IDENTIFICATION OF POTATO PURCHASING BEHAVIORS AND PREFERENCES OF CONSUMERS BY MEANS OF ROBUST FACTOR ANALYSIS

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Abstract

The present questionnaire study was conducted to establish potato purchasing preferences of 385 consumers selected randomly from Igdir, Turkey. All the items ranging from 1 to 11 on the basis of an ordinal 11 point scale data on fresh potato and its products were collected from the consumers. Robust Unweighted Least Squares (RULS) extraction method was used based on promin rotation method for obtaining better solutions in the ordinal data set. Polychoric correlation matrix was used instead of Pearson correlation matrix in the violation of the basic assumption on normal distribution of the ordinal items due to the fact that it is evidence that null hypothesis of multivariate asymmetric kurtosis was rejected (P=0.000). Four new factors were extracted from all the items on both fresh potato and its products through `Factor` software program, which gives more comprehensive and understandable outputs. The rotated factor loadings for potato products were clustered into four factors: content (Factor 1), value of nutrient and calorie (Factor 2), additives and price (Factor 3) and situation of package and health (Factor 4), respectively. The rotated factor loadings for fresh potato preferences of the consumers were also assigned to four factors: source (Factor 1), price and color (Factor 2), tubers structure (Factor 3) and tubers properties (Factor 4), respectively. The current results revealed that an application of EFA factor analysis on the basis of ULS extraction method, promin rotation method and polychoric correlations as a dispersion matrix was more effective when compared with the traditional EFA applications for the ordinal data. Besides, potato producers, sellers and entrepreneurs who desire to develop new marketing strategies might be recommended to take into account four factors that can affect purchasing preferences of the consumers on fresh potato and its products

Key words: *Unweighted Least Squares, Ordinal data, EFA, Bootstrapping, purchasing preferences*

INTRODUCTION

Potato is one of the most important crops human nourishment in the world and rich in carbohydrates and its protein quality is quite high with a biological value of 90-100. It contains more lysine, methionine and cysteine amino acids in comparison with cereal proteins and phenolic compounds neutralizing free radicals due to their antioxidant activities (Donnelly and Kubow, 2011) [2].
However, there are some factors (economical, demographic, cultural, political etc.) influencing consumer purchasing preference on potatoes (Srivastava and Tiwari, 2014) [9]. Before a potato variety produces in an agricultural area, an examination of consumer preferences and attitudes toward the variety is recommendable. Hedonic variables such as color, texture, flavor etc. are important for identifying consumer potato preference in fresh market. This information might help breeders and marketers to make a precision decision on selection of accurate potato varieties (Leksrisompong et al., 2012) [5]. Smith and Peavay (2000) [8]investigated factors affecting potato purchasing preferences of consumers and consumer preferences for three types of potatoes, the russet, round white and red-skinned. Kezis et al. (1988) [4] examined the effect of potato variety on consumer preferences in home use and attitude toward Marine round white potatoes. Srivastava and Tiwari (2014) [9] evaluated the consumer preference on Lay`s potato chips and factors affecting brand preference of the consumers. Ribeiro et al. (2016) [7] made an assessment on factors

(shape, skin colour and texture and seal of quality etc.) affecting consumer preferences the French potato cultivars. Teweldemedhin and Mulonda (2016) [10] have tried to determine significant factors on consumer preference on sweat potato in Namibia. There are many reports on identifying consumer preferences on potato and its products at different regions of the world, but there is lack of the related studies in Turkey. The aim of this survey was therefore to determine potato purchasing preferences of 385 consumers who were selected randomly from Igdir province, located in the Eastern Anatolia Region of Turkey through Robust Unweighted Least Squares (RULS) extraction method, which provides more advantages in comparison with a routine factor analysis application with principle component extraction method (Baglin, 2014) [1].

MATERIALS AND METHODS

The questionnaire study was conducted to determine potato purchasing preferences of 385 consumers chosen randomly from Igdir, Turkey.

Formula of simple random probability sampling used in the determination of the required sample size can be written as follows as defined by Erturk et al. (2014) [3].

$$n \frac{z^2}{e^2} p.q = n \frac{1,96^2}{0,05^2} 0,05.0,05 = 385$$

n= sample size

z= Standard table value for 95%.

p= proportion of those who prefer potato (0.5)

q=proportion of those who don't prefer potato (q=1-p)

e= proportion of error accepted in sampling method (5%)

All the items ranging from 1 to 11 on the basis of an ordinal 11 point scale data regarding fresh potato (12 items) and its products (16 items) were gathered from the consumers.

Robust Unweighted Least Squares (RULS) extraction method was specified based on Promin rotation method for gaining better solutions in the ordinal data set. Polychoric correlation matrix was used instead of Pearson correlation matrix in the violation of

the basic assumption on normal distribution of the ordinal items since null hypothesis of multivariate asymmetric kurtosis was rejected (P=0.000). Four new factors were extracted from all the items on both fresh potato and its products through `Factor` software program, which gives more comprehensive and understandable outputs (Lorenzo-Seva and Ferrando, 2006; Baglin, 2014) [1, 6]. Suitability of explanatory factor analysis with the RULS extraction method to the studied data sets was tested with Kelley`s criterion, giving the expected value for Root of Mean Square of Residuals (RMSR). Determinant, Kaiser-Meyer-Olkin (KMO) and Bartlett test values of the polychoric correlation matrix were estimated. Also, Bias-corrected bootstrap 5% confidence interval for the KMO test was found.

