number of visits to the bakery per week, means of going to the bakery, method of carrying bread, waiting time in the bakery, assessment of bread price and quality, monthly household income, household education, household average age, average rate of bread consumption, preference for consuming fresh bread, method of preserving bread, mother's education, mother's job, and number of household members, all influence measures of household bread wastage.**

**Key words:** Ordered Logit Model, consumption, bread wastage, Iran.

## INTRODUCTION

The world experienced a sharp increase in food prices during 2008/2009 and there has been a recent recurrence in 2011/2012 (Figure 1). The causes of these food price spikes are currently being debated among economists (Headey, 2011; Mason et al., 2011; Piesse and Thirtle, 2009) and it is particularly important to separate short-term factors (such as periodic droughts and one-time events) from long-term secular factors (such as increased incomes in emerging countries, higher population, and climate change). Once the profession sorts out the fundamental (and likely long-run) movements of food prices, policy makers can begin to make better decisions on ways to improve food availability and reduce scarcity.

Most observers believe that the world is in a new environment where food prices will be generally higher and more volatile so that recent years will be more indicative of the future. The emphasis on food security in the formulation of policies by many governments shows that there is serious concern on the future availability of grains and other basic foodstuffs to provide for healthy living. Even if these projections of higher food prices in

the future are not true, it is clear that there are some food policies that are not encouraging efficiently use of the production that takes place. There is significant pressure on governments to change policies that encourage inefficient use of food products (including food as a fuel) so that the available food supplies are consumed in the highest and best use. Some food subsidies provided by governments, particularly those that are not targeted to needy families, are under increased scrutiny because they are very costly and could promote wastage and overconsumption.

The basic idea behind subsidies for basic food items is rather simple - it allows households on very low incomes to purchase vital foods and food ingredients at affordable prices. It is a social safety net that is relatively easy to administer and effective in keeping the poorest households from severe deprivation. There are normally

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Figure 1. FAO Food Price Index, 1990-2012, Nominal and Real. Source: FAO (2012).

leakages to higher income households that are not economically stressed so there may be qualification requirements that target the subsidies to very poor families, but this is not always the case. Furthermore, highly subsidized products to very poor families could be sold to higher income families to undermine the purposes of the subsidies. These issues are important for determining food subsidy policies, but they are not relevant to the current analysis.

This study deals specifically with factors that affect bread wastage through a survey of Iranian households. Bread subsidies alone have accounted for 60% of Iranian food subsidies recently (totaling about 8 trillion rials or \$800 million) and they have a very large impact on the retail price of bread (through flour price subsidies to bakers) (Bread subsidies were eliminated in 2010, with protests by consumers. There was substantial political pressure on the Iranian government to reinstitute bread subsidies to improve food security. Currently there are cash subsidies paid to low income households). The price of bread is so low that there is an entire salvage industry that collects stale bread from households for use in animal feed and other purposes. Yet bread also accounts for 47% of the calories consumed by Iranians (Ministry of Agriculture). The objective of this paper is to investigate the effects of household socio-economic factors and demographics, bread purchasing patterns, and food culture on bread wastage.

Food wastage can take place in many ways (including the use of food in relatively low-valued forms such as animal feed or even fuel), but for the purposes of this analysis it is the discarding of food so that it is not consumed by humans. Highly subsidized food prices will

be a contributing factor because subsidies change the price of food relative to other economic factors (such as wages and preparation costs) and distort behavior toward treating food as being less valuable than other consumer products. In some countries, the price of subsistence goods (due to government subsidies) is so low that consumers do not care whether some of the products spoil and are discarded before they are consumed. The major cost involved in obtaining the product is the trip to the store (and any queuing) and that can be quite low if a child does the shopping.

This paper looks at the degree that subsidized food products, particularly subsidized bread prices in Iran, encourage all households to discard food and allow its wastage. The specific objectives are to provide evidence on bread wastage in Iran and investigate the effects of factors that increase (or reduce) bread wastage by Iranian households. The analysis also suggests ways that the government can improve bread utilization while still maintaining low bread prices for the poor.

