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**Survey and analysis of postharvest practices: A case study of fruit market, Islamabad**Abdullah Shafiq<sup>1\*</sup>, Touqeer Ahmad<sup>1</sup>, Khalid Hamza<sup>2</sup><sup>1</sup> Department of Horticulture, PMAS Arid Agriculture University Rawalpindi, Pakistan.<sup>2</sup> Department of Plant Pathology, PMAS Arid Agriculture University Rawalpindi, Pakistan.**Article History:***Received: October 22, 2023**Revised: November 29, 2023**Accepted: December 03, 2023***ABSTRACT**

In Pakistan, fruits and vegetables lose 20–40% of their value after harvest, and sometimes even more. This enormous percentage of losses points to insufficient post-harvest handling procedures and a subpar value chain management system, which hurts every link in the value chain financially and drives up consumer prices. This study examined the postharvest handling and management strategies used in Islamabad's fruit and vegetable market, which receives both imported and locally produced fruit from all provinces. According to the survey, the local fruits were frequently packed in shoddy cardboard boxes and wooden crates made of low-grade packaging material. These boxes frequently had dimensions that were inappropriate for the kind of fruit that was being packed inside of them. The appearance of the fruit products was adversely affected by the sturdy construction and design of these boxes. The label's traceability and product information were inadequate. In a similar vein, these fruits were transported in cars devoid of any kind of cooling system or specially designed interior to guard against travel injuries. The cold storage facilities presented another difficulty because they were not designed specifically for the storage of fruit products and had insufficient capacity. Conversely, imported fruits, particularly those from developed nations such as France and New Zealand, were packaged in an eye-catching, long-lasting, and customized manner that included comprehensive information and traceability protocols. Reefer containers were used to carry these imported goods. The impact of these policies was evident in the pricing disparity between imported and local fruits. While local varieties ranged in price from Rs 2000 to Rs 4000 per box (16-18 kg), Granny Smith apples imported from France were retailing for Rs 10,000 for 100 apples. Imported citrus and grapes from Iran, Egypt, and India were more expensive but of higher quality. To guarantee food security and boost the competitiveness of local fruit products on the global market, it is imperative to raise the bar for value chain and post-harvest management practices. It will assist the nation in generating significant foreign exchange and reducing its import expenses.

**Keywords:** Cold storage; Fruit; Islamabad; Losses; Postharvest**INTRODUCTION**

In the field of agriculture, post-harvest procedures are quite important, especially when it comes to fruits. The market value and general quality of fruits are directly and significantly impacted by the effectiveness of post-harvest treatment. Ensuring the safety and quality of produce becomes a top priority for producers and other agricultural industry stakeholders. The phrase "postharvest technology" describes how agricultural produce is treated after harvest to guarantee its preservation, processing, packing, distribution, marketing, and use to satisfy the population's need for food and nutrition (Faqeerzada et al., 2018). A crucial time for maintaining the integrity of agricultural products and maximizing their market value is the post-harvest period. A set of characteristics or standards that

assign a specific value to horticulture commodities, such as fruit, vegetables, and ornamentals, are collectively referred to as the quality of fresh crops. Consider the nutritional importance of fruits and vegetables and the aesthetic satisfaction of ornamentals. When referring to different kinds of horticultural output, the term "quality" can be used in a variety of ways, such as "eating quality," "shipping quality," "market quality," or "consumer quality" (Malik et al., 2017). It can also refer to internal or exterior quality. Whether a crop is sold for fresh consumption or utilized as an ingredient in a processed food product depends primarily on postharvest treatment. According to El-Ramady et al., (2015), the main objectives of postharvest management are to keep the product cool to prevent moisture loss and delay unwanted chemical changes, as well as to prevent physical damage such bruising and delay spoiling.

Pakistan boasts a diverse array of agroclimatic conditions ranging from tropical to temperate, which facilitate the growth of up to thirty distinct fruit varieties (Aujla et al., 2011; Ahmad et al., 2018). Pakistan is the developing nation that produces about 58% of the world's veggies and 45% of its harvested fruit. Fruits and vegetables, which account for 12% of Pakistan's agricultural GDP, are crucial to the country's economic development. Approximately 6. percent of the country's planted land, or 1.24 million hectares, are in the fruit and vegetable region (Rizvi et al., 2020). According to Ahmad et al. (2015), Pakistan produces guava, mango, and oranges at rates of 7%, 27%, and 31%, respectively. Post-harvest losses in Pakistan's agriculture industry, especially for fruits and vegetables, are a serious problem. These losses can vary from 20 to 40 percent, and in some cases they even surpass these percentages. Horticultural items can have losses of up to 80%; with fruits, for instance, losses in the distribution chain can exceed 50% from harvesting to consumption, particularly in tropical nations (Indiarto et al., 2020; Ahmad et al., 2015). Up to 35 percent of all agricultural produces experience physical loss at various stages, after the crops have matured and before the food is consumed. This results in the agriculture sector losing between Rs. 32 and 40 billion annually due to a lack of a proper fruit processing industry and a lack of post-harvest operations (Parveen et al., 2014). In technical terms, post-harvest losses are quantifiable, qualitative losses that can be measured at various stages of a produce's shipment from the point of harvest to the point of consumption. Examples of these losses include changes in availability, edibility, wholesomeness, and quality (Shahzad et al., 2013). Such significant losses draw attention to shortcomings in post-harvest handling procedures as well as a weakness in the current value chain management system. Every link in the value chain feels the financial impact of these losses, which causes financial losses for stakeholders and higher prices for customers. The primary, but frequently overlooked, step in providing the world with more nutrient-dense food and preventing loss between harvest and consumption is careful post-harvest handling (Fatima et al., 2009).

Our research focuses on this crucial element, specifically examining the postharvest procedures in the busy Islamabad Fruit Market. Together with imported fruits, this market acts as a hub for regional produce from several provinces. The conditions that exist in storage facilities play a crucial role in achieving a longer shelf life and improved fruit quality (Kassim et al., 2013). An analysis of the postharvest methods used in this heterogeneous market provides information about common issues and areas for development. As the research evolves, obstacles arise for the native fruits—a vital part of Pakistan's agricultural production—even before they are packaged. Food packaging serves three main purposes: long-term storage, preservation, and protection (Kassim et al., 2013). These fruits are kept in subpar wooden crates and cardboard boxes that frequently lack size and shape specifications. The durability of these containers is jeopardized by the inadequate packing material, which also detracts from the fruit products' overall presentation. The difficulties in preserving and improving the quality of regional produce are further compounded by problems like inadequate traceability and product information on labels.

Another crucial aspect of the post-harvest journey is transportation. Local fruits are vulnerable to injuries caused by transportation because they are frequently transported in cars without specialized lining or cooling equipment. Moreover, insufficient capacity and a lack of specificity regarding the kinds of fruits stored are features of cold storage facilities, which are crucial for maintaining fruit quality. Compared to imported fruits, especially those from developed countries like France and New

Zealand, this is a stark contrast. These imported goods have well-designed, long-lasting, personalized packaging that includes thorough documentation and traceability procedures. These imported fruits are transported in reefer containers, which further guarantees their quality during the trip.

The stark contrast in post-harvest practices between local and imported fruits is reflected not only in their quality but also in their market prices. Imported fruits command higher prices, driven by their adherence to superior post-harvest handling practices. The research highlights specific instances, such as Granny Smith apples from France, which are retailed at a premium compared to local varieties.

The need to improve post-harvest management practices and the value chain's standards is highlighted by this study. These advancements are essential for raising the competitiveness of regional fruit products on the global market in addition to guaranteeing local food security. