



Purchase Frequency of Fresh Fruit in Trinidad and Tobago: A Binary Logit Analysis

C. W. Ardon Iton

Department of Agricultural Economics and Extension, University of the West Indies, St. Augustine,
Trinidad

Abstract: The retail sector of many Caribbean countries is being transformed as supermarkets and traditional outlets fight for market share. In Trinidad and Tobago of particular interest in this regard is the proliferation of roadside retailers, especially fruit and vegetable stands. As the Caribbean continues to succumb to the pressure of Non-Communicable Diseases innovative strategies are being sought to rectify the problem. However, very little empirical work appears to be undertaken in fresh fruit retailing. Traditionally, fruit formed a major component of the diets of Caribbean people as they were readily available and in many cases free. Today, things have changed and the consumption of fresh fruits might be strongly linked to purchase ability, education, ethnicity and other demographic factors. This study analyzes the frequency of fresh fruit purchasing by women in Trinidad and Tobago using a Binary Logit Model. The results of the study show that of the seven demographic variables analyzed, only two were statistically significant – age and marital status. The results are helpful as retailers strive for market share and nutritionists and others attempt to reduce the health care costs of the Caribbean countries through the increased consumption of fresh fruit.

Keywords: Fresh fruits, frequency of purchasing, demographics, Binary Logit analysis.

Introduction

Shoppers are not homogeneous nor are the retail fresh fruit market outlets in Trinidad and Tobago (T&T) static. As the attitudes and needs across consumer groups in T&T continue to evolve there will be need for practitioners and academics to come together to address pressing societal problems. One such problem is the rising level of Non-Communicable Diseases (NCDs).

NCDs such as obesity, diabetes and heart diseases continue to attract a lot of attention in developing countries as they represent not only a drain on the public purse as health care costs, but also a loss in labor productivity. The health benefits of fruits and vegetables in the diet are widely documented in the health-nutrition-diet literature. Despite the clear advice from the scientific community of the benefits to be derived from the consumption of fresh fruits and vegetables, intake levels still appear to be below desired and/or recommendations in many developing countries where there is supposedly an abundance of fresh fruits and vegetables.

The World Health Organization 2014 country profile for Trinidad and Tobago suggests that NCDs are estimated to account for 80% of total deaths. Table 1 show that cardiovascular diseases represent the highest percent. However, the diseases reported in table 1 account for over 75% of the total deaths. With the recent knowledge provided by epidemiologic investigations on the role of fruits and vegetables intake and the development of coronary heart diseases, stroke etc. what can be done to improve the intake by Trinidad women? This study attempts to investigate this problem from the retail end of the market.

Table 1: The top four causes of death in Trinidad and Tobago

| Disease | Percent of total deaths |
|-------------------------|-------------------------|
| Cardiovascular diseases | 32 |
| Cancers | 16 |
| Other NCDs | 15 |
| Diabetes | 14 |

Source: WHO Non-communicable Diseases Country Profiles, 2014

An examination of the marketing literature for developed and developing countries reveals that there have been numerous studies undertaken on such issues as, choice of retail outlet. However, there appears to be limited studies on purchase frequency in developing countries and the Caribbean in particular. An understanding of frequency of purchase and consumption of fresh fruits is an imperative for food retail managers and nutritionists as they continue to try and find innovative ways to reduce the costs of health care and boost the consumption of fresh fruits and vegetables. This study attempts to contribute to our knowledge in this area by looking at the frequency of fresh fruit purchasing by women in Trinidad and Tobago.

The rest of the paper is organized as follows: The next section provides a brief description of the literature on fresh fruit frequency of purchase and consumption. This is followed by the conceptual framework and a statement of the problems addressed in the study. Thereafter the analytical approach and data used in the study are described. This is followed by the results and discussion, and finally some conclusions and recommendations are offered.

Literature Review

Ting Meng et al (2014) in a study titled "Consumer's Food Shopping Choice in Ghana: Supermarkets or Traditional Outlets?" looked at purchase frequency at supermarkets, open-air markets, and hawkers. The explanatory variables used in the ordinal logit regression model included household income, education, occupation, age, marital

status, household composition and regional location. They stated "Food retail outlets play a significant role in affecting consumers' diet-related health and nutrition by the foods they sell and prices they charge." In that study they found that supermarkets are preferred by high income and well educated households. However, the appeal of supermarkets varied by location. Open-air markets are attractive to large households, and location did influence the shopping frequency to open-air markets. Hawkers appear to be more attractive to households of a lower socio-economic status than households of the better educated or higher income. Again, location did influence the shopping frequency from hawkers. They suggested that high income and well educated households, who shop regularly in supermarkets, are more likely to consume healthy food items including imported fruits and vegetables.

In a study titled "Demographics and patronage motives of supercenter shoppers in the United States" Carpenter M. (2006) examined the shopping frequency for apparel, health and beauty products, home furnishings and consumer electronics. In this study Stepwise Regression was used to analyze the effect of the continuous demographic attributes of shoppers on the three levels of frequency – frequent, occasional, and infrequent, while "One Way Analysis of Variance" was used for marital status and ethnicity. Age, income, education and household size were significant for apparel, home furnishings, and consumer electronics. The ANOVA models for ethnicity and marital status produced non-significant results. He concluded that age, income, education and household size may be useful in predicting supercenter shopping frequency in some product categories.

Yoo Sunmi et al (2006) examined food purchasing patterns for the home. One big weekly shopping trip for food was the preferred pattern for their sample (34.9%). They also suggested that African American families shopped for food least frequently and Asian American families were the most frequent shoppers for food. The statistical Portal in 2013 reported that households with income of less than \$40,000.00 tend to shop

less frequently, with 19% of this group purchasing grocery items once per month. This suggests that income could be a major influence on the frequency of grocery shopping, of which fruits are a subsector.

Therefore, the literature suggests there is a link between where one shops, i.e. retail outlet choice and diet quality, patronage behavior, and frequency of shopping for food and grocery products. In the next section the research problems identified for this study are outlined and the conceptual framework developed.

Research Problems, conceptual framework and hypotheses

Based on the brief review provided above the problems that will be addressed in this study are as follows:

- (1) Identify the percentages of regular and occasional fresh fruit purchasers of Trinidadian females;
- (2) To identify the demographic factors that influences the frequency of fresh fruit purchasing by women in Trinidad;

The primary data collection was restricted to Trinidad, which is only one part of the twin island state. In Trinidad respondents were asked to classify themselves as regular or occasional fresh fruit purchasers where:

Regular purchasers: were those that bought fresh fruit every week, and

Occasional purchasers: were those that bought fresh fruit less frequently than once a week.

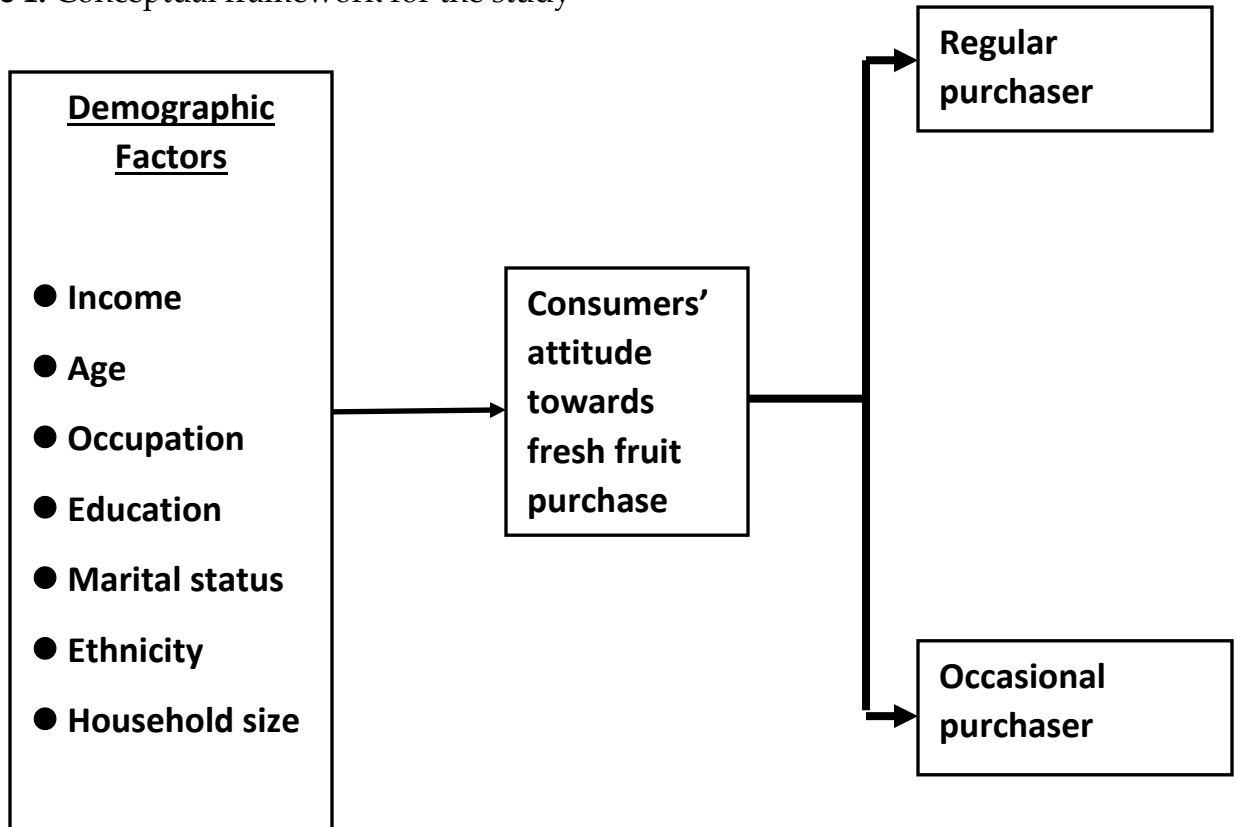
Figure 1: Conceptual framework for the study

