

# Market Analysis of Beverages Using Principal Component Analysis

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## ABSTRACT

Processed beverage industry has become a booming product sector during the last few years in Sri Lanka and beverages products have become a highly demanded commodity in Sri Lanka in any occasion. There are various beverage categories available in the market including carbonated drinks, fruit juices and milk and malt based products. Consumers have become more observant on the attributes of a beverage product, prior to the purchasing decision. Therefore, this research was carried out to find out consumers' perception for different types of beverages based on attributes. For that, a survey was conducted to get consumers' response. Principal Component Analysis was done to position the products based on their response. The results revealed that milo stands out from the rest of the milk and malt based products while elephant house twstee is different from the rest of the fruit juices. Of the carbonated drinks, coca cola was rated lowest in all attributes concerned.

**KEYWORDS:** Beverages, Principal Component Analysis

## INTRODUCTION

A beverage is any one of various liquid for human consumption, usually excluding water. In addition to the basic needs, beverages play a major role as part of the culture of human society. Therefore, there is a trend to manufacture various types of beverages basically alcoholic drinks and non alcoholic drinks. There is a wide range of non alcoholic beverage types available in the market including carbonated drinks, soft drinks, fruit juices, ready-to-drink tea and energy drinks. In modern society, people used to consume processed beverages available in the market to quench thirst and other needs.

To get high market share and high market growth, beverage manufactures should identify the consumers' perception and their expectations from beverages. Market research is the way in which producers find out what their customers' and potential customers' needs and wants. Consumer perception can be taken from questionnaire surveys and focus group. Then, products can be positioned or market can be segmented using techniques such as perceptual maps. It would give competitive advantages to the producers. Perceptual mapping is widely used in marketing to analyze market structure, design new products, and develop advertising strategies (Hauser and Koppelman, 1979). Having segmented the market, beverage producers can decide how to respond to the differences in customer needs identified and will reach a conclusion as to which segments are worth targeting.

There is a stiff competition among the beverage producers in the world; for example, carbonated beverages constitute the biggest sector worldwide and is dominated by Coca-

cola and Pepsi cola. Coca cola held a market share of 48.6 percent. The global market was estimated at 341.6 billion U.S. dollars in 2015. The statistics highlight that Coca cola company held a market share of 13.1 percent of the fruit and vegetable juice market worldwide. The global market was estimated at 146.7 billion U.S. dollars (Anon, 2016a). Statisticians projected that the annual sales growth of carbonated beverages will decrease and that of energy drinks will increase through 2018 (Anon, 2016b).

In this competitive industry, knowledge of consumer perception gives competitive advantages for producers. Thus, this research is aimed to find consumer perceptions on various soft drinks in the Sri Lankan market.

Most consumers are generally unable to describe objectively what it is that they are perceiving. The majority of their comments will be hedonically based rather than related to specific product attributes. For example, beverages that are liked will usually described as tasty, refreshing, quality and energizing, where as those that are disliked will receive similar negative responses (Greenhoff and Macfie, 1994).

## METHODOLOGY

### *Data and Variables*

First, a focus group was formed with university students (n=20). Twenty two types of beverages that are highly consumed among people were selected including: Milo, MD Mango Nectar, Coca-Cola, Rich Life Choco Milk, Smack, Pepsi, Daily Chocolate Milk, Lucky Yoghurt drink, Cream Soda, MD Diwul kiri, Highland Fresh Milk, 7-Up, Ambewela Fresh Milk, Elephant house Twstee, Kist Mixed

Fruit Nectar, Fanta, Kothmale Vanilla Flavored drink, Sprite, Mirinda, EGB, Anchor Newdale Flavored Vanilla drink and Necto. Also, the focus group was able to identify nine main attributes that affect the purchasing decision of beverages, namely: suitability of budget pack, thirst quenching nature, refreshing nature, quality, tasty, nutritious, naturally, attractiveness and volume.

**Data Collection**

The survey was conducted in Wayamba University of Sri Lanka including Faculty of Agriculture and Plantation Management and Faculty of Livestock Fisheries and Nutrition with a selected sample of 300 students. Questionnaires were presented batch wise using a slide show. The survey questionnaires consisted of questions that were intended for ranking the products and to collect demographic information of students. The respondents were asked to provide ranks on nine attributes on 1-9 points likert scale statements. In addition, ingredient amounts were taken from the package of the beverages and their web sites.

**Data Analysis**

Data were analyzed using both descriptive analysis and Principal Component Analysis. Principal components analysis was done for carbonated drinks, juices and milk and malt based products, separately Principal Components Analysis was done to interpret the data in a more meaningful form. It is therefore necessary to reduce the number of variables to a few, interpretable linear combinations of the data. Each linear combination corresponds to a principal component.

