



NUTRITION COMPARISON BETWEEN GENUS OF APPLE (*MALUS SYLVESTRIS* AND *MALUS DOMESTICA*) TO SHOW WHICH CULTIVAR IS BEST FOR THE PROVINCE OF BALOCHISTAN

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ABSTRACT


Apple farming cultivation is expanding in Balochistan. But there is no scientific study present on this subject which apple genus is beneficial according to nutritional point of view. This is the main object of this study to evaluate the nutritive composition of different Genus of apples. Keeping this objective in mind two different genus of apples were selected i.e. Malus Sylvestris and Malus domestica. To know the percentage composition of Moisture, Ash, Brix, Fat, Pectin, Fiber, Protein, Total sugar, Calcium, Sodium, Potassium, Phosphorus, Magnesium, Iron, Fat and water soluble vitamins in apples, they have been quantitatively analyzed using Atomic Absorption Spectroscopy, Flame Photometry and other chemical methods. The nutritional assessment results show that Malus domestica (Discovery) has an edge over Malus sylvestris (Red Sentine). The percentage of Moisture, Potassium and Ascorbic acid is slightly high in Malus Sylvestris, On the other hand the Ash, Brix, Fat, Pectin, Fiber, Protein and Total sugar percentages are comparatively high in Malus domestica and show a difference 0.15, 3.9, 0.48, 0.4, 5.5, 0.25, 8.25 of percentages respectively. The concentration of Calcium 20.79, Sodium 11.01, Phosphorus 16.4, Magnesium 14.62, Iron 7.23 and Vitamin A 0.97 (mg/100gm) in Discovery apples and show a respective difference from Malus Sylvestris Calcium 0.99, Sodium 8.21, Phosphorus 0.3, Magnesium 6.82, Iron 3.23 and Vitamin A is 0.04 in mg/100gm.

Keywords: Pome fruit, Pakistan diet, Food assessment, Nutrient evaluations

INTRODUCTION

Malus is a genus of family *Rosaceae* which contains about 30–55 species (Phipps, 1990). In this study we will only compare two varieties of genus *Malus* to show the difference in results. We compare *Malus sylvestris* with *Malus domestica* or (*pyramalus*) is a Domestic Apple while *Malus sylvestris* is the European crab apple. To compare their nutrition profile we selected one fruit from each species. Crab apple was selected from *Red Sentinel* tree while domestic apple was selected from *Discovery* Apple Tree. The main purpose of this study is to compare the Fruits which are the basic need for life and provides us with macronutrients and micronutrients. Different fruits are consumed by man and each cultivar has its own importance and provides nutrients in different proportions. Micronutrient deficiencies are of great public health and socioeconomic importance worldwide. The Global demand of fruit is increasing day by day to full fill the required demand of fruits farmers practice artificial contaminant to get the required yield. After the lapse of few years a systematic review of the available published literature was very important to determine the relevance to health in terms of nutrients and other substances. This review also reflects the use of contaminant content level (such as herbicide, pesticide and fungicide residues). Example the use of excessive quantity of any pesticide alters the natural contents of fruits. But if the study on the subject is not considered previously by anyone than it is very difficult to show a time regression effect on crops. In Balochistan negligible work is reported by many authors on apple. Abdul wahid *et al.* (2001) study the mode of action of insects on apple plant. Asghar *et al.* (2004) determine the chemical composition of apple trees in Balochistan. Marwat and Hussain (1988) in his study show the different weed varieties of apple in Balochistan. Pervez Wasim (2011) reported the trend of apple cultivation in Balochistan. Badar Naseem Siddiqui (2006). Show awareness of farmer about apples cultivation in Balochistan and Mukhtar (2010) study the nutritional aspects of three varieties apples of *Malus domestica*. Many people like apple due to its unique natural taste that's why wine and artificial food processing industry takes keen interest in apple production, so there is an urgent need of study in a scientific manner to show which cultivar is best for human consumption and also beneficial for farmer too. Therefore, study was conducted on scientific line to define the nutrition difference among the different genus of apples and define which genus is suitable. Besides this apple is also used in treatment like diarrhea and dysentery in infants (Considine, 1982) the consumption of apples also reduces risk of some cancers, cardiovascular disease, asthma, and diabetes Boyer and Liu (2004).

Taxonomy

Floral formula  , $K_{(5)}$, $C_{(5-w)}$, A_2 , $G_{(4-5)}$ (Javed iqbal mughal). Apple belongs to genus *Malus* which is the member of family *Rosaceae*. Apple is a delicious fruit, which is widely grown and consumed in many areas of the world. Apple is a pome fruit so the ovaries are involved. The height of the tree is usually not more than 15 meters (UniProt Consortium, 2002-2013). To develop fruit plants do cross-pollinate. Flower and fruit are of multi color.

Morphology

Case 1. *Red Sentinel* tree is a cultivar of *Malus x robusta*, which is a hybrid of the Asian trees *Malusbaccata* and *Malus Prunifolia* (Ashridgetrees, 2013) Due to its eye catching beauty Royal Horticultural Society, London has given an Award of Garden Merit. (RHS). Fruit is dominant with Red colour.