Figure 1 illustrates the conceptual framework used in the study. The demographic variables, income, age, occupation, education, marital status, household size and ethnicity are hypothesized to have an influence on being either a regular or occasional purchaser of fresh fruits. Since the dependent variable is a dichotomous variable – regular or occasional purchaser of fresh fruits, and the predictors – demographic variables are all categorical the binary logit model was thought suitable for this exercise.

Analytical Approach and Data

To investigate if there was a relationship between the socio-economic/demographic variables outlined in the conceptual framework above and frequency of fresh fruits purchasing by Trinidad women a questionnaire was developed and pretested in August 2014. The questionnaire consisted of two sections. Section one of the

questionnaire focused on the consumers' classification as a regular or occasional purchaser of fresh fruits. Section two attempted to gather data on the demographics of respondents, such as, age, household size, if employed, ethnicity, marital status, and highest educational level attained and income data were collected.

A convenience sampling method was used to collect the data. Questionnaires were administered to prospective respondents at the University of the West Indies and outside supermarkets, banks and in public markets. A convenience sampling method was used in an attempt to get as large a sample size as possible in the shortest time. A total of 300 completed analyzable questionnaires were obtained at the end of September 2014.

The data collected was not continuous; as such the analytical approach used was primarily descriptive in the first stage of the analysis. In marketing research the use of descriptive statistics is very common, and the present study used this approach to address the first research problem, that is to find the percentage of regular and occasional fruit purchaser.

To test the stated hypotheses in the second problem the following binary logit model was developed:

$$\text{Logit (Y)} = \text{Natural log odds} = \ln (\pi / (1-\pi)) = \alpha + \beta X$$

Where:

Y = is the frequency of women purchasing fresh fruits;

α = constant

X₁ = age

X₂ = income

X₃ = educational level attained

X₄ = marital status

X₅ = household size

X₆ = employment status

X₇ = Ethnicity

Tables 2 and 3 illustrate the coding of the variable used in the binary logit model.

Table 2: The coding of the independent variables

| Variables | Coding | Label |
|-------------------|--------|----------------------|
| Age | 1 | 40 years and younger |
| | 0 | >40 years |
| Employment status | 1 | Employed |
| | 0 | Unemployed |
| Ethnicity | 1 | African descent |
| | 0 | Other |
| Educational level | 1 | Secondary and below |
| | 0 | University |
| Marital status | 1 | Single |
| | 0 | Other |
| Household size | 1 | 4 and less persons |
| | 0 | >4 persons |
| Income | 1 | Below \$ 15000 |
| | 0 | >\$15001 |

Table3: The coding of the dependent variable.

| Variable | Coding | Label |
|--------------------|--------|--------------|
| Dependent variable | 1 | Regularly |
| | 0 | Occasionally |

Results

Table 4 illustrates a breakdown of the independent variables into the various categories. The sample consisted of 34% of women over 40 years old and 66% forty years and younger. The majority (72%) were employed. With regards to educational status, 70% were tertiary level trained with the remaining 30% having secondary and lower levels

of education. The majority of the women (64%) were single. Seventy percent of the women lived in households that had one to four persons. The majority of the households (68%) had monthly income of less than TT\$ 15,000¹.

