TRACE ELEMENTS IN SOME SELECTED FRUITS AT MASTUNG IN REGION OF BALOCHISTAN (A CASE STUDY)

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ABSTRACT: *The objective of this study is to determine the level of trace elements (Na, Mg, K, Ca) in fruit samples of apples, peaches and grapes from Mustung , Balochistan and analyzed to assess their trace elements contamination. It was noted that majority of samples of fruits were contaminated. It was discovered that Ca and K had the greatest concentrations. Heavy metals and minerals are found in high concentrations in fruit as a result of soil contamination, which results in the accumulation of these elements in the fruit. Furthermore, the findings of the research revealed that customers are more at risk of buying fresh peach and grapes that contain heavy metals beyond the legally allowed levels set by the Joint FAO/WHO guidelines.*

Keywords: Trace Elements, Fruits, Induced Coupled Plasma (ICP).

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1. INTRODUCTION

Every kind of fruit may be found in Pakistan, regardless of the season or terrain. So, for example, there are apples, prunes, apricots, peaches and bananas. Citrus fruits are popular both in the United States and overseas. Pakistan is blessed with rich land, a hospitable atmosphere, and a favorable climate. There are four seasons in Pakistan. Hence the abundance of fruit and greenery. Pakistan sells these fruits to more than 60 nations worldwide, including the United States.

Balochistan, Pakistan's largest province, covers 347,190 square kilometers, or 43.6 percent of Pakistan's total land area. Baluchistan is Pakistan's biggest province, although it has the lowest population of any province in the country. Between 2455 and 3204 north latitude, and 60.45 to 70.17 east longitude, is this province. There is a 2.42 percent average yearly increase in population in this province compared to 2.61 percent nationwide. A total of 29 districts are located in Balochistan. It is said that Balochistan is Pakistan's fruit basket. There are a variety of fruits that grow in Balochistan due to its unique climatic conditions.

Figure-1 Map of Balochistan ,Pakistan

Known as Pakistan's fruit paradise, the region produces 90 percent grapes, 60 percent peach, pomegranate and apricot, 34 percent apple and 70 percent date each year. More than 1,49,726 hectares of fruit trees are planted in Balochistan, yielding approximately 0.9 million tonnes of fruit each year [2]. In Quetta, grapes are a delectable fruit that is produced in abundance (Pishin, Kalat, Zhob, Loralai and Mastung districts). In these regions, grape varietals such as Kishmishi and Sundarkhani are widely grown. These fruits are produced in the highlands of Balochistan. A significant quantity of coal, gas, gold and other resources are found in this province [3].

The apple, Pyrus malus, is a member of the Rosaceae family. It is estimated that there are between 5000 and 6000 kinds of apples [2]. Among other nutrients, apples are rich in vitamin A, C and B. An estimated 80 percent of Pakistan's apple production comes from Balochistan's districts of Kalat, Killa Saifullah and Loralai as well as Mastung and Pishin as well as Quet-ta and Ziarat. Over the period of 1980-81 to 1996-97, the region around this fruit has grown more than five times [4]. There are approximately 60.22 hec-tares of peach (Prunus persica L.) grown in Balochistan, with a production of 30.31 tonnes [3]. The domestic plum (Prunus domestica) is grown across the world. Depending on the type, they may have trees that grow straight up. The leaves come in a variety of sizes and forms, although they are typically egg-shaped. A smooth and thin skin covers the oval or round fruits [4].

Pakistani apricots (Prunus armeniaca) are cultivated in the northern Pakistani province of Baluchistan. Every year, Pakistan produces about 170680 tonnes of fruit and vegetables. Fruit cultivation is the province's most important source of income. Plantago armaniaca is cultivated in Mastung, Kalat, Ziyarat, Zhob, and Pashine [5], all of which are located in Balochistan [6].

Fruit orchards and mountains surround Mastung, a picturesque city. Mastung's mountains are home to a wide variety of medicinal plants that the locals utilise to treat a variety of ailments. Mountain ranges in Mastung include the Chiltan, Aamach, and other ranges. Approximately 180,349 people lived in Mastung in 2005. People of Mastung are mostly Muslim and Baloch in ethnicity, with 99 percent of the population identifying as Muslim. Brahvi and dehwari are the native languages of this area (a broken shape of Persian).