Wheat, as the main food for half of the world's population, is vitally important as a food source. This crop is cultivated for bread, animal feed, and industrial consumption throughout the world. For Iran, wheat is considered the most important food crop and nutrient; it accounts for more cultivated area and consumption than any other food product. The Research Planning Institute estimates that Iran needs almost 12 million tons of wheat per year to fulfill normal consumer needs (Ministry of Agriculture). Iran has been able to produce a large amount of wheat by increasing its yields, but many experts believe that wheat consumption will outpace production in the long run. Thus, it is likely that Iran will need to import wheat in the future and use precious hard

currency in order to pay for these imports. This puts increasing pressure to investigate ways to use wheat more efficiently and to reduce wastage, especially bread waste. Thus, this study investigates factors that affect bread wastage in the consumption process.

## BACKGROUND

Bread wastage in Iran has been extensively investigated in the literature; however, most studies concentrate on the technical features of bread production, such as dough preparation, gluten percentage, cooking times, oven efficiencies, etc. Descriptive research methods are usually applied to investigate socio-economic factors affecting bread wastage (Abedi-Shapoorabadi, 2005; Azizi, 2004; Irani, 2004; Irani and Yazdi-Samadi, 2005; Zarei and Shekarforush, 2004; Azadbakht et al., 2007). The two studies most related to this research are Aykut et al. (2003) and Abedi-Shapoorabadi (1996).

Aykut et al. (2003) studied the effects of major socio-economic characteristics of households on bread consumption and bread wastage in urban areas of Adana province, Turkey. They found that 4.45 loaves of bread were consumed per household per day, while 4.65 loaves were purchased per household per day. As household income increases, the amount of bread consumption decreases, as is expected, indicating that bread is an inferior good. They found that the average rate of daily bread wastage of the households analyzed was 9.63%. Bread wastage was highest in the highest income group and smallest in the lowest income group.

Abedi-Shapoorabadi (1996) studied factors affecting the amount of bread waste using a multivariate linear model for one province in Iran. He found that the number of people purchasing bread, number of times of going to the bakery, time spent buying bread, and education level of household head were the most important factors affecting bread wastage. These are some of the variables that are used in the present study.

## METHODOLOGY

Bread wastage is not readily observable and there is no credible government data; thus a household survey is the only reasonable approach to address the study objectives. The literature on bread wastage in Iran was reviewed (there is an extensive literature because of the long-running bread subsidies) to determine variables that should be included in the survey. A team of scientists (including economists, other social scientists, and food scientists), government officials, and bakers also met to construct the survey and make sure that all the relevant factors influencing bread wastage were included in the survey. Households and bakers in Mashhad, Iran were also interviewed to make sure that the survey was comprehensive and useful for the analysis.

The population variance associated with bread wastage was unknown so the necessary sample size could not be determined *a priori*. The survey was pilot tested with 160 households and the results from that pilot were used to estimate the population variance. This variance estimate was inserted into the formula for optimal sample size (1,409 in this case) in order to determine the number of households that were surveyed (Gujarati, 1987). The sample was drawn from a simple random sampling of 1409 Iranian households in 2008 from all of the major cities in Iran. Students were sent throughout the country (after they were trained regarding the survey and interview techniques) to conduct the interviews in person.

The survey was constructed with intervals for bread wastage because household members have a difficult time in providing an exact number for wastage, but are comfortable in assigning the wastage within an interval. The survey found that 65% of Iranian households wasted more than 200 g of bread per capita per week; 13% of households had per capita bread wastage of more than 1.83 kg (a very large number).

Nearly one-half (48%) of the Iranian respondents felt that their bread wastage was in the lower two categories, though. They know about the market for stale bread, though, with 62% saying that they sell their wasted bread.

Iranians love fresh bread and 44% of the respondents said their bread had to be very fresh (44% said they did not care much).

Almost 75% of bread buyers walked to the bakery and 68% said the bakery was close (on average within six minutes for them). Those who said the bakery was close visited the bakery more than five times per week. The rest of the respondents said the bakery was distant and it took them an average of seventeen minutes to get to the bakery. They still visited the bakery an average of four times per week.

Most respondents (74%) believed that the quality of bread is in the lowest category. A little more than one-half of the respondents (53%) believed that the poor bread quality is the reason for bread wastage and 31% said the only way to reduce bread wastage is to increase bread quality.

There seems to be a mismatch between the bread that Iranians want (the traditional thin bread) and the thick bread (that is soft in the middle) that is supplied by most bakeries.

Sixty percent of households purchase the thick bread, while 45% of households report they cannot get the type of bread they desire. Less than 10% of the respondents thought that the price of bread was too low.

The investigation of the factors that have impact on household bread wastage is a classic case of an Ordered Logit Model. The Ordered Logit Model assumes that there is a continuous process explaining an unknown variable  $y$  to independent variables  $x$  by some function. In the logit model, additive error terms are used, so that the underlying process is given by:

$$y_i^* = \beta' x_i + \varepsilon_i, \quad -\infty < y_i^* < +\infty_i \quad (1)$$

where  $y_i^*$  is a continuous variable of per capita bread waste, the  $\beta$ s are parameters to be estimated,  $x_i$  is vector of independent variables indicating characteristics of household  $i$ , and  $\varepsilon_i$  is the disturbance term, assumed to be independent across observations;  $y_i^*$  can take any value and the subscript  $i$  refers to the household number. Remember that  $y_i^*$  is not observable so standard regression techniques are not suitable for estimation. If the observed variable  $y_i$  is given in ordered classes (1, 2, ..., J), the relation between  $y_i$  and  $y_i^*$  is that adjacent intervals of  $y_i^*$  correspond with qualitative information  $y_i$ . This relation is given by:

$$\begin{aligned} y_i = 1 & \quad \text{if} \quad -\infty \leq y_i^* < \mu_1, & i = 1, \dots, n, \\ y_i = 2 & \quad \text{if} \quad \mu_1 \leq y_i^* < \mu_2, & i = 1, \dots, n, \\ y_i = 3 & \quad \text{if} \quad \mu_2 \leq y_i^* < \mu_3, & i = 1, \dots, n, \\ \dots & \quad \dots & \dots \\ y_i = J & \quad \text{if} \quad \mu_{J-1} \leq y_i^* < +\infty, & i = 1, \dots, n \end{aligned} \quad (2)$$

Parameters  $\beta$  and the thresholds  $\mu(\mu_1, \dots, \mu_{J-1})$  are simultaneously estimated using the maximum likelihood method, which maximizes the probability of correct classifications. We calculate the probability (Pr) that  $y_i = J$  by:

$$\begin{aligned} \text{Pr}(y_i = J) &= \text{Pr}(y_i \geq \mu_{J-1}) = \text{Pr}(\varepsilon_i \geq \mu_{J-1} - \beta' x_i) \\ &= F(\beta' x_i - \mu_{J-1}) \end{aligned}$$

To meet the requirements of a probability model (monotonic-increasing CDF with results lying between 0 and 1), the disturbances  $\varepsilon_i$  are assumed to possess a logistic distribution, leading to a cumulative logistic transformation function L. This function maps the admissible area of  $y_i^*$ , that is,  $(-\infty, +\infty)$  to  $[0, 1]$ , with a first derivative that is always positive (Sonneveld and Dent, 2007). This model is defined as the following:

$$\log \left[ \frac{\gamma_j(x_i)}{1 - \gamma_j(x_i)} \right] = \mu_j - [\beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_k x_{ik}] \quad j = 1, \dots, J; i = 1, \dots, n$$

Where  $\gamma_j$  is cumulative probability, that is,  $\gamma_j(x_i) = \gamma(\mu_j - \beta' x_i) = P(y_i \leq j | x_i)$ . Estimation of

parameters in this model should meet the regression hypothesis.

Interpretation of the coefficient in the Ordered Logit Model is not direct; hence, in order to interpret them, the marginal effects were used. Marginal effect of one unit variation in  $x_k$  on probability of group  $j$  is:

$$\begin{aligned} \frac{\partial P(y_i = j | x_i)}{\partial x_k} &= \left[ \frac{\partial \gamma(\mu_j - \beta' x_i)}{\partial x_k} - \frac{\partial \gamma(\mu_{j-1} - \beta' x_i)}{\partial x_k} \right] \\ &= [\lambda(\mu_{j-1} - \beta' x_i) - \lambda(\mu_j - \beta' x_i)] \beta_k \end{aligned}$$

Where  $\lambda_j(x_i) = \frac{\partial \gamma_j(x_i)}{\partial x_k}$ ,  $\mu_0 = -\infty$  and  $\mu_j = +\infty$ . It is

necessary to mention that marginal effect for a binary variable is calculated indirectly and it is equal to the difference between the probabilities of two possible states.

## RESULTS

As mentioned earlier, this study applies the Ordered Logit Model to determine effective factors on the level of household bread wastage. Table 1 shows the variables included, their definition and their expected influence on bread wastage. The SPSS 11.5 software package was used to estimate the Ordered Logit Model. Preliminary data analysis indicated that average per capita bread waste of Iranian households varied widely among household groups. The Tukey HSD test was used to divide households into three groups based on their per capita bread waste measures. The groups are: low and middle (Group 1), high (Group 2), and very high (Group 3), and households are divided into these three categories.

The results of applying the Ordered Logit Model to investigate the effective factors on a household in each of these three groups are presented in Table 2. The Wald statistic for each coefficient is used to judge significance for coefficients with an Ordered Logit Model. Based on  $R^2$  pseudo statistics, it can be seen that the estimated Ordered Logit Model is a suitable regression and that the independent variables of the model explain the variation in bread wastage from different household groups. Moreover, the model predicts the correct category for bread wastage 71% of the time, indicating that it has good forecasting ability. In addition, the results of the parallel regression shown in Table 3 specify that the assumption of proportional odds among the three groups is valid. The Pearson and Deviance goodness of fit measures show no ill-fitting tendencies in the model (Table 4). Hence, based on all of these criteria, this model is appropriate and trustworthy.

It is clear from Table 2 that the means of going to the bakery, the method of carrying bread, the number of

**Table 1.** Definition of applied variables in the Ordered Logit Model.

Variable	Definition	Expected sign
Bread purchaser	Cooperation=1; individual=0	-
Distance to the bakery	Far and average=1; near=0	+
Means of going to the bakery	Walking=1; a vehicle=0	+
Method of carrying bread	On hand=1; with a basket, cloth=0	+
Cool bread after purchasing?	Yes=1; No=0	+
Number of household members	(continuous)	-/+
Number of trips to the bakery per week	(continuous)	-/+
Frequency of eating bread per week	(continuous)	-
Preference for fresh bread	Low and middle =1; high =0	-
Purchase more than daily need?	Yes=1; No=0	+
Method of preserving bread	In refrigerator and freezer=1; other=0	-
Waiting time at bakery	(continuous) minute	+
Assessment of bread quality	Good=1; middle and weak=0	-
Assessment of bread price	Low=1; middle and high=0	+
Assessment of bread's salvage value	Middle and high=1; low=0	+
Monthly household income	(continuous) 100,000 Rial	+
Education level for household head	Illiterate=0; elementary=1; guidance=2; diploma=3;	-
Mother's education	upper diploma=4; license=5; master=6; PhD=7	-
Mother's job	Housekeeper=1; employer=0	-
Average household age	(continuous) year	-/+
Average rate of food consumption	(continuous)	-/+
Average rate of bread consumption	(continuous)	-/+
Household bread waste	Middle-low=1; high=2; very high=3	-/+

**Table 2.** Results of the Ordered Logit Model.

Variable	Coefficient	Standard error	Wald
Bread purchaser	-0.4038**	0.281	2.059
Distance to the bakery	0.1598	0.222	0.518
Means of going to the bakery	0.2316*	0.237	0.960
Method of carrying bread	0.3231***	0.2	2.611
Cool bread after purchasing	-0.0396	0.216	0.034
Number of household members	-0.3279****	0.076	18.691
Number of trips to the bakery per week	0.1266****	0.036	12.286
Frequency of eating bread per week	0.0016	0.016	0.010
Preference for fresh bread	-0.2627*	0.204	1.651
Purchase more than daily need?	0.1270	0.205	0.384
Method of preserving bread	-0.2294*	0.197	1.351
Waiting time at bakery	0.0163****	0.006	7.274
Assessment of bread quality	-0.4538***	0.241	3.556
Assessment of bread price	0.6607****	0.231	8.170
Assessment of bread's salvage value	0.3479**	0.19	3.358
Per month income of household	0.0035*	0.003	1.016
Education level for household head	0.1350**	0.084	2.594
Mother's education	-0.3682****	0.104	12.555
Mother's job	-0.6257***	0.286	4.786
Average household age	0.0126*	0.012	1.168
Average rate of food consumption	-0.9928***	0.437	5.150

**Table 2 Contd.**

Average rate of bread consumption	2.7080 <sup>***</sup>	1.32	4.209
Percentage of right prediction		70.25%	
<b>Pseudo R-Square (Alternatives of Pseudo R-Square recommended by Ben Akiva and Lerman (1985) and Pai and Saleh (2008))</b>			
Cox and Snell		0.16	
Nagelkerke		0.19	
McFadden		0.11	

Dependent variable: Ordered variable household bread waste groups. <sup>\*\*\*\*</sup>Significantly different from zero at the 1% level; <sup>\*\*\*</sup>Significantly different from zero at the 5% level; <sup>\*\*</sup>Significantly different from zero at the 10% level; <sup>†</sup>t-ratio is greater than 1.0.

**Table 3.** Results of parallel regression test.

Model	-2 Log Likelihood	Chi-Square	Level of significance
Current model	886.683	20.349	0.561
General model	866.334		

**Table 4.** Indices of goodness of fit.

Criterion	Chi-Square	Level of significance
Pearson	1162.989	0.601
Deviance	886.683	1.000

visits to the bakery per week, the waiting time in the bakery, the assessment of bread price, monthly household income, education level for the head of household, average age of household, and the average rate of bread consumption positively affect household bread waste. In other words, increasing these independent variables increase the probability that a household will be in the higher bread waste groups. Furthermore, preference for consuming fresh bread, method of preserving bread, assessment of bread quality, the mother's education level, the number of household members, the mother's job and the average rate of food consumption negatively affect household bread waste. In other words, increasing these independent variables increases the probability of embedding households in the lower bread waste group. As stated earlier, interpretation of coefficients for the Ordered Logit Model is not possible. Hence, it is necessary to estimate marginal effects, which are reported in Table 5 for this model. The marginal effects of the Ordered Logit Model show that walking to the bakeries - instead of using a vehicle - carrying bread by hand and without a cover, increasing the number of trips to the bakery per week, increasing waiting time at the bakery, high preference for consuming fresh bread,

low assessment of bread price, increasing monthly household income, increasing the education level of the household head, increasing the average age of the household, and increasing the rate of bread consumption, all decrease the probability of including a household in the low-middle waste bread group (or increase the probability of placing a household in the high and very high waste groups).

Based on the results of this study, cooperation in bread purchasing, preserving bread in a refrigerator, good assessment of consumption bread quality, increasing the mother's education, increasing the number of household members, having the mother as housekeeper, and increasing the average rate of food consumption all increase the probability of placing a household in the low-middle waste bread group. On the other hand, these variables decrease the probability of including a household in the high and very high waste groups.

When there is only one purchaser of bread, the household reduces the number of trips to the bakery and purchases more bread per trip. This decreases the probability of including the household in the low-middle bread waste group. Walking to the bakery increases the probability of including the household in the high and very

**Table 5.** Marginal effects of the three groups of households in terms of their bread waste.

Variable	Marginal effect of Group 1	Marginal effect of Group 2	Marginal effect of Group 3
Bread purchaser	0.0877	-0.0479	-0.0398
Distance to bakery	0.0319	-0.0146	-0.0172
Means of going to the bakery	-0.0650	0.0324	0.0326
Cool bread after purchasing?	0.0469	-0.0220	-0.0248
Method of carrying bread	-0.0829	0.0392	0.0436
Number of trips to the bakery per week	-0.0271	0.0141	0.0130
Preference for fresh bread	0.1357	-0.0588	-0.0770
Method of preserving bread	0.1163	-0.0600	-0.0563
Waiting time in the bakery	-0.0035	0.0018	0.0017
Assessment of bread quality	0.1114	-0.0566	-0.0548
Assessment of bread price	-0.1291	0.0554	0.0738
Assessment of bread's salvage value	-0.0607	0.0318	0.0289
Monthly household income	-0.0007	0.0003	0.0004
Education level for household head	-0.0289	0.0151	0.0138
Mother's education	0.0789	-0.0411	-0.0378
Mother's job	0.0143	-0.0020	-0.0122
Number of household members	0.0703	-0.0366	-0.0336
Average household age	-0.0027	0.0014	0.0013
Average rate of food consumption	0.2127	-0.1109	-0.1018
Average rate of bread consumption	-0.5803	0.3026	0.2777

high bread waste groups because people do not like walking, so they try to buy bread from the nearest bakery without paying attention to the taste and quality of bread. If the bread is not good, it is more likely to be discarded. Carrying bread in a basket, cloth, or other container increases the probability of including a household in the low-middle bread waste group because these containers maintain the quality of bread.