Case 2. *Discovery* Apple Tree is a result of a cross between the apple varieties *Worcester Pearmain* x *Beauty of Bath* (Trees, 2013). First seen in Essex in 1949. Fruit is dominant with colour yellow or pale.

Location for which study were conducted

Balochistan is the provinces of Pakistan and occupies the eastern part of the Iranian Plateau. It lies at coordinates 30.12°N 67.01°E. Balochistan is bordered by Afghanistan to the north and north-west, Iran to the south-west, the Arabian Sea to the south, Punjab and Sindh to the east, and Khyber Pakhtunkhwa to the north-east. Balochistan is an ideal location on earth for the apple growth, the dry and cool climatic conditions and higher altitudes (Pakistan Paedia) in the following districts motivate farmers to cultivate apples in Quetta, Ziarat, Pishin, Kalat, Loralai, Qilla Abdullah, Mastung and Zhob. Total production of apples in Pakistan is 525.9 (000, tones) which includes 426.8 from Balochistan (Agricultural Statistics of Pakistan, 2010-2011).

METHOD AND MATERIAL

Sample Collection

Selection criteria. To avoid human error and represent species on the basis of merit Random generation method is used. Three fruits are collected from the each batch which contains mature and medium size apples only.

Malus domestica (Discovery) and *Malus sylvestris* (Red Sentinel) was selected for analysis. Before analysis fruit was saved in Glass cap bottle and kept in dark, Stanislaw and Bruce (1936).

Sample Digestion

One gram of dried and ground sample was taken in a beaker and 100ml concentrated HNO₃ was added. The sample was allowed to stand for overnight and then heated on hot Plate until the Hydrogen and Oxygen fumes ceased. The beaker was cooled and 2-4 ml of 70% HClO₃ was added, heated again and allowed to evaporate to small volume. The sample was transferred to 50ml flask and diluted up to point with distilled water.

Chemical Analysis

The chemical composition (Moisture, Protein and Ash) of different apples cultivars was determined according to standard method of A.O.A.C (1990). Total sugar was estimated by Dinitrosalicylic acid (DNS) method as described by Miller (1995). Vitamin A was measured using the method of Valadone and Mummery (1975) after extracting it in Petroleum ether and acetone mixture. Ascorbic acid was determined according to Bazaz and Gardeep (1981) method on a

Spectrophotometer. The fibers contents were estimated by fiber tee system by applying the method provided by the manufacture Tecator, Japan. The fat of fruit was estimated by extracting fat of the sample in Soxhlet system by Diethyl ether. The pectin contents were estimated by the method of Carr'e and Haynes (1922). The Brix of the fruit was determining by the Refracto meter ATAGO (Model Beckman -43).

Name of instrument

Flame Photometer PF7, JENWAY, Atomic absorption spectrophotometer 2380 perk in Elmer USA, Spectrophotometer U- 2000 Hitachi, Japan.

Statistical Analysis

Data obtained from above mentioned parameter was subjected to statistical analysis through Statistical package for the social sciences (PC software S.P.S.S Version 14).

Chemical Structure and Analysis

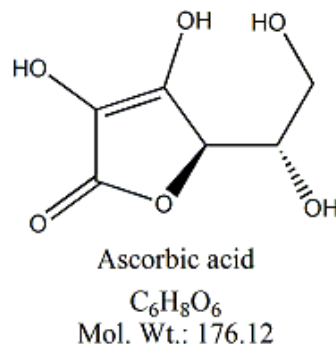
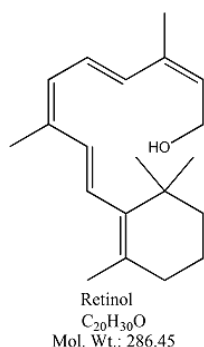
All chemicals modeling and analysis is carried out with the help of Chem Office Ultra 2002 cs3DChemDraw (Chemical information sciences p.c software pro Version 7.0).

RESULT AND DISCUSSION

Table-1. Comparison between two apple genus

Observation	Malusdomestica.	Malussylvestris.
	Result Mean of three reading	
Name of cultivar	Discovery Apple	Red Sentinel
Moisture %	76	80
Ash %	1.15	1.0
Brix %	16.1	12.2
Fat%	0.66	0.18
Pectin%	1.7	1.3
Fiber%	8.7	3.2
Protein %	0.45	0.2
Total sugar %	16.65	8.4
Calcium ^{mg/100gm}	20.79	19.8
Sodium ^{mg/100gm}	11.01	2.8
Potassium ^{mg/100gm}	110	213
Phosphorus ^{mg/100gm}	16.4	16.1
Magnesium ^{mg/100gm}	14.62	7.8
Iron ^{mg/100gm}	7.23	4.0
Vitamin C ^{mg/100gm}	4.2	8.1
Vitamin A ^{mg/100gm}	0.97	0.92

Fig-1. show the structure of Retinol (vitamin A) **Fig-2.** show the structure of Ascorbic acid (vitamin C)



