Research Article

Decoding the Nutritional Mystique: A Comparative Analysis of Guava and Peach Varieties from Diverse Climatic Regions

Mansoor Ali Khan*, Khalid Imran, Zahid Rauf, Tanvir Hussain, Muhammad Umair Khan and Sajid Ali

Pakistan Forest Institute, Peshawar - 25130, Khyber Pakhtunkhwa, Pakistan.

Abstract | Climatic conditions and genetic modifications play an important role in determining the nutritional value of the fruit. Fresh guava fruit samples were collected from Kohat, Lahore (Punjab), Mardan, and Karak. Four varieties of fresh peach including one genetically modified from Peshawar and three conventional varieties were collected from Karak, Kohat and Nowshera. Different conventional (seasoning and titrometric) and spectrophotometric methods were used for sample analysis. Results from the Guava (*Psidium guajava*) revealed that moisture contents (80.16%), protein (2.52%), fibers (2.22%), phosphorus (1.47%), iron (80.20PPm), Vit-C (1.36%), total phenol contents (180.00mg/100g), calcium (11.00mg/100g), magnesium (16.50mg/100g), manganese (0.12mg/100g) and potassium (373.20mg/100g) were maximum in the famous Kohat variety of guava. Alkaloids (0.60%), pectin (0.10%) lipids (2%), and zinc (0.34mg/100g) were maximum in Lahore (Punjab) variety, while ash, acidity carbohydrates and copper were found in greater amount in Karak and Mardan varieties of guava respectively. Additionally, the G.M samples of peach (*Prunus persica)*, when compared with the conventional varieties showed high moisture contents (81.20%), protein (1.26%), fibers (1.48%), phosphorous (1.86%), iron (76.50 PPm), calcium (2.00mg/100g), magnesium (7.12mg/100g) and manganese (0.16mg/100g). However, in pectin (0.18%), lipids (0.32%), acidity (0.62%) carbohydrate contents (16.04%), and total phenol contents (22.25mg/100g), the Karak variety of peach were ahead of the other. Besides this, alkaloids (1.00%), sodium (0.09mg/100g), ash (4.20%), and Vit-C (7.23mg/100g) were found greater in Kohat and Nowshera varieties of peach, respectively. In a nutshell, the famous Kohat region guava variety is more beneficial and should be preferred over other conventional varieties. Additionally, genetically modified Peach use is also recommended for good health after the studied data analysis.

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***Correspondence** | Mansoor Ali Khan, Pakistan Forest Institute, Peshawar - 25130, Khyber Pakhtunkhwa, Pakistan; **Email:** mansoorchemist87@gmail.com
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Introduction

Food has been classified into conventional and genetically modified foods (Baker and Burnham 2001). The naturally occurring foods are called conventional food while the foods which have been transformed genetically are called genetically modified foods (GMFs) (Uzogara, 2000). Genetically modified

foods are drought-resistant, nutritionally rich, disease resistant, and larger in size (Cellini *et al.*, 2004).

Guava (*Psidium guajava*), belong to Myrtaceae family, is a gift of tropical America and is known as the Apple of Tropics, as its commercial cultivation is becoming important in tropical and sub-tropical climatic conditions (Singh and Singh, 2005). Masses use conventional varieties of guava in Pakistan, but genetically modified guava fruit is not marketable (Nimisha *et al.*, 2013). It is an evergreen tree and can survive below -4 degree Celsius (Dolkar *et al.*, 2014). Guava (*Psidium guajava*) is second rich source of ascorbic acid (Vit-C). Apart from ascorbic acid guava is rich with minerals, dietary fibers, Vit-A, and antioxidants (polyphenolic compounds). The extract of guava branches and leaves shows a high anticancer and antibacterial activity. In the process of digestion, guava fruit play very important role (Seo *et al.*, 2014). Maximum ascorbic acid (220.4 mg/100g) and carbohydrates (6.36%) are present in the Hong Kong variety of guava. Maximum dry matter (14.93%) and total soluble solids (11.87%) are present in the Sufaida variety, while protein contents (1.85%) and acidity (1.67%) in the Gola variety, and contents of ash (0.85%) are higher in the Rubi x Supreme (Adrees *et al.*, 2010). The degradation of ascorbic acid (Vit-C) during storage in the dried guava follows a pseudo-first-order reaction (Uddin *et al.*, 2002).