Increasing the number of trips to the bakery each week increases the probability of a household that is in the high and very high bread waste groups because Iranians usually buy more bread than their daily need. They prefer to eat fresh bread, so if they go to the bakery often, they are more likely to discard older bread, bringing about more waste. Preserving bread in the refrigerator increases the probability of including a household in the middle-low bread waste group and decreases the probability of including the household in the high and very high bread waste groups because refrigeration decreases bacteria activity and preserves bread quality. Increased waiting time at the bakery encourages households to buy more bread than their daily need, resulting in an increased probability that the household is in the high and very high bread waste groups.

If the household views the price of bread as low, due to the subsidy or other reasons, there is an increased probability that the household will be in the high or very high bread wastage groups. A low salvage value for

bread reduces the opportunity cost of waste and therefore, increases the probability of including a household in the high and very high bread wastage groups. As illustrated in Table 5, increasing the per capita income of a household reduces the real value of bread, so the household does not pay sufficient attention to use bread efficiently; this leads to a decreasing probability of including the household in the middle-low bread wastage group.

Higher education for the household head brings about more discriminating attitudes to bread quality and its nutrient values. Higher education also increases per capita household income. Consequently, these factors increase the probability of including the household in the high and very high bread waste groups and decrease the probability of including it in the middle-low bread waste group. Due to the managerial role of the mother, this situation is reverse in the case of the mother's education level; a more highly educated mother reduces bread wastage. However, mothers employed outside the home do not have as much time to manage and administer their home environment, which increases the probability of including a household in the high and very high bread waste groups.

Increasing the number of household members increases the probability of including it in the middle-low bread wastage group. This may be because larger households are more traditional and they place a higher

intrinsic value on bread. They also have more children and they might be able to find more ways to make bread consumption appealing to kids. Finally, they are more likely to have a lower per capita income, making them more cognizant of bread wastage.

Increasing the average household age decreases the probability of including a household in the middle-low bread wastage group, and increases the probability of including a household in the high and very high bread wastage groups. Households with older adults have many problems with buying bread so they might purchase more bread during each visit to the bakery, but they also have more problems in eating stale bread.

Lastly, increasing the average rate of food consumption increases the probability of including a household in the middle-low bread wastage group on the grounds that these type of households typically have a lower level of per capita income and spend more of their income on food. Increasing the average rate of bread consumption decreases the probability of including a household in the middle-low bread wastage group and increases the probability of including them in the high and very high bread wastage groups since they consume more bread and produce more bread waste.

## Conclusions

This study finds that there is significant bread wastage by Iranian households, which is not surprising given the highly subsidized price for bread. Such a low bread price encourages consumers to waste it and also discourages bakers from providing high quality bread. This encourages high levels of bread wastage. The Iranian government may find it difficult to increase bread prices much because of the need to improve food security for the poor. Bread wastage is not a problem with low income consumers; it is much higher for households with more education and higher incomes. Higher income, more educated households realize that bread quality (and nutritive value) can deteriorate quickly over time so they buy bread more often and discard bread more readily. They readily provide their stale bread to recyclers to take it away.

There is a role for increased education of bread producers and consumers on practices that will reduce bread wastage. Bakers can be better educated so they handle bread and flour in ways that improve quality. They also need to pay better attention to the type of bread desired by households (the thin traditional bread) and improve their baking skills for the thicker bread. The low price of bread provides little incentive for the baker to worry about these issues, though. Consumers need to understand that the thick bread provided by bakers is more nutritious than the traditional bread and it needs to be preserved to maintain quality. Placing the thick bread in the refrigerator will preserve its quality for a much longer time. Cooling the bread properly and placing it in a

wrapper (rather than simply carrying it by hand) will also increase the bread's shelf life. Better preservation methods will reduce the number of trips to the bakery too.

The mother's administrative role is key to educating households on improved bread utilization. Using popular media to educate mothers on bread nutrition, handling, and preservation (including refrigeration and positive characteristics of thicker bread) will decrease per capita bread wastage and enhance the household's diet. This will be a challenge because cultural traditions and household norms are firmly established. The traditional thin bread is consumed (though it has little nutritional value) and it is not preserved because it is quite cheap and is easily discarded. Reducing bread wastage is an uphill battle with current bread subsidies, but it is a battle that should be fought by the authorities.

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