Table 4: Frequencies of independent variables in model

| Variables | Frequency | Percent |
|--------------------------|------------------|----------------|
| Age | | |
| 40 years and younger | 197 | 65.7 |
| >40 years | 103 | 34.3 |
| Employment status | | |
| Unemployed | 85 | 28.3 |
| Employed | 215 | 71.7 |
| Ethnicity | | |
| African descent | 123 | 41.0 |
| Other | 177 | 59.0 |
| Educational level | | |
| University | 211 | 70.3 |
| Secondary & under | 89 | 29.7 |
| Marital status | | |
| Single | 191 | 63.7 |
| Other | 109 | 36.3 |
| Household size | | |
| 1-4 persons | 211 | 70.3 |
| >4 persons | 89 | 29.7 |
| Income | | |
| <\$15000 | 203 | 67.7 |
| >\$15001 | 97 | 32.3 |

¹ US\$1.00 = TT\$6.25

Figure 2 illustrates the categories of the dependent variable. As is observed, the majority (63%) of the women considered they were regular fruit purchasers, while only 37% were in the occasional category.

Figure 2: Categories of women fresh fruit purchasing

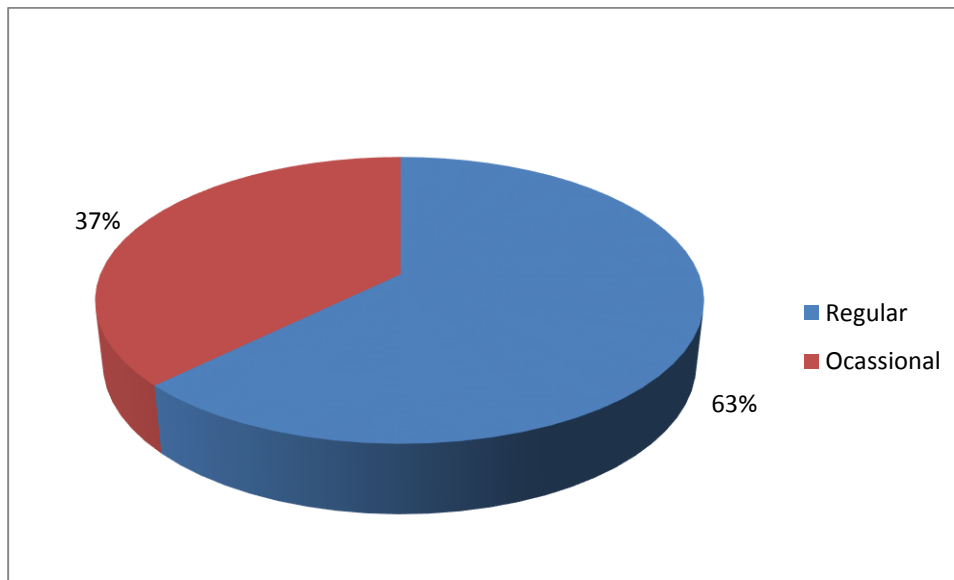


Table 5 illustrates the “Model Summary” for the logit regression step 1. The -2 Log likelihood in this table was 370.282 which is a reduction of 26.15 from step 0, the model with the constant only. The Cox & Snell and Nagelkerke R Squares (“pseudo R Squares”) are both statistically insignificant at the 5% level as we would like for logit models.

Table 5: Model Summary

| Step | -2 Log likelihood | Cox & Snell R Square | Nagelkerke R Square |
|------|-------------------|----------------------|---------------------|
| 1 | 370.282 | .083 | .114 |

The results of the Hosmer and Lemeshow Test are shown in table 6. This is a measure of fit which evaluates the goodness of fit between predicted and observed probabilities in

classifying the dependent variable. Again, we want this Chi-square to be low and not statistically significant if the predicted and observed probabilities match up nicely. The p value in table 6 is .875 and statistically insignificant.