Peach (*Prunus persica)* is a common fruit, and belongs to the family Rosaceae (subfamily Prunoideae). Peach is a deciduous tree and it is originated in northwest China. China is considered the largest productive country of peach (Shah *et al.*, 2013). In Swat and Peshawar valleys of KPK (Pakistan), peach production is about 53.30% of all fruit. Most of them are marketed to the Lahore area of Punjab (Zeb and Khan, 2008). Peach (*Prunus persica)* tree generally gives fruit in 3rd year. The normal life span of peach is about 12 years (Parvez *et al.*, 2007). Peach is also suffering from many diseases. Peach scab is the most dangerous disease; in which circular, small green to black spots on the fruit appear. In severe scab disease, the fruit cracking or development of abnormal fruit takes place. Peach's fruit other virulent diseases are brown rot, anthracnose, bacterial spot etc (Nesi *et al.*, 2014).

Justification

Guava (*Psidium guajava*) and peach (*Prunus persica)* are globally consumed fruit, renowned for their health benefits. They are an excellent source of essential vitamins, minerals, and antioxidants. However, a comprehensive comparison of their nutritional value across varieties and climatic regions is lacking. Such a study would provide valuable insights into how climatic conditions and variety differences influence the nutritional value of these fruit.

Objectives

The objectives of the present work are to:

- Evaluate the nutritional value of different varieties of guava and peach.
- Compare the nutritional value of different varieties of guava and peach.
- Find which variety of guava and peach from the different climatic regions is more suitable for the masses health.

Materials and Methods

Methodology

For the planned research work, four different varieties of guava (*Psidium guajava*) and four different varieties of peach (*Prunus persica)* fruit were collected from different climatic regions. Fresh Guava fruit samples were collected manually from Kohat, Lahore (Punjab), Mardan, and Karak. Four varieties of fresh Peach (*Prunus persica)* including one genetically modified from Peshawar and three conventional varieties were collected from Karak, Kohat and Nowshera. The collected samples were cleaned and then kept in a freezer for further analysis. Some samples were seasoned and dried in an oven for protein and other parameters determination. Phosphorus (P), iron (Fe), sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), manganese (Mn), zinc (Zn), copper (Cu) have been evaluated through Spectrophotometer at various wavelength. All the samples were made dried before placing in sophisticated Spectrometer.

Sample analysis

Moisture contents, ash, protein, acidity, and ascorbic acid (Vit-C) in samples were determined on a fresh weight basis, while alkaloids, pectin, lipids, fibers, phosphorus (P), iron (Fe), sodium (Na), potassium (K), calcium (Ca), magnesium (Mg), manganese (Mn), zinc (Zn), copper (Zn) and total phenol contents were determined in samples on a dry and seasoned weight basis. Moisture contents, ash, protein, lipids, total phenol, fibers, alkaloids, pectin, and minerals were determined by AOAC method (AOAC, 1990).

Statistical analysis (Standard Deviation) was evaluated for each sample. The SD value is plotted against each samples in the respective table with average results.

Acidity

Acidity was determined by the method of alkali titration method. In this method, 0.01N NaOH was prepared. Then the juice was extracted from the samples. The juice was filtered and 10ml of each juice was taken and was diluted up to 100mL. Then the solution was titrated against 0.01N NaOH. Acidity was determined by the following formula.

$$\% \text{ Acidity} = \frac{0.064 \times 0.1\text{N NaOH} \times \text{Titer} \times \text{Dilution} \times 100}{\text{Wt of sample} \times \text{mL taken for titration}}$$

Ascorbic acid determination

For ascorbic acid (Vit-C) determination fruit samples were cut with a knife and crushed through the juicer. The weight of 5g, each sample was mixed in 0.4% oxalic acid and then titrated against 2, 6 dichlorophenol indophenols dye up to the color change. The results of ascorbic acid were expressed in mg/100g. (Suntornsuk *et al.*, 2002; Lim *et al.*, 2006).

$$\text{Ascorbic acid} = \frac{\text{dye factor} \times 100 \times \text{titre} \times \text{volume made}}{\text{Wt of sample} \times \text{mL of the sample taken}}$$

Results and Discussion

The data of the sample analysis (different varieties of guava and peach) are given below in the tables.

