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RESEARCH ARTICLE

An Examination of Applicability of Logistic Regression Model with Respect to Ready-To-Eat food Products

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ABSTRACT:
The purpose of this study is to understand the perception of consumers about RTE foods and to find the factors which influence the purchase intention of them towards RTE foods. Diversification of food habits, rapid changes in lifestyle, adoption of western culture creates opportunity for the growth of RTE food habits. The popularity of ready-to-eat packed food no longer marks a special occasion. Consumers appreciate value for time, money in terms of quality and variety. Hence the main focus of the study is to find thefactors affecting consumer purchase intention towards the ready to eat products in India. Logistic regression approach was carried out to find the applicability of the best fit of the factors**.** This study creates an alternative for manufacturing firms to concentrate on the influencing factors and to frame strategies for the growth of RTE foods in India.

KEY WORDS: Purchase-intention, Diversified-food-habits, logistic regression, Perception.

1. INTRODUCTION:
In this fast growing push –button era, both male and females are employed. Because of excessive workloads, they do not find time to cook fresh foods. They preserve the prepared food for two- three days or tend to go out for food. Hence nutritional imbalances like starvation, fatness, under and over diet came into existent which is a growing problem in world especially in developing countries like India. This deficiency arises across all economic segments. According to Subodh Marwah, Head Global Consumer Health care (Economic Times, dated Dec 20, 2016), India has nearly 90 percent of protein deficient adults. Fortification of food with other micronutrients and with value added ingredients helps to balance the nutrition deficiency facing the country.

This creates the innovative idea of Ready to Eat products in the market. The increasing pattern of dual income in families changes the lifestyle behaviour for inclination towards branded Ready to eat food products (Kathuria and Gill, 2013). In India, apart from nutritional disease, changing food habits and shifts in eating trends are adding advantage in seeking Ready to Eat food. Also the pricing advertisements in media are the centre of attraction (Vijayeta Priyadarshini, 2015). Demand towards RTE foods is increasing day by day and consumers are ready to avail the product if they came to know about the product (Lampila and Lahteenmaki, 2007).Changes in the socio- demographic characters of the consumers play a significant role in the purchase behaviour of the RTE foods (Selvarajn, 2012). Increasing shopping behaviour in super markets and hyper markets which showcase the packaged foods creates popularity of Ready to eat food in the society. Even though RTE food is a big success in market, the success rate in India is comparatively low with other countries. India exports RTE foods in large scale to

Saudi Arabia, US and Germany but the consumption in India is comparatively low (APEDA, 2016).

RTE FOODS – SIGNIFICANCE:
The ready to eat (RTE) food products, also called convenience foods, are often refrigerated and have defined food handling guidelines. Initially these foods were consumed during emergencies like disaster, war, mountain climbers and travellers. Nowadays it has become fashion, trendy, easy to cook and time saving in modern cities. RTE foods provide a technique to have a healthy food while adjusting with their tight schedule.RTE Cereals are considered to be healthy alternative breakfasts.

Since the products are prepared under protected conditions and well maintained standards of food council, it has been used by many consumers around the world. The nutrition values also maintained in case of frozen of fruits and vegetables. But it is full of chemical preservatives. The fact remains that RTE foods are in great demand because of its availability, convenience and safe.

On the whole, RTE foods save a lot of time and labour but in reality it is difficult to digest and can cause serious health problems. On the other hand, many married professionals who do not have the time and energy to cook opt to go in for ready to eat meals.In this context, there is a growing demand to find about segment of consumers which prefers RTE foods. Hence there is a need for socio demographic analysis to understand the growing consumer purchase intention towards RTE food.

2. REVIEW OF STUDIES:
Most of the studies examine the demographic and socio-economic characteristics of households which is important for the consumption of Ready-to-Eat food. The study (VIJAYETA PRIYADARSHINI, 2015) revealed that majority of the respondents had planned decision in purchasing instant food products.

A study by Selvarajan, (2012) concluded that apart from demographic characters, lifestyle, rise in the standard of living and time consuming were the highly influenced variables and are positively correlated to the purchase intention of the households. Convenience and cost effectiveness were also found to be influenced by RTE foods. Nielsen (2006) found that RTE foods were more consumed by lower age groups than old aged ones. Few studies (Arjunan, 2012; Selvarajn, 2012) argued that the non availability of RTE foods,huge price and health issues were some of the factors that resulted in non-purchasing of RTE foods.