Mastung city was once known as the city of Karez water system till a few years ago. Around 360 Karezes lived here,

which was a lot. 'Qadi' Karez, 'Noth' Karez, and'sour' Karez were the most renowned. Most of these Karezes, however, had dried up over time with the exception of one or two. Now, the orchards and other cultivated areas are irrigated with electricity-powered rigs/turbines for agro industry. Agricultural production is the mainstay of Mastung's economy. As a result, this city is well known for its fruit production. You'll find pomegranates and apples in plenty here. Few road development projects were started in this city in 2005. Construction of a national highway was the primary project (from Quetta to Karachi). The project was supposed to be completed in two years, but it's still in its early phases. In addition to the dust and pollution caused by heavy machinery and untreated car traffic, fruit orchards in close proximity to the projects are being destroyed. This has resulted in a rise in poverty and a significant decline in the province's economy. In addition to grapes and apples, plums and peaches are also affected.

Pollutants are substances that pollute the environment. However, changes were observed in soil and plants in industrialized areas as a result of the outflow of different types of pollutants [6]. Plants have the ability to absorb and collect pollutants via the use of their leaves and roots [7]. It has been discovered that the leaves contain biological and natural absorbents of pollutants [8]. Industrial areas are seeing an increase in air pollution, which poses a major threat to plant life. Due to the fact that plants are much more sensitive to their surroundings than other species, the impacts of the plant community on the environment have been widely studied [10]. To be sure, most air pollutants interfere with photosynthesis either directly or indirectly, either by causing the death of photosynthetic tissues or by interfering with the opening of stomatal holes, which are essential for photosynthesis. [12] The vast majority of airborne pollutants, gases, particles, and aerosols are absorbed and collected by large sinks, such as plants, especially trees and shrubs, which act as natural pollution traps by absorbing and collecting pollutants in the air they pass through.

It is widely recognized that the roadside plays a significant role in the absorption and accumulation of airborne pollutants, and this is true in many cases. Plants suffer morphological, physiological, and anatomical changes when exposed to contaminated conditions [13, 14]. Plant growth is inhibited as a consequence of heavy metal contamination [10]. [14] Using motor cars in cities across the world has been related to a rise in air pollution, according to recent studies. Approximately 60 to 70% of the urban population is made up of these individuals [15]. The yield and concentration of annual non-leguminous crops were both decreased by cement dust [16]. The investigation was motivated by a change in the size of stomata and epidermal cells in roadside tree species such as the pongamia pinnata (L) Merr. Cement produced from clinker, volcanic rock, and gypsum hydrate is created from raw materials that are high in aluminium, calcium, silicon, iron, magnesium, and other trace elements such as manganese, copper, zinc, nickel, lead, cobalt, copper, and copper. As a result, concrete dust alkalized soil, and the alkaline dust fell on trees, causing significant differences in mineral composition of the plants [18].

Roadside dust may also include high quantities of inorganic elements, resulting in the formation of alkaline dust. Vehicle-derived particles have been shown to be especially hazardous to human health [20].

Known for its delicious, pomaceous fruit, Malus domestica (apple tree) is a deciduous tree in the rose family. It is the most commonly farmed species of the Malus genus. In Central Asia, where its wild progenitor, Malus sieversii, is still found today, the Malus tree originated. Europe's colonies introduced apples to North America from Asia and Europe thousands of years ago. As a result, apples have religious and mythical importance in a variety of civilizations including Norse, Greek and European Christian ones. Figure-2 shows a general view of the apple fruit (Malus domestica):

Figure-2. The general image of the apple fruit (*Malus domestica*) .

In 2013, about 80 million tonnes of apples were produced globally, with China accounting for almost half of this amount [21]. The United States is the world's second-largest producer, accounting for more over 6% of total global output. Turkey is ranked third, followed by Italy, India, and Poland, in that order. Apples are often consumed raw, but they may also be found in a variety of prepared meals (particularly desserts) and beverages. Apple consumption is considered to have many health benefits; nevertheless, it has been linked to two kinds of allergies, both of which are believed to be caused by different proteins present in the fruit.

Figure-3. The general image of the peach (*Prunus persica*) .

In Northwest China, the peach (Prunus persica) was domesticated and farmed in the Tarim Basin and Kunlun Shan mountains [22], where it is still cultivated today. The peach and nectarines are examples of fruits. Figure 3 depicts a panoramic view of the peach (Prunus persica).