Vitamin

Fat soluble and water soluble vitamin in body has its own value. The primary source of vitamin is fruits and vegetables so individuals mainly depend on it. Vitamin C is a basic requirement of Human body because higher Mammalian bodies lack the enzyme L-gulonolactone oxidase, which is an essential Biocatalyst in the conversion of glucose into ascorbate (Koolman *et al.*, 2005). Study of Moshfeq *et al.* show that most Americans show a deficiency of vitamin A in their body. The vitamin C (Ascorbic acid) concentration in Malussylvestris is 8.1 mg/100gm which is 3.9 mg/100gm higher as compared to Malusdomestica. On the other hand the vitamin A concentration is slightly high in Malusdomestica i.e. 0.97 mg/100gm. which is 0.04 mg/100gm higher as compared to MalusSylvestris. According to Food and Nutrition Board U.S (2013) the R.D.A amount of vitamin C is 90Mg per day. It means one to two apples fulfill the body demand of ascorbic acid. The fat soluble vitamin A is notably essential for eyes. Apples are a poor source of vitamin A, we can get almost 1- 2% of RDA of vitamin A from fruit concerned.

Minerals

Minerals play a key role to form structural and functional components of protein and enzymes in body. Each mineral has its own role and plays a number of Biochemical functions inside the body. The most important pathway of minerals to transport into human is from soil to plant and from plant to human. The study of Yoshimura *et al.* (1991) show that high concentration of potassium depresses blood pressure and low concentration of sodium enhances blood pressure. This ideal ratio is present in the above mentioned fruit. The ideal ratio of sodium and potassium ions present in Discovery apple is 11.0:110 as shown in table 1. The concentration of magnesium is relatively high in Discovery apple and it shows a difference of 6.8 mg/100 gm. The excess amount of iron can result in toxicity and even death of a human being Corbett (1995). A more common problem for humans is iron deficiency which also affects oxygen delivery to cells, resulting in fatigue, poor work performance, and decreased immunity Hass and Brownlie (2001), Hallberg *et al.* (1989) studies show that iron absorption is significantly increased by the presence of vitamin C. Due to the presence of iron absorption element vitamin C, a few grams of apple provides the required RDA value of iron for the human body. The higher concentration of iron and ascorbic acid presence in Malusdomestica make it more suitable for the patient of anemia. Multi authors also elaborate the

phosphorus and calcium ratio which is a very essential factor for development and maintenance of bones, teeth and muscles describe by [Dosunmu \(1997\)](#) and [Turan *et al.* \(2003\)](#) in current study we come to know that the concentration of phosphorus is relatively low in apples as compare to calcium. The result of mineral composition of *malusdomestica* is slightly similar with the pervious study [Mohammad Aziz *et al.* \(2013\)](#).

Physio Chemical and Proximate

Moisture percentage also reflects the ability of fruit to store water concentration in it, which is a symbol of life from the time of plucking to analysis. The wet status of fruit is also a use full tool to show the ability of survival and freshness in the fruit. This survival status is slightly best in crab apples. Ash residues increases in fruits when there is burning of coal, Combustion processes for the sake of energy and more waste volume reduction. This fly ash improves and increases the yield and market value of fruits as shown by [Mujeebur Rahman *et al.* \(1996\)](#). The percentage of Brix is slightly high in Discovery apple and the concentration of ascorbic acid also less, which means *Malusdomestica* is more sweet than crab Red Sentinel apple. The percentage of Fat is 0.48% high in *Malusdomestica*. Dietary fiber defined as the remnants of plants cells resistant to hydrolysis by the alimentary enzymes of man. All dietary fiber is degraded to a certain extent in the large bowel and provides little energy to the body. Dietary fiber mainly consists of cellulose, hemi cellulose, lignin and pectin. Percentage of fiber in Discovery apple is high and shows a difference of 5.5 %. Pectin in apple is mainly present in the form of protopectin, an acid soluble polysaccharide. Pectin is a family of complex variable polysaccharides extracted from the primary cell wall of higher plants. Consumption of pectin reduces blood cholesterol levels as shown by [Pornsak Sriamornsak \(2003\)](#). In current study percentage of pectin in domestic apple is slightly high. The percentage of Protein and Total sugar is less in crab apple and show a difference of 0.22 % and 8.2% respectively.

CONCLUSION

In advance countries Governments show a keen concern on the nutrition status of population ([Andersen *et al.*, 2003](#)) because diet is indirectly related to the health of human, and also motivate farmer and define which cultivation is beneficial for country and farmer. In an under developed country like Pakistan government gives less attention to agriculture sector and hardly determines the nutrition status, due to the following facts poor economic condition, natural disasters, poor agriculture policy, bad management in agriculture. So on the basis of the evidence provided above we easily draw following conclusions that the *Malus domestic* is rich in nutrition, less sour more suitable fruit for processing juice and wine making industries as compared to *Malussyvestris*. If farmers of Balochistan cultivate *Malusdomestica* then, they will get full reward of their efforts in terms of money. We also come to know that apples of both genus is according to the permissible limit of W.H.O standard. All nutritional values are below the threshold level.

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