From the Table 1 nutrients of guava, it is evident that the famous Kohat variety of guava (*Psidium gujava*) is rich in moisture contents (80.16%), fibers (2.22%), Vit-C (1.36%), protein (2.52%). While Ash (1.00%), carbohydrates (14.72%) are more in Karak variety. From the Table 1 it is also clear that Lahore variety of guava is rich in lipids (2.00%).

Guava (Psidium guajava) data

From the Table 2 it is evident that the famous Kohat variety of guava (*Psidium gujava*) is rich in most minerals like iron (Fe) (80.20PPm), potassium (373.20 mg/100g), phosphorus (1.47%), manganese (0.12 mg/100g), calcium (11.00 mg/100g) and magnesium (16.50 mg/100g) than other varieties of guava. The above Table 2 also shows that Karak variety of guava is rich in sodium (1.45 mg/100g), while zinc (0.34 mg/100g) and copper (0.09 mg/100g) are greater in Lahore and Mardan variety, respectively.

Table 1: *Nutrients in Guava.*

		Percent contents ± SD value						
S. No	**Variety of Guava**	**Moisture contents**	**Ashes**	**Lipids**	**Protein**	**Fibers**	**Carbohydrates**	**Vit-C**
1	Kohat	80.16±0.15	0.20±0.05	1.80±0.01	2.52±0.01	2.22±0.01	13.10±0.19	1.36±0.04
2	Lahore (Punjab)	80.06±0.04	0.60±0.19	2.00±0.17	2.32±0.02	1.84±0.02	13.18±0.40	1.23±0.01
3	Mardan	79.76±0.03	0.40±0.03	1.40±0.01	2.38±0.01	2.04±0.01	14.04±0.05	1.12±0.03
4	Karak	78.52±0.06	1.00±0.26	1.62±0.02	2.48±0.01	1.66±0.01	14.72±0.23	1.26±0.03

Table 2: *Various minerals in Guava.*

		Varieties of Peach (±SD Value)			
S. No	**Contents**	**Kohat**	**Lahore (Punjab)**	**Mardan**	**Karak**
1	% phosphorus (P)	1.47±0.01	1.33±0.03	1.41±0.02	1.39±0.03
2	Iron (Fe) ppm	80.20±1.01	71.10±0.03	75.33±0.05	77.62±0.03
3	Sodium (Na) mg/100g	1.25±0.04	1.32±0.03	1.35±0.05	1.45±0.10
4	Calcium (Ca) mg/100g	11.00±0.20	7.00±0.40	5.60±0.26	7.50±0.45
5	Magnesium (Mg) mg/100g	16.50±0.19	14.30±0.20	15.40±0.13	12.34±0.03
6	Potassium (K) mg/100g	373.20±0.07	344.00±5.29	349.60±0.43	333.25±0.13
7	Zinc (Zn) mg/100g	0.31±0.08	0.34±0.14	0.28±0.07	0.29±0.04
8	Manganese (Mn) mg/100g	0.12±0.01	0.08±0.02	0.03±0.02	0.11±0.01
9	Copper (Cu) mg/100g	0.08±0.02	0.06±0.01	0.09±0.01	0.02±0.01

Table 3: *Alkaloid, Pectin (Antinutrients) in Guava.*

Varieties of Guava (±SD Value)					
S. No	**Contents**	**Kohat**	**Lahore (Punjab)**	**Mardan**	**Karak**
1	% Alkaloid	0.40±0.02	0.60±0.01	0.20±0.01	0.40±0.01
2	% Pectin	0.08±0.01	0.10±0.01	0.08±0.01	0.06±0.02

Alkaloids (0.60%) and pectin (0.10%) have been greater in Lahore from other varieties as shown in the table 3.