4–10 m (13–33 ft) tall, Prunus persica may grow to a diameter of 6 inches. It has lanceolate leaves that are 7–16 cm long, 2–3 cm wide, and pinnately veined. A single or paired 2.5–3 cm pink flower with five petals blooms in the early spring, before the leaves appear. Varieties of peaches and nectarines come in yellow or white flesh with a delicate fragrance and a velvety or smooth skin depending on the cultivar. When green, the flesh of certain commercial types is extremely fragile and readily damaged; nevertheless, the flesh of other cultivars is rather solid. Large, red-brown, oval-shaped seed, 1.3–2 cm long, enclosed in a wood-like shell. Stone fruits include peaches, cherries, plums, and apricots (drupes). Indian peach, for example, is a heritage variety that comes in the late summer[23]. In botany, grapes are deciduous woody vines of the botanical genus Vitis that produce a berry. It is possible to consume grapes fresh, but they may also be used to make wine and other products such as grape seed oil and grape seed extract. A non-climacteric fruit, grapes grow in bunches. Grape (disambiguation) as a whole is seen in Figure-4.

Figure-4. The general image of the Grape (disambiguation).

6,000–8,000 years ago in the Near East, domesticated grapes were first cultivated [24]. It is believed that yeast, one of the first domesticated microorganisms, is found naturally on the skin of grapes, leading to the invention of alcoholic beverages such as wine and beer. As far back as 8,000 years ago in Georgia[25-26], archaeological evidence indicates that winemaking was a major part of human civilization. It was discovered in Armenia that the oldest winery dates back to approximately 4000 BC. At that time, Shiraz was producing some of the Middle East's best wine. In this way, it has been suggested that Syrah red wine be called after Shiraz, a city in Persia where the grape was used to produce Shirazi wines before it became popular. Purple grapes were cultivated in ancient Egypt, according to hieroglyphics[26], and the ancient Greeks, Phoenicians, and Romans cultivated purple grapes for both consumption and wine making. Other areas in Europe as well as North Africa and North America would ultimately adopt the grape-growing practise as well.

Besides macronutrients (N, P, K and S), important micronutrients (Co, Cu, Fe, Mn, Mo, Ni and Zn) are also needed for healthy plant development [28]. Due to the intensive farming systems that continuously apply large quantities of fertilisers (inorganic fertilisers and livestock manure) to soils in order to provide adequate nutrients for plant growth, a large proportion of Saudi Arabia's agricultural soils are composed primarily of bare sand with little organic matter. It has been shown that applying livestock dung (cattle, sheep, and poultry) to the land may result in the accumulation of heavy metals such as arsenic, cadmium, copper, and lead in the soil, as well as heavy metals such as mercury and nickel in the soil [29]. If sprayed frequently to a small area of land, Cu and Zn may accumulate in soil for a long period of time in the chicken business [30-31].

As an added bonus in integrated pest management, the majority of the insecticides and fungicides that are widely used in agriculture are based on compounds that include copper, mercury, iron, manganese, lead, or zinc [32]. Environmental contamination by heavy metals in Saudi Arabia's agricultural ecosystem has not yet reached a critical level. The actual impact of potential pollutants produced by industrial capitals on agricultural regions surrounding industrial cities should be highlighted. As Pakistan's industrial sector has grown, contamination of the environment with heavy metals has skyrocketed in certain areas of the country. It was found that there is insufficient information on the mineral composition of Pakistan's agricultural sector to estimate the hazardous levels of certain heavy metals in fruits for human consumption, based on a literature study.

It is a well-known fact that fruit juices are highly regarded, delicious, and nutritionally beneficial foods. Due to the low quantities of necessary elements, they may be a source for harmful elements, some of which have an accumulation impact or cause nutritional issues [32 &28].

As few as 50 parts per million (ppm) of trace metals may be found in food, and they may have toxicological or nutritional importance When it comes to people's health, elements such as na, k, c, and p are important, while elements like Pb, Cd, Hg and As have been shown to have harmful effects at levels as low as 10–50 parts per million (ppm). Fe, Cu, and Zn, on the other hand, are shown to be essential in specific levels in meals, but they may have negative consequences when consumed in large numbers. Al, B, Cr, Ni, and Sn are other benign metals that are not hazardous when present in quantities less than 100 ppm. As, Sb, Cd, F, Pb, Hg, and Se are the non-nutritive toxic metals that are known to have harmful effects even in tiny amounts (below 100 ppm). Food safety and nutritional concerns depend on knowing the main and trace amounts of metal presence in foods [34].

So, the trace element levels in fruit juice to be affected by the kind of fruit, soil mineral composition, irrigation water composition, meteorological conditions, and agricultural methods such as fertiliser types and quantities, among other things [35].