**Principal Component Analysis**

Principal component analysis (PCA) is an exploratory tool used to simplify a large and complex data set into a smaller, more easily understandable data set. The principal component variables are defined as linear combinations of the original variables. The extracted Eigenvectors table provides coefficients for equations below (Anon, 2016 c).

$$Y_k = C_{k1}X_1 + C_{k2}X_2 + \dots + C_{km}X_m$$

where,

$Y_k$  is the k-th Principal component  
 $C$ 's are coefficients.

For plotting purposes, two or three principal components are usually sufficient, but for modeling purposes the number of

significant components should be properly determined (Esbensen *et al.*, 1987).

**RESULTS AND DISCUSSION**

**Description of the Sample**

Out of the total number of respondents, the majority were females (63%), while 37% was males. The majority of the respondents were Sinhala (83.6%); whereas Tamil was (9%) and Muslim was (7.3%). Education level of the respondents was same as all are university students. All respondents were under the age group 21-25 years. The data on monthly expenditure in university shows that, the majority of students (90.6%) spent about Rs.499 -5000, 8% spent about Rs. 5001-10,000 while 1.3% was about Rs. 10,001 -15,000 per month. The data on monthly expenditure beverage consumption shows that, the majority of students (56%) spent about Rs. 100-500, 43.3% was about Rs. 501-1000 while 0.6% spent about Rs. 1001-1500 in the same month (Table 1).

**Table 1. Descriptive analysis of the sample**

Variables	Category	Percentage (%)
Gender	Female	63.0
	Male	37.0
Race	Sinhala	83.6
	Tamil	9.0
	Muslim	7.3
Age	21	32.6
	22	32.3
	23	29.6
	24	4.6
	25	0.6
Monthly expense in university	499-5,000	90.6
	5,001-10,000	8.0
	10,001- 15,000	1.3
Monthly expense for beverages	100-500	56.0
	501-1000	43.3
	1001-1500	0.6

**Outcome of the Principal Component Analysis for Survey Data**

Interpretation of the principal components is based on finding which variables are most strongly correlated with each component.

**Milk and Malt Based Products**

The first component explains 59% of the variability in the data and the second component explains 74% of the variability in the data (Table 2). The remaining components explain only 26%. So, component 1 and 2 are considered in order to get two variables. The first principal component is strongly correlated with six of the original variables (refreshing nature, quality, tastiness, nutritiousness, naturalness and thirst quenching nature) that

**Table 2. Principal components obtained**

Component	Milk and malt based products		Fruit juices		Carbonated drinks	
	Eigenvalue	Cumulative	Eigenvalue	Cumulative	Eigenvalue	Cumulative
1	5.350	0.595	3.443	0.383	8.111	0.901
2	1.390	0.749	2.319	0.640	0.697	0.979
3	1.272	0.890	2.121	0.876	0.147	0.995
4	0.839	0.984	1.117	1.000	0.025	0.998
5	0.097	0.994	0.000	1.000	0.014	0.999
6	0.046	0.999	0.000	1.000	0.005	0.999
7	0.005	1.000	0.000	1.000	0.015	1.000
8	0.000	1.000	0.000	1.000	0.000	1.000
9	0.000	1.000	0.000	1.000	0.000	1.000

vary together when selecting milk beverages. The second principal component is strongly correlated with volume, attractiveness and suitability to budget pack (Table 3). These three criteria vary together when selecting milk beverages.

#### *Fruit Juices*

The first component explains 38% of the variability in the data and the second component explains 64% of the variability in the data (Table 2). The remaining components explain only 36%. So, component 1 and 2 are considered in order to get two variables. The first principal component is strongly correlated with five of the original variables (refreshing nature, quality, tastiness, nutritiousness and volume) that vary together when selecting a fruit juice. The second principal component is strongly correlated with attractiveness, naturalness, thirst quenching nature and suitability to budget pack (Table 3). These four criteria vary together when selecting a fruit juice.

#### *Carbonated Drinks*

The first component explains 90% of the variability in the data and the second component explains 97% of the variability in

the data (Table 2). The remaining components explain only 3%. So, component 1 and 2 are considered in order to get two variables. The first principal component is strongly correlated with six of the original variables (refreshing nature, quality, nutritiousness, attractiveness, naturalness and suitability to budget pack) that vary together when selecting a carbonated drink. The second principal component is strongly correlated with thirst quenching nature, volume and tastiness (Table 3). These three criteria vary together when selecting a carbonated drink.

#### *Score Plots from the Principal Component Analysis*

##### *Milk and malt based productions*

Milo is a high quality and tasty product which effectively quenches thirst and highly refreshes the consumer than other products. Kothmale vanilla flavoured drink, Rich life choco milk and Anchor newdale flavoured drink have right size volume, attractiveness and also attractive budget pack. Lucky yoghurt drink, Ambewela fresh milk, Highland fresh milk and Daily chocolate milk are less satisfying products with respect to all attributes than other products (Figure 1).