Table 6: Hosmer and Lemeshow Test

| Step | Chi-square | df | Sig. |
|------|------------|----|------|
| 1 | 3.798 | 8 | .875 |

Table 7 shows the classification table for the model with the variables included. As is observed in this table the overall percentage correct classification is 64.3. This is an increase, though not very large, from 62.7 for step 0, the model with only the constant included.

Table 7: Classification Table step 1

| Observed | | Predicted | | |
|---------------------------|--------------|--------------------|-----------|--------------------|
| | | Purchase frequency | | Percentage Correct |
| | | Occasionally | Regularly | |
| Step 1 Purchase frequency | Occasionally | 45 | 67 | 40.2 |
| | Regularly | 40 | 148 | 78.7 |
| Overall Percentage | | | | 64.3 |

Table 8 illustrates the variables in the equation with the estimated coefficients and relevant data. The first thing to note here, is only two of the demographic variables are statistically significant – Age (.003) and Marital status (.010). Also, both of these coefficients carry negative signs. For example, the coefficient for “Age” is -.921. This is interpreted that given an increase in age of one unit, we can expect the log odds of being a regular purchaser to decrease by .921, controlling for other variables in the

equation. In other words the higher the age, the less likely it is that a woman would be a regular purchaser of fresh fruits.

The estimated model can be written as follows:

$$\begin{aligned} \text{Logit (purchase frequency)} = & 1.855 + (-.921)*\text{Age} + (-.380)*\text{Employment status} + .028*\text{Ethnicity} \\ & + .100*\text{Education} + (-.785)*\text{Marital status} + .082*\text{Household size} \\ & +.009*\text{Income} \end{aligned}$$

Table 8: Variables in the equation

| | | B | S.E. | Wald | df | Sig. | Exp(B) |
|--------|--------------------------|----------|-------------|-------------|-----------|-------------|---------------|
| Step 1 | Age | -.921 | .309 | 8.879 | 1 | .003 | .398 |
| | Employment status | -.380 | .299 | 1.620 | 1 | .203 | .684 |
| | Ethnicity | .028 | .255 | .012 | 1 | .913 | 1.028 |
| | Education level | .100 | .288 | .121 | 1 | .728 | 1.105 |
| | Marital status | -.785 | .306 | 6.571 | 1 | .010 | .456 |
| | Household size | .082 | .285 | .082 | 1 | .774 | 1.085 |
| | Income | .009 | .275 | .001 | 1 | .974 | 1.009 |
| | Constant | 1.855 | .510 | 13.248 | 1 | .000 | 6.389 |

The estimated logit model can be used to predict the probability of a female shopper being either regular or occasional, given specific values of the independent variables. Table 9 and what follows illustrates the calculation for a hypothetical case with some specific coded values.

Table 9: An illustration of estimating the probability of being a regular or occasional shopper

| Variables | Coded Value | Coefficients | Coded value*Coefficients |
|----------------|-------------|--------------|--------------------------|
| Income | 0 | 0.009 | 0 |
| Household size | 0 | 0.082 | 0 |
| Marital status | 1 | -0.785 | -0.785 |
| Education | 0 | 0.100 | 0 |
| Ethnicity | 1 | 0.028 | 0.028 |
| Occupation | 1 | -0.380 | -0.380 |
| Age | 1 | -0.9211 | -0.921 |
| Total | | | -2.058 |
| Constant added | Total | | -0.203 |

Logit = -0.203

Exponentiating the logit = 0.816278 = Odds

Probability = Odds / (1+Odds) = 0.816278 / (1+0.816278) = 0.449424

Given the coded values the probability of a female shopper being a regular shopper is 45%, if her household income is below \$15,000 per month, household size is 4 and less, single, attained university level education, is of African descent, employed, and below forty years old. With continuous demographic variables the interpretation of a change in age would be much more meaningful.