A lot of international research is available about the changing consumption patterns of the consumers of the RTE foods. Studies (Vijayabasker et al, 2012) show that obesity, health conscious and lifestyle have positive impact on the consumption of foods.

Previous studies observed that there exists huge gap in the consumption pattern of RTE foods. Number of factors has been identified for the reason for consumption and non consumption of foods. Finally, there is no such study especially in India for the consumption pattern of RTE foods including both buyers and non buyers. Present study tries to fill the gap and attempted to test the applicability of Logistic Regression in finding the determinants of the purchase decision of RTE foods.

3. RESEARCH METHODOLOGY:
3.1. OBJECTIVES:
1. To study the demographic variables impacting consumer-food-choice towards Processed ready -to - eat Food.
2. To study the applicability of Logistic regression model and to find the determinants factors of the respondent for their purchasing decision of ready- to-eat food.

3.2. RESEARCH DESIGN:
The study was conducted in the city of Bangalore, Karnataka.215 respondents from both genders were randomly selected as the sample for the study. Retail outlets were visited to ensure better coverage of all types of consumers. Convenience sampling technique was used to collect the data. Sample size selected is heterogeneous because of the diverse cultural and economic background. The structured questionnaire is taken as a survey tool and data has been collected through face-to-face interview with respondent.

3.3. SELECTION OF RESEARCH VARIABLES:
This paper refers to the variables used in the past literature and the feasibility of accessing data to define the variables in the present study. Both demographic variables and the variables which measure the purchase intention, attitude and preferences were considered for this study. The data has been collected in Likert scale from (1) strongly disagrees to (5) strongly agree. The respondents comprise the people who are the decision makers with respect to food products.

3.4. STATISTICAL METHODS:
The first objective is studied through descriptive statistics (cross tabulation and graphs). Chi-squaretest was applied to verify the independence between the demographic factors and the purchase intention of respondents.

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The second objective of finding the determinant factors of the respondent for their purchasing decision of ready- to- eat food was done by fitting the logistic regression model.

3.5.Concepts Related to Logistic Regression:

Logistic regression sometimes called the logistic model or logit model, analyses the relationship between multiple independent variables and a categorical dependent variable, and estimates the probability of occurrence of an event by fitting data to a logistic curve. There are two models of logistic regression, binary logistic regression and multinomial logistic regression. Binary logistic regression is typically used when the dependent variable is dichotomous and the independent variables are either continuous or categorical. The present study uses Binary logistic regression.

The logistic regression model assumes that the probability ofa dichotomous outcome is related to a set of potential predictor variables in the form:

$$\text{Log}\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots\ldots\ldots + \beta_k x_k$$

Where is the probability of the outcome of interest, β_0 is the intercept term, and $\beta_i (i=1, ...,k)$ represents the coefficientassociated with the corresponding explanatory variable $x_i (i=1, ...,k)$ The dependent variable

is the logarithm of the odds, $\left\{\text{Log}\left(\frac{p}{1-p}\right)\right\}$ which is the logarithm of the ratio of the two probabilities of the outcome of interest. The maximization of the likelihood function is commonly applied as the convergent criterion to estimate the coefficients of corresponding parameters when the logistic regression models are utilized.

Logistic regression does not require many of the principle assumptions of linear regression models that are based on ordinary least squares method–particularly regarding linearity of relationship between the dependent and independent variables, normality of the error distribution, homoscedasticity of the errors, and measurement level of the independent Variables. Logistic regression can handle non-linear relationships between the dependent and independent variables, because it applies anon-linear log transformation of the linear regression. Logistic regression can handle not only continuous data but also discrete data as independent variables.

4. DATA ANALYSIS, FINDINGS AND DISCUSSION:

Table 1 show the personal profile of the respondents who fall under different category of sex, occupation, monthly income and marital status towards buying behavior of ready- to eat food.

