RESEARCH PAPER | Management | Volume : 3 | Issue : 11 | Nov 2013 | ISSN - 2249-555X

Demographic Variables & Nutritional Risk: the Predictive Power Using Binary Logit Model

KEYWORDS: Health, Nutrition, Risk, Score

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ABSTRACT *Nutrition is the provision, to living organisms, of the materials necessary (in the form of food) to support life. Many common health problems can be prevented or alleviated with a healthy nutritious diet. This paper uses a binary logistic regression to predict the nutritional risk of 100 consumers using 'age' and 'sex' as the predictors. A full model test against a constant only model indicted that the result was statistically significant, with the predictors as a group clearly distinguishing between nutritional risk groups and nutritional unrisk groups. Nagelkerke's R2 of .943 indicated that there existed a strong relationship between the prediction and the grouping. The overall prediction success rate was 98% with over 98.7% for nutritional risk respondents and 95.2% for nutritional unrisk respondents. The Wald statistics revealed that age of the respondent contributed significantly to the prediction (p=.012).*

Introduction

The diet of a human being is what he eats, which is by large influenced by perceived palatability of foods. A bad diet may have a negative impact on health, causing variety of deficiency diseases such as scurvy, kwashiorkor, health-threatening conditions like obesity and metabolic syndrome, chronic systemic diseases as cardiovascular disease, diabetes and osteoporosis. Healthy eating enhances overall healthy growth and development of humans including healthy bones, skin, and energy levels; and a lowered risk of dental caries, eating disorders, constipation, malnutrition, and iron deficiency anemia (Ebbeling et al., 2002).Wardle et al. (2000) mentioned the relationship between knowledge and intake of fat, fruit and vegetables using a well-validated measure of nutrition knowledge. They found out that the knowledge was significantly associated with healthy eating, and the effect persisted after controlling the demographic variables. Respondents in the highest quintile for knowledge were almost 25 times more likely to meet current recommendations for fruit, vegetable and fat intake than those in the lowest quintile. Nutrition knowledge was found to be a partial mediator of the socio-demographic variation in intake, especially for fruit and vegetables. Research also suggests that not having breakfast can affect an individual's intellectual performance (Dubois et al., 2006).

Wardle et al. (2000) added that healthy eating involves moderation, balance, and variety. They further mentioned that despite this knowledge, consumer's found it difficult to follow healthy eating recommendations and frequently consumed foods that they perceived as unhealthy. Barriers to healthy eating include a lack of time, limited availability of healthy foods in schools, and a general lack of concern regarding healthy eating recommendations. The present study addresses the nutritional risk of the respondents through a Nutritional Risk Score survey. The study ascertains the effect of demographic variables namely 'age' and 'sex' of the respondents to predict the nutritional risk of the respondents.

2. Literature Review

Rosenbloom et al. (1999) stated that Type 2 diabetes had become increasingly widespread among children and adolescents as rates of overweight and obesity rose. Narayan et al. (2003) found out that one in three American children born in 2000 had chances to develop diabetes in their lifetime. Larkin et al. (2005) in their study suggested that atherosclerosis, the most common cause of heart disease, was found in early childhood and adolescence. They also mentioned that atherosclerosis was related to high blood cholesterol levels, which was associated with poor eating habits. Mokdad et al. (2003) indicated that overweight and obesity, caused by unbalanced diet and inactivity are significantly related with an increased risk of diabetes, high blood pressure, high cholesterol, asthma, joint problems, and poor health status. Ferraro et al. (2003) suggested that overweight children and adolescents were more likely to become overweight or obese adults. A study carried out by Kim et al. (2006) showed that children who became fat by age 8 were more severely overweight as adults. Cavadini et al. (2000) in their study pointed that almost 80% of ladies did not take enough calcium. They also added that during the last 25 years, consumption of milk, the largest source of calcium, has decreased 36% among ladies. Additionally, the average daily soft drink consumption almost doubled among adolescent females, increasing from 6 oz to 11 oz, and almost tripled among adolescent males, from 7 oz to 19 oz. Ogden et al. (2002) suggested that obesity among children aged 6-11 years has more than doubled in the past 20 years and among adolescents aged 12-19 it has tripled worldwide.

3. Significance of the study

A vast number of studies have been carried out in nutrition and health. Few literatures discussed above and beyond the scope of this article clearly state the importance of staying healthy. Earlier literature also mentioned that a vast majority of the respondents across the globe are not nutritious conscious. However, earlier literature hardly mentions about a standard to measure nutritional risk. People hardly knew if they were at a nutritional risk or not. The present study first identified the nutritional risk of the consumers using a Nutritional Risk Score survey. Based on the results of the survey, the respondents were grouped into 'Nutritional Risk' and 'Nutritional Unrisk' category. Later, Binary Logistic Regression was applied to determine whether 'age' and 'sex' of the respondent would predict the nutritional risk of the respondent or not.