The Table 4 shows that the acidity (0.13%) is more in the Karak variety of Guava. While total phenol contents (180.00mg/100g) are greater in the famous Kohat guava variety.

Peach (Prunus persica) data

From the analyzed data of Peach (*Prunus persica*) it is evident that genetically modified peach contains more moisture contents (81.20%), protein (1.26%), fibers (1.48%). While ash (4.20%), and Vit-C (7.23mg/ 100g) are more in Nowshera variety of peach. Karak variety of peach is rich in lipids (0.32%) and carbohydrate contents (16.04%).

From the Table 6 it is clear that phosphorous (1.86%), iron (76.50 PPm), calcium (2mg/ 100g), magnesium (7.12mg/100g) and manganese (0.16mg/ 100g) are greater in genetically modified peach from other varieties. While, sodium (0.09mg/ 100g) is greater in Kohat variety. Minerals like zinc (0.64mg/ 100g), potassium (163.40mg/ 100g) and copper (0.29mg/ 100g) are much more in Karak peach than other varieties.

Table 4: *Total phenol and acidity in Guava.*

Varieties of Guava (±SD Value)					
S.No	**Contents**	**Kohat**	**Lahore (Punjab)**	**Mardan**	**Karak**
1	% Acidity	0.12±0.03	0.10±0.01	0.09±0.03	0.13±0.01
2	Total phenol mg/100g	180.00±5.56	155.23±0.04	135.50±1.05	144.10±0.02

Table 5: *Nutrients in Peach.*

Percent contents ± SD Valuemg/100g±SD								
S. No.	**Variety of peach**	**Moisture contents**	**Ashes**	**Lipids**	**Protein**	**Fibers**	**Carbohydrates**	**Vit-C**
1	Genetically modified	81.20±1.10	0.40±0.01	0.24±0.02	1.26±0.02	1.48±0.02	15.60±1.12	4.44±0.01
2	Karak	79.20±0.26	2.40±0.02	0.32±0.01	0.82±0.02	1.22±0.02	16.06±0.31	5.23±0.04
3	Kohat	79.80±1.02	2.80±0.02	0.22±0.02	0.90±0.02	1.26±0.01	15.02±1.02	3.05±0.01
4	Nowshera	79.40±0.43	4.20±0.02	0.20±0.02	0.66±0.01	1.18±0.01	14.36±0.47	7.23±0.03

Table 6: *Various minerals in Peach.*

Varieties of Peach (±SD Value)					
S.No	**Contents**	**Genetically modified (GM)**	**Karak**	**Kohat**	**Nowshera**
1	% phosphorus (P)	1.86±0.02	1.39±0.02	1.32±0.02	1.41±0.01
2	Iron (Fe) ppm	76.50±0.04	68.12±0.07	71.33±0.01	70.53±0.03
3	Sodium (Na) mg/100g	0.02±0.01	0.03±0.02	0.09±0.01	0.02±0.01
4	Calcium (Ca) mg/100g	2.00±0.20	1.80±0.05	1.18±0.02	1.13±0.04
5	Magnesium (Mg) mg/100g	7.12±0.01	6.11±0.02	6.70±0.07	4.30±0.18
6	Potassium (K) mg/100g	161.12±0.04	163.40±0.21	160.45±0.13	144.30±0.22
7	Zinc (Zn) mg/100g	0.62±0.03	0.64±0.03	0.53±0.04	0.56±0.05
8	Manganese (Mn) mg/100g	0.16±0.03	0.13±0.03	0.11±0.04	0.10±0.02
9	Copper (Cu) mg/100g	0.28±0.03	0.29±0.07	0.21±0.03	0.19±0.04

Table 7: Alkaloid, pectin (Antinutrients) in peach.