These results were then compared with the maximum permissible limit for drinking water set by the United States Environmental Protection Agency (USEPA) [36] and the World Health Organization (WHO) [37].

2. EXPERIMENTAL

Samples and sampling

It was necessary to collect samples of Mastung apples, peaches, and grapes for this study. Inductively Coupled Plasma Quadrupole Mass Spectrometry was utilised for all

studies. Perkin Elmer ELAN DRC (e) was used with a Meinhart nebulizer, a silica-cyclonic spray chamber, and continuous nebulization. The Perkin Elmer ELAN DRC (e) was used with a nebulizer to deliver the medication. Flow rates of gases Nebulizer You may choose between three different gas flow rates: 0.92 litres per minute for the Auxiliary Gas, and 1.20 litres per minute for the Plasma Gas. A 10.5-volt lens is used, along with 1100-watt ICP RF power, CeO/Ce of 0.020, and Ba++/Ba+ of 0.23. 103Rh was chosen because it had the highest signal and the lowest percentage of double-charged and oxide ions (measured as Ba++/Ba+ intensities ratio, always 3 percent), with an accuracy higher than 2 percent and a background of 30 cps was chosen for a compromise.

3. RESULTS AND DISCUSSION

Due to their widespread use throughout the globe, commercial fruit juices must be evaluated for consumer safety [38]. The nutritional importance of cations such as potassium, sodium, and calcium necessitates their detection in fruit juices. Recent studies, for example, have shown that excessive dietary salt is a risk factor for heart disease. Even though Ca is an essential dietary component for most, individuals with renal insufficiency may be at risk for complications. For optimum health, vitamin K is also important and may be found in high quantities in some juices. Accordingly, it's important to record cation levels accurately. There are two tables with the data: Table 1 and Figure 5.

Table-1. Trace elements level(mg/kg) in fruits from Mastung.S.NO

No.	Name of Fruit	Na	Mg	K	Ca
1	Apples	35.35	49.41	44.25	71.07
2	Peaches	129.2	40.33	257.23	26.53
3	Grapes	132.1	37.5	191.1	19.8

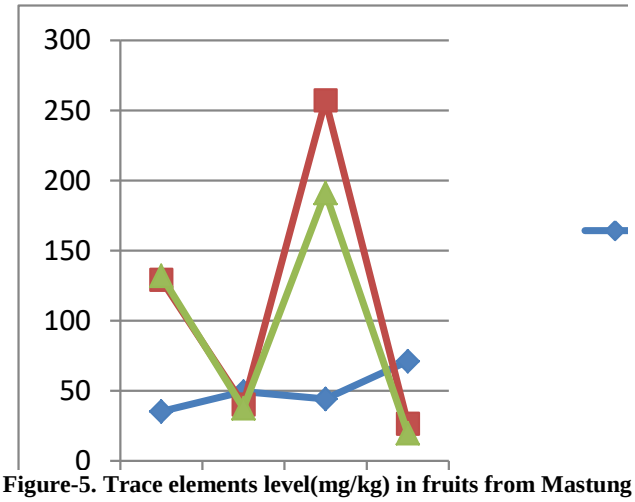

Figure-5. Trace elements level(mg/kg) in fruits from Mastung

As a result of road building, roadside dust is a major source of air pollution in Mastung, South Korea. In the vicinity of the projects, fruit orchards are being damaged by the dust of cars, as well as pollution caused by heavy equipment and untreated vehicle traffic. Thus, poverty has increased, and the country's economy has suffered a great deal as a result of this. Some of the worst-affected fruits are apples, plums, peaches, apricots, and grapes. Apple, Plum, Peach, and Apricot orchards along the road are severely affected by the dust particles produced by the road construction. As part of the current research, data was gathered from two orchards that were located near a road that was being constructed. It was decided to gather the leaves of the following fruit: Apple, Plum, Apricot and Peach. Plants collect dust, heavy metals, and other airborne particles in their leaves.

In many nations, air pollution is a significant issue [40]. As a result of air pollution, all plants in contaminated regions function as dust filters [1]. For example, pyrus malus L. leaves in Miyyaghundi had the greatest dust content (1.05 gm), whereas Prunus domestica L. leaves in a more rural area had the lowest dust content (0.08gm). [41] According to several experts, air pollution is responsible for changes in leaf surfaces and features. As a result of highway pollution, plant rates of growth slow down. The hazardous compounds such as chromium and copper in the cement dust are detrimental to humans, plants, and other living things [42. 43] The main source of urban air pollution is the use of diesel and gasoline fuels in automobiles and other modes of transportation.