Table 1:Demographic profile of the respondents (n=215)

Category		Frequency of		Percentage of buyer	Pearson Chi-square	d.f	Sig.
		Buyer	Non-Buyer				
Sex	Male	78	44	64.5	6.718	1	0.010
	Female	43	50	35.5			
Occupation	Student	75	69	62.0	7.945	3	0.047
	Service	29	22	24.0			
	Self-employed	15	3	12.4			
	Housewife	2	0	1.6			
Income	Less than Rs.10000	63	32	52.1	29.427	4	0.000
	10000 – 20000	5	12	4.1			
	20000 – 30000	21	41	17.4			
	30000 – 50000	14	4	11.6			
	More than 50000	18	5	14.9			
Marital status	Single	101	86	83.5	1	3.003	0.083
	Married	20	8	16.5			

Table1 portrays the sex, occupation, income are significant with regard to buying of ready -to -eat food whereas marital status is insignificant. With regard to ready- to -eat food products, 64.5 and 35.5 per cent of male and female respectively were consuming instant packaged food products. Among the occupation, students are largely using the ready- to -eat food packets and percentage is 62. In the income category, 52.1% of people prefer to consume ready- to -eat food packets, whose monthly income less than Rs.10, 000. To study the applicability of Logistic regression model, first of all, respondents are classified as buyer and non-buyers of ready-to-eat food. A survey was conducted on 215

respondents and out of which 121 were buyers and 94 are non-buyers of the product. Further, for classification purpose, following nine variables based on purchase intention, attitude and preference are considered.

Variable	Description of the variable
X1	Saves time
X2	Sufficient Quantity
X3	Easily available
X4	Value for money
X5	no taste
X6	best quality
X7	nutrient
X8	availability in superstores
X9	good packaging

The logistic regression study includes the four types:a) An overall evaluation of the logistic model and goodness-of-fit;b) Statistical significance of individual regression coefficients; c) model summary and d) classification accuracy. The data was analysed through SPSS.

A) An overall evaluation of the logistic model and goodness of fit:

Overall fit of a model shows how strong the relationship **is** between the independent variables and dependent variable. It can be assessed by comparing the fit of the two models with and without the independent variables. A logistic regression model with the *k* independent variables (the given model) is said to provide a better fit to the data if it demonstrates an improvement over the model with no independent variables (the null model). The overall fit of the model with *k* coefficients can be examined via a likelihood ratio test which tests the null hypothesis.

H_0: $\beta_1 = \beta_2 = \ldots = \beta_k = 0$.

To do this, the deviance with just the intercept (-2 log likelihood of the null model) is compared with the deviance when the *k* independent variables are added (-2 log likelihood of the given model). Likelihood of the null model is the likelihood of obtaining the observation if the independent variables had no effect on the outcome. Likelihood of the given model is the likelihood of obtaining the observations with all independent variables incorporated in the model. The difference of these two yields a goodness of fit index G, χ^2 statistic with *k* degrees of freedom (Bewick, Cheek, and Ball, 2005). This is a measure of how well all the independent variables affect the outcome or dependent variable. The term 'likelihood ratio test' is used to describe this test. The Hosmer–Lemeshow test is to examine whether the observed proportions of events are similar to the predicted probabilities of occurrence in subgroups of the model population. The Hosmer-Lemeshow test is performed by dividing the predicted probabilities into deciles (10 groups based on percentile ranks) and then computing a Pearson Chi-square that compares the predicted to the observed frequencies in a 2-by-10 table. This test statistic asymptotically follows a χ^2 distribution with 8(number of groups -2) degrees of freedom.

Table 2: Output from Logistic Regression: Overall Model Evaluation and Goodness-of-Fit statistics

Test	Category	χ^2	d.f	P value
Over model evaluation	Likelihood Ratio test	85.260	9	0.000
Goodness-of-fit test	Hosmer &Lemeshow	14.924	8	0.061

It is clear from the table that the *p*-value for the overall model fit statistic (LR test) is less than the conventional 0.05, the H_0 is rejected with the conclusion that there is evidence that at least one of the independent variables contributes to the prediction of the outcome. (Given logistic model with independent variables is more effective than the null model).Table 3 also indicates the goodness-of-fit of the model. The value ofHosmer-Lemeshow test statistics 14.924which is insignificant (*p*>.05), suggesting that the model fits to the data well.