RESULTS AND DISCUSSIONS

A limited use of robust factor analysis methods is currently available in literature. In the violation of the assumptions on normal distribution of ordinal items, the routine use of explanatory factor analysis may cause biased estimates. With the intention of this problem, a new free software `FACTOR` was developed by Lorenzo-Seva and Ferrando (2006) [6]. Very high reliabilities of four rotated factors were determined. Table 1 presents results of Robust Unweighted Least Squares Method for potato products. The rotated factor loadings for potato products grouped into four factors: content (Factor 1), value of nutrient and calorie (Factor 2), additives and price (Factor 3) and situation of package and health (Factor 4), respectively. Determinant (0.004), Kaiser-Meyer-Olkin (KMO=0.871) and Bartlett test values (2090, P=0.00001) of the polychoric correlation matrix were calculated for potato products. Bias-corrected bootstrap 5% confidence interval estimated for the KMO test was found between 0.867 and 0.882. Root Mean Square of Residuals (RMSR=0.0265) was found lower than an expected mean of RMSR estimated for Kelley`s criterion (0.0510), implying that the explanatory factor analysis exposed to 16 items regarding potato products

in the present study gave reliable outcomes. Table 2 illustrates results of Robust Unweighted Least Squares Method for fresh potato comsumption. The rotated factor loadings for fresh potato preferences of the consumers were also assigned to four factors: source (Factor 1), price and color (Factor 2), tubers structure (Factor 3) and tubers properties (Factor 4), respectively. Ribeiro et al. (2016) [7] reported that potato shape, skin color and texture etc. were significant variables in purchasing preference of consumers, which was in agreement with the results obtained here. In line with our study, Smith and Peavey (1990) [8] highlighted that potato type and color had a significant effect on consumer potato preference, depending upon cultural factors. To improve promising potato types and marketing tactics, consumer preferences should be taken into consideration (Smith and Peavey, 1990) [8].

To the best of our knowledge, there was lack of information about structures and characteristics of tubers in fresh potato in literature but this information was available in the present study.

Determinant (0.087), Kaiser-Meyer-Olkin (KMO=0.653) and Bartlett test values (924, P=0.00001) of the polychoric correlation matrix were estimated. Bias-corrected bootstrap 95% confidence interval for the KMO test was determined between 0.621 and 0.718. Root found slightly lower than an expected mean of Mean Square of Residuals (RMSR=0.0277) was RMSR found for Kelley`s criterion (0.0510), inferring that the explanatory factor analysis exposed to 12 items on consumer preferences of fresh potato in the present study gave reliable outcomes. In general, cultural, economic, cultural, political and technological factors affecting consumer preferences are present together with personal characteristics (Srivastava and Tiwari, 2014) [9].

When previous studies were examined, our study showed the value of potato nutrient and calorie was a significant factor in the scope of consumers` potato purchasing preferences

Table 1. Results of Robust Unweighted Least Squares Method for potato products

Factor Names	Items	F1	F2	F3	F4
F1 (Content)	Fat content control	0.37			
	Salt content	0.63			
	Cholesterol level	0.66			
	Vitamin content	0.67			
	Sugar content	0.70			
	Fibre content	0.68			
	Odor	0.47			
F2 (Value of nutrient and calorie)	Nutritional value		0.85		
	Calorie value		0.74		
F3 (Additives and price)	Additives and preservatives			0.71	
	Price			0.44	
F4 (Situation of package and health)	Expiry date				0.34
	Unhealthy- healthy food				0.58
	Packaged-unpackaged				0.64
	Manufactured from hazardous material				0.44
	Taste				0.34

Table 2. Results of Robust Unweighted Least Squares Method for fresh potato

Factor names	Items	F1	F2	F3	F4
F1 (Source)	Place of production	0,66			
	Odor	0,58			
	Species	0,65			
F2 (Price and color)	Price		0,48		
	Color		0,55		
F3 (Tubers structure)	Fresh-Early riser-stored			0,49	
	stiffness			0,83	
	Size of tubers			0,30	
F4 (Tubers properties)	Bruises				0,24
	Multistemmed or not				0,74
	Stem depth				0,74
	Cleanness				0,19

CONCLUSIONS

The current results revealed that an application of EFA factor analysis on the basis of ULS extraction method, promin rotation method and polychoric correlations as a dispersion matrix was more effective compared with the traditional EFA applications for the ordinal data.

Also, potato producers, sellers and entrepreneurs who desire to develop new marketing strategies might be advised to consider four factors influencing purchasing preferences of the consumers on fresh potato and its products. Thus, potato producers gain more income and consumers provide more benefit by obtaining more qualified potatoes and potato products.

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