Conclusion and recommendation

Self-reported purchase frequency is often used in nutrition related studies as a proxy for intake levels. Several factors might influence frequency of food and grocery shopping, of which fresh fruits is a subsector. Unlike Carpenter (2006) which did not find a statistically significant result for marital status, here marital status is statistically significant. Common to both studies, age is statistically significant. Unfortunately the

results of this study did not support the view that household monthly income influences the frequency of buying fresh fruits as was found in "MARKETS FOR MEGHRI (2010)" and many other health-diet related studies.

As was suggested earlier in this study there appears to be limited studies on food retailing in the Caribbean, as such the results need to be taken with some caution. A limitation of the usefulness of this study is the fact that none of the independent variables, such as, age which, was found to be statistically significant was continuous. In the pretesting stage of the questionnaire there was hesitance by respondents to provide exact personnel information such as household income and age, hence the reason for the use of ranges. Provided with a few continuous demographic variables, such as, household size, age and income levels the predictive use of the model would greatly improve.

References

- [1] Bern/Yerevan, (2010), MARKET FOR MEGHRI: Consumption Habits and Purchasing Behaviour Survey Report. Intercooperation and Shen. Retrieved from the Internet November 26th, 2014.
- [2] Carpenter, J. M. (2008), "Demographics and patronage motives of supercenter shoppers in the United States", *International Journal of Retail & Distribution Management*, Vol. 36 No. 1, 2008, pp.5-16.
- [3] Carpenter, J. & M. Moore (2006), "Consumer Demographics, Store Attributes, and Retail Format Choice in the US Grocery Market", *International Journal of Retail & Distribution Management*, Vol. 34 No. 6, 2006, pp.434- 452.
- [4] Gorton, M., J. Sauer & P. Supatpongkul, (2009), "Investigating Thai Shopping Behavior: Wet-Markets, Supermarkets and Food Quality", The 83rd Annual Conference of the Agricultural Economics Society Dublin, 30th March to 1st April 2009
- [5] Gujarati, D. N. & D. C. Porter (2009), *Basic Econometrics*: McGraw-Hill Publishing Company.
- [6] Iqbal, H. K., Ghafoor, M. M., & Shahbaz, S. (2013), "Impact of Demographic Factors on Store Selection: An Insight in Pakistani Society" *Journal of Marketing Management* Vol. 1, No. 1, 2013, 34-45.
- [7] Meng, T. W. J. Florkski, D. B. Sarpong, M. S. Chinan, & A. V. A. Resurreccion (2014) "Consumer's Food Shopping Choice in Ghana: Supermarket or Traditional Outlets?" *International Food and Agribusiness Management Review* Vol. 17 Special Issue A. 2014, pp. 107 – 129.
- [8] Mirza, S. (2010) "The Influence of Demographic Factors on the Choice of Retail Outlet Selected for Food and Grocery Purchases by Urban Pakistanis". In *Proceedings of the International Conference on Business and Economic Research*, Kuching Sarawak, Malaysia: International Conference on Business and Economic Research, 2010, pp. 1-16
- [9] Okello, J. J., CJ. Lagerkvist, S. Hess, M. Ngigi, & N. Karanja (2012) "Choice of Fresh Vegetable Retail Outlets by Developing-Country Urban Consumers: The Case of Kale Consumers in Nairobi, Kenya". *European Journal of Development Research* Vol. 24 No.3, 2012, 434 – 449.
- [10] Polat, C., Kulter, B. (2007). The factors that affect the retail store preferences of consumers: an application on the consumers in Niğde. 12th National Marketing Conference, Sakarya, Turkey.
- [11] Prasad C. J. S., & A. R. Aryasri (2011). "Effect of Shopper Attributes on Retail Format Choice Behavior for Food and Grocery Retailing in India". *International Journal of Retail & Distribution Management*, Vol. 39 No. 1, 2011, pp.68- 86.

- [12] Prasad C. J. S., & Reddy D. R. (2007). A Study on the Role of Demographic and Psychographic Dynamics in Food and Grocery Retailing. *The Journal of Business Perspective* Vol. 11, No. 4, October – December 2007
- [13] Yoo S., T. Baranowski, M. Missaghian, J. Baranowski, K. Cullen, J. O. Fisher, K. Watson, I. F. Zakeri, T. Nicklas (2006). Food-purchasing patterns for home: a grocery store-intercept survey. *Public Health Nutrition* 9(3), 384 -393.