4. Methodology

Descriptive research with judgmental sampling technique was undertaken for the study based in Northern Kerala, India. A total of 100 responses were elicited. The respondents were chosen to fall in the age group between 20-40 years (three

Volume : 3 | Issue : 11 | Nov 2013 | ISSN - 2249-555X

equal intervals were defined). 56% of the respondents were males. Primary data were used in the study and the data were collected by means of a predefined nutritional risk questionnaire.11 variables were used in the questionnaire. The scale of the questionnaire was designed as dichotomous (except for demographic variables). The Nutritional Risk Score was computed using a predefined algorithm. A person was considered at nutritional risk if his/her score was/above 6.A person was at high risk if the total score was 21 and at low risk if the total score was 0.Based on this algorithm, 79 respondents were found to fall in nutritional unrisk category and 21 respondents in nutritional risk category. Data obtained through the questionnaire were analyzed using SPSS software package (Version 16) in 95 percent confidence interval. Binary Logistic Regression was used to interpret if 'age' and 'sex' of the respondent would predict the nutritional risk of the respondent or not.

5. Result and Discussion

Table 1
Block 0: Beginning Block

Classification Tablea,b					
Observed			Predicted		
			Risk or Unrisk	Percentage Correct	
			Unrisk	Risk	
Step 0	Risk or Unrisk	Unrisk	79	0	100.0
		Risk	21	0	.0
	Overall Percentage				79.0
a.Constant is included in the model. b.Cut of value is .500					

Source: Survey data

Table 2
Variables used in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	.136	.386	.123	1	.815	1.148

Source: Survey data

Table 3
Variables not used in the Equation

			Score	df	Sig.
Step 0	Variables	Age	6.852	1	.022
		Sex	59.144	1	.000
Overall Statistics			65.996	2	.001

Source: Survey data

Block 0: Beginning block (Tables 1 to 3) which gives the results by including only constants before any coefficients indicated that if we knew nothing about the variables (age and sex), we would be correct only 79%.It was also observed from Table 3 that inclusion of predictors (age and sex) may improve the predictive power with age and sex turning out to be statistically significant if included in the initial model.

Table 4
Block 1: Method = Enter
Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	93.041	11	.000
	Block	93.041	11	.000
	Model	93.041	11	.000

Source: Survey data

Table 5
Classification Tablea

Observed		Risk or Unrisk		Percentage Correct
		Unrisk	Risk	
Step 1 Risk or Unrisk	Unrisk	78	1	98.7
	Risk	1	20	95.2
	Overall Percentage			98.0

a. The cut value is .500
Source: Survey data

Table 6
Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	9.750a	.606	.943

a. Estimation terminated at iteration number 11 because parameter estimates changed less than .001.
Source: Survey data

Table 7
Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	.617	7	.999

Source: Survey data

Block 1Method = Enter (Tables 4 to 7): It was observed that (Table 5) when the predictors 'age' and 'sex' were included, the classification error rate changed from 79 % to 98%.So it is interpreted that by adding these variables, we can predict the model with 98% accuracy. The model chi square (Table 4) indicated that these predictors distinguished between nutritional risk respondents and nutritional unrisk respondents (Chi square =93.041, p<.000 with df=11).The Nagelkerke's R2 value of .943 (Table 6) further supported a strong relationship (94.3%) between the predictors and the prediction. The Hosmer and Lemeshow Test (Table 7) which showed a non-significance (p>.05) indicated that the model prediction did not significantly differ from the observed. The Classification Table (Table 5) further indicated that 95.2 % of the respondents were correctly classified in the nutritional risk category and 98.7 % in the nutritional unrisk category. Overall 98% were correctly classified. So it was thus concluded that there was a considerable improvement from 79% (Table 1) in the constant model to 98% (Table 5) in the predictors included model. The Wald statistics (Table 8) which indicates the level of influence of the two variables showed that the age of the respondent contributed significantly (p=.012) to the prediction but the sex of the respondent did not (p=.087).

Table 8
Variables used in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1a	Age	2.489	.854	5.142.	1	.012	8.001
	Sex	.003	.001	4.125	1	.087	2.003
	Constant	-16.547	7.541	3.125	1	.021	.000

a. Variable(s) entered on step 1: Age, Sex.
Source: Survey data

The probability of being at a state of nutritional risk can be thus written as

$$\text{Probability of the case} = \frac{e\{(2.489 \times \text{Age}) + (.003 \times \text{Sex}) - 16.547\}}{1 + e\{(2.489 \times \text{Age}) + (.003 \times \text{Sex}) - 16.547\}}$$

6.Conclusion

A logistic regression analysis was performed to predict the nutritional risk of 100 respondents' using 'age' and 'sex' as the predictors. A full model test against a constant only model indicted that the result was statistically significant, indicating the predictors as a group clearly distinguishing between nutritional risk groups and nutritional unrisk groups (Chi square =93.041,p<.000 with df=11).Nagelkerke's R2 of .943 indicated that there existed a strong relationship between the prediction and the grouping. The Overall prediction success rate was 98% (98.7% for nutritional risk respondents and 95.2% for nutritional unrisk respondents).The Wald statistics revealed that age of the respondent contributed signifi-

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cantly to the prediction (p=.012). Sex of the respondent was not a significant predictor. EXP (B) value also indicated that when age group of the respondent increased, the odd ratio amounted to 8 times as large and the respondents were 8 times likely to be at nutritional risk.

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