**Table 3. Principal component (Eigenvectors)**

Attributes	Milk and malt based products		Fruit juices		Carbonated drinks	
	Comp 1	Comp 2	Comp 1	Comp 2	Comp 1	Comp 2
Suitability to budget	0.157	0.722	0.200	0.467	0.332	-0.113
Thirst quenching nature	0.389	0.156	0.207	-0.369	0.328	0.420
Refreshingness	0.412	0.069	0.381	0.335	0.350	-0.036
Quality	0.399	0.123	0.397	0.142	0.350	-0.040
Tastiness	0.428	0.043	-0.331	0.182	0.285	0.696
Nutritiousness	0.428	0.070	0.400	-0.350	0.348	-0.051
Naturalness	-0.278	0.155	0.264	0.308	0.345	-0.090
Attractiveness	-0.163	0.526	0.011	-0.492	0.346	-0.163
Volume	-0.158	-0.358	0.524	-0.147	0.312	-0.535

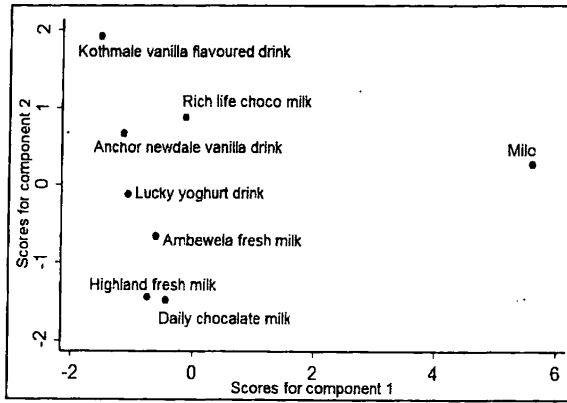


Figure 1. Score plot of milk and malt based products

*Fruit Juices*

MD mango nectar and MD diwul kiri are products that have good scores for all attributes. Smack and Kist mixed fruit nectar are high quality, very tasty, highly nutritious, highly refreshing and have right size to consume; but they are less attractive, less natural, less suitable to budget pack and less suitable for quenching thirst. Elephant house twstee has the lowest score for all attributes (Figure 2).

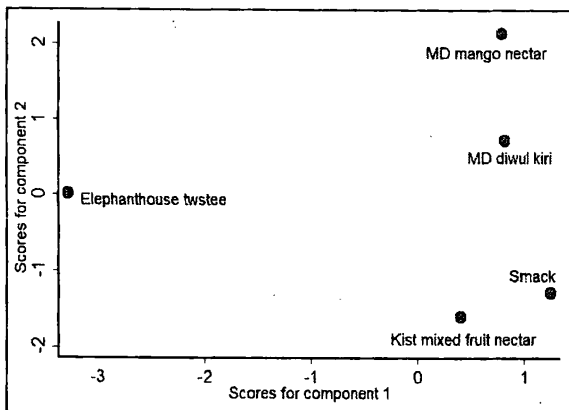


Figure 2. Score plot of fruit juices

*Carbonated Drinks*

When considering Pepsi, 7-up, Fanta, Sprite, Mirinda and Necto, all have favourable attributes for consuming those products. Respondents have decided that Coca cola is not a suitable product when considering all attributes. EGB was not satisfactory with respect to tastiness, thirst quenching nature and right size. But EGB satisfied other attributes such as refreshing nature, quality, nutritiousness, attractiveness, naturalness and suitability to budget pack. Cream soda did not show the significant attributes (Figure 3).

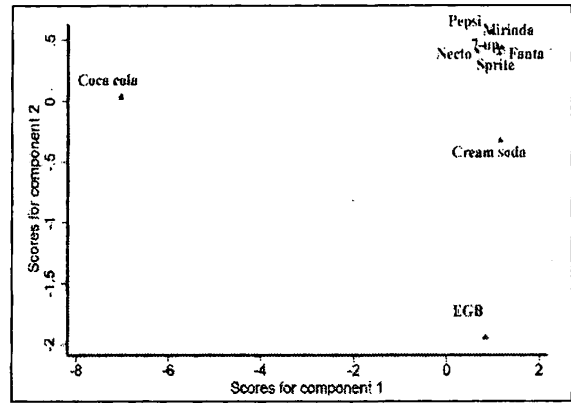


Figure 3. Score plot of carbonated drinks.

**CONCLUSIONS**

Milo is a highly competitive product available in the market because Milo satisfied all attributes that customers are found. When considering the market of carbonated drinks, Coca cola was rated low by the respondents. According to the respondents, EGB does not satisfy attractiveness, natural, thirst quenching nature or attractive budget pack. If those attributes are increased to the EGB, then it can reach to a higher position in the market. Other carbonated products are available in the market have already reached a highest position in carbonated drinks.

When considering fruit juice market, MD products show high market growth because they satisfy all consumers' perceptions. However Elephant house twstee has not yet secured a good position in the market probably because it has come to the market only recently.

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