Orchards that grow Apple, Plum, Peach, Apricot and Grape are severely impacted by the dust particles produced by road construction. It was found that trees near the borders of orchards were more severely damaged than those in the centre. They were located near roadways, where they were immediately exposed to vacuolar traffic and road construction dust.

They are pore-like holes found on the underside of leaves. Each stomata has two guard cells that regulate the opening and shutting of the stomata. By opening and shutting, these stomata enable Carbon dioxide, oxygen, and water vapour to flow into and out of the leaf. Stomatal opening and closure is responsible for transpiration and photosynthesis in plants [44]. It was shown that the opening and shutting of stomatal apertures is crucial for plant development in the absence of stomata or when stomata are damaged [45].

Trees near highways were found to open and close their leaf stomata owing to the dust from road building. Researchers examined leaf stomata and found that air pollutants such as SOz, Ozone, and fluorides had little effect on stomata because they close them, and the opening and shutting of the stomata is crucial for gas exchange in plants [46]. Furthermore, dust from cars and road construction was shown to induce stomata to close since the dust particles are polluting elements that have phytotoxic effects on plants in the current research. A large variety of metabolic activities in plants, such as photosynthesis, transpiration and respiration, are adversely impacted as a consequence [47].

Researchers noticed contaminated and unpolluted leaves in the current research. The leaves of trees that were close to the roadways were more severely damaged than those that were further away. Near the highways and immediately facing the dust from road construction and cars, pyrus malus L. trees showed the greatest number of close stomata (419.3) The size and quantity of stomata and epidermal cells in polluted and uncontaminated locations were the same [17]. Those Prunus domestica L. trees that were far from the highways had the greatest number of open stomata (285.3), compared to those trees that were close to the roads. Leaf and soil pollution are two ways in which air pollution affects plants [48]. As much as 200g of cement dust per kilogramme of soil was found on most trees'

plumules and radicles [16]. A lack of oxygen impacts plant growth, flowering, fruit maturation, and the development of new leaves. Due to air pollution, trees' senescence and fruit yield are also affected [49].

The mechanism of sto-matal fluctuation caused by external pressure has been discovered [50]. Due to dust deposition, several physiological processes in plants are affected, such as photosynthesis, stomatal functioning and production, as well as shade and wax removal [51]. Phytochemists have utilised chlorophyll fluorescence, which indicates the destiny of excitation energy in the photosynthetic system, as an early, in vivo indicator of plant response to various stressors As a result of pollutant-derived phytotoxic compounds [47], metabolic processes such as transpiration, respiration, and photosynthesis have been affected. When plants are exposed to contaminants, their stomatal openings alter [53]. The physiological, biochemical, and morphological effects of pollution on trees are studied [54]. Researchers discovered that dust interferes with photosynthesis and gas exchange, as well as affecting stomata functions, leaf temperature [19], and transpiration [55], reducing photosynthesis [56], and increasing the absorption of gaseous pollutants [57]. Stomatal opening and closure was shown to be complicated [584]. Numerous variables interacted in a complicated way [59].

4. CONCLUSION

According to this research, roadway dust has a negative impact on fruit plants. Due to the dust from road construction, the foliage of these trees were severely damaged. Data on mineral and heavy metal levels were collected from fruit samples taken from Mustung in Balochistan. On the Romanian market, you may get apple, peach, apricot, orange, kiwi, pear, pineapple, and multi-fruit juice. Ca and K were determined to be the most abundant elements in the area. Heavy metals and minerals in fruit are a result of soil contamination. Several variables influence the metal concentration in soil pollution, including soil composition and weather conditions during fruit growth and harvesting. According to the findings of the research, customers are more at risk of buying fresh peach and grape products that contain heavy metals over the legally allowed levels as specified by the Joint FAO/WHO guidelines.

5. RECOMMENDATIONS

- As a precaution against environmental contamination, fruit trees should be placed away from highways.
- To prevent the trade of edible fruits and vegetables in and near areas where the atmospheric lead content is higher, people need to be aware of the risks (i.e. industrial surroundings or heavily traffic congested roads).
- Determining how much Pb is in veggies from dangerous regions should be regulated, and the plants may then be used to monitor the environment and its potential to produce harmful effects, depending on the metal load. There is a great deal of opportunity for future study into the mineral composition of fruits to minimise health and environmental risks expected to arise from the eating of contaminated fruit, particularly with heavy metal ions, as shown by the findings.

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