Varieties of Peach (±SD Value)					
S.No	**Contents**	**Genetically modified (GM)**	**Karak**	**Kohat**	**Nowshera**
1	% Alkaloid	0.40±0.03	0.20±0.02	1.00±0.26	0.60±0.01
2	% Pectin	0.16±0.01	0.18±0.01	0.14±0.02	0.08±0.01

Table 8: *Total phenol contents and acidity in peach.*

		Varieties of Peach (±SD Value)			
S. No	**Contents**	**Genetically modified**	**Karak**	**Kohat**	**Nowshera**
1	% Acidity	0.12±0.02	0.62±0.03	0.54±0.02	0.47±0.02
2	Total phenol mg/100g	18.20±0.02	22.25±0.01	19.30±0.05	15.66±0.05

The Table 7 shows that alkaloid (1.00%) is more in Kohat variety and pectin (0.18%) is greater in Karak variety of peach.

The Table 8 shows that acidity (0.62%) and total phenol contents (22.25mg/100g) are greater in Karak variety from any other varieties.

Limitations

- Seasonal variation: Seasonal changes could impact nutrient content, affecting the accuracy of the findings.
- Climate vs. Genetic Factors: It may be difficult to separate the effects of climate from genetic differences among varieties.
- Variability in Nutrient Content: Differences in soil, farming practices, and ripeness could affect the accuracy of nutritional comparisons.

Conclusions and Recommendations

The exploration into the nutritional composition of different varieties of guava and peach from diverse climatic regions has unveiled a fascinating tapestry of nutritional diversity. Each fruit variety, grown under its unique set of climatic conditions, carries a distinct nutrient, providing a different blend of health benefits.

In a nutshell, the obtained data from the study revealed that; The famous Kohat conventional variety of guava contains more quantity of important nutrients like moisture contents, protein, fibers, phosphorus (P), iron (Fe), Vit-C, total phenol contents, Calcium (Ca), magnesium (Mg), manganese (Mn) and potassium (K). Alkaloids, pectin, lipids, and zinc (Zn) are abundant in guava's Lahore (Punjab) region. Ash, acidity, and carbohydrates are greater in the Karak variety of guava. Additionally, the genetically modified peach is rich in moisture content, iron (Fe), Phosphorus (P), fiber protein, calcium (Ca), magnesium (mg), and manganese (Mn). Nowshera variety of peach contains more Vit-C (Ascorbic Acid).Pectin, lipids, acidity, carbohydrates, and total phenol contents were abundant in the Karak region variety of peach. Alkaloids, sodium, and ash were markedly higher in the Kohat peach.

On the basis of the study following are the recommendation:

- The fruit's nutritional and economic potential remains unexploited in Pakistan, which should be exploited all over Pakistan to find a healthy fruit location.
- The famous Kohat variety of guava is nutritionally rich than the other conventional variety of guava. So it is recommended to use the famous Kohat guava variety for the maintenance of good and sound health.
- Genetically modified peach can also meet the various nutrient requirements for human bodies.

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Novelty Statement

This article presents a novel approach to understanding the nutritional nuances of guava and peach varieties originating from diverse climatic regions through a comprehensive comparative analysis, offering insights into the potential impacts of environmental factors on their nutritional composition and health benefits.

Author's Contribution

Mansoor Ali Khan: Collected the samples from the diverse climatic regions of Pakistan. Some samples were seasoned and other samples were tested on fresh weight basis for various Parameters. Contributed in

writing the manuscripts and as a correspondence author also.
Khalid Imran: Contributed in writing the manuscript, tabulating the data and in literature review.
Dr. Zahid Rauf: Evaluated the standard deviation value and properly examined the moisture and ash contents of samples.
Dr. Tanvir Hussain: Identified and differentiated the conventional and genetically modified varieties of samples.
Muhammad Umair Khan: Prepared various normal and molar solutions of chemicals for various parameters analysis and composed the limitations of the manuscript.
Sajid Ali: For samples analysis contributed a lot especially in spectrophotometer operation and correlated vitamin C contents with soil composition.

Conflict of interest
The authors have declared no conflict of interest.

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