B) Statistical significance of individual regression coefficients:

If the overall model works well, the next question is how important each of the independent variables is. The logistic regression coefficient for the ith independent variable shows the change in the predicted log odds of having an outcome for one unit change in the ith independent variable, all other things being equal. That is, if the ith independent variable is changed1 unit while all of the other predictors are held constant, log odds of outcome is expected to change *bi* units.

Table 3: Output from Logistic Regression: Statistical Tests of Individual Predictors

Predictors	B	S.E.	Wald	df	Sig.	Exp(B)
X1	1.128	.381	8.769	1	.003	3.091
X2	-.583	.263	4.920	1	.027	.558
X3	.610	.373	2.669	1	.102	1.840
X4	.705	.265	7.076	1	.008	2.023
X5	.461	.218	4.478	1	.034	1.586
X6	-1.265	.407	9.670	1	.002	.282
X7	-.110	.333	.109	1	.741	.896
X8	-.253	.315	.645	1	.422	.776
X9	.579	.300	3.722	1	.044	1.784
Constant	-2.440	.596	16.744	1	.000	.087

Table 3presents the statistical significance of individual regression coefficients (s) tested using the Wald Chi-square statistic. According to Table 3, Saves time(x_1),Sufficient Quantity(x_2),Value for money(x_4),no taste(x_5),best quality(x_6) and good packaging(x_8) are significant predictors for the buying intention of ready-to-eat food (*p*<.05). The test of the intercept (*p*<.05) is also significant suggesting that the intercept should be included in the model.

Above significance shows that Indian consumers are more worth sensitive. They need good packaging, quality of product and also looked into the quantity of product. Repeat in the purchase of product depends upon the value of money and time consuming. Indian consumers are well spent and ready to spend more money if the products are best in quality, quantity and time saving.

C) Model Summary:
Table 4: Output from Logistic Regression: Model summary

Step	-2 Log likelihood	Cox and Snell R Square	Nagelkerke R Square
1	209.393[a]	.327	.439

Table 4 showing Nagelkerke R square of 0.439 indicates that 43.9 % variance in the outcome i.e response variable (in this study it is buying intention of ready-to-eat food by respondent) is explained by the predictor variables and it is reasonably good in the present study.

D) Classification Accuracy:
The classification table is a method to evaluate the predictive accuracy of the logistic regression model (Peng and So, 2002). In this table the observed values for the dependent outcome and the predicted values (at a user defined cut-off value) are cross-classified. In the present study, the cutoff value is 0.5; all predicted values above 0.5 are classified as predicting an event (buyer), and all below 0.5 as not predicting the event (non-buyer).

Table 5: Output from Logistic Regression: Classification Table:

	Observed		Predicted		
			Buyer		Percentage Correct
			Buyer	Non-Buyer	
Step 1	Buyer	Buyer	105	16	86.8
		Non-Buyer	29	65	69.1
	Overall Percentage				79.1
a. The cut value is .500					

Table 5 presents the degree to which predicted probabilities agree with actual outcomes in a classification table. The overall correct prediction, 79.1% is considerably good. In other words, in our study, the predictor variables are able to classify the respondents in to two categories buyer and non-buyer of ready-to-eat food to the extent of 79.1% which indicates the fitted logistic regression model is good.

5. CONCLUSION:
The above findings clearly indicates that the demand for ready-to-eat foods are very high and the major reasons for these products are convenience, saving time, sufficient quantity, value for money, best quality and good packaging. It reveals an optimistic attitude towards the RTE food products. The gender and occupation of individuals are also significant in buying ready-to-eat food. This trend is more visible among young consumers. However, there is no specific result that how much demand will be there for these products because the study is based on sample collected from the users of social media only.

Hence, there exists a large scope for producers to provide variety of dishes depending upon the demand of the consumers. This creates opportunity for corporations to increase the availability of RTE and to assign special scale of preservatives to avoid misconception about adding preservatives in RTE foods. This provides opportunities for Indian food firms to establish separate place in market and also finds expansion across globe. Competing firms can concentrate on the right segments according to the demographic characters by understanding the preferences of choice and can devise different strategies to enable the consumers to avail their products easily.

Finally, these days media (Print and electronic) are also giving major contribution in providing information about instant food products. Further, model can be utilized for classification because of its high accuracy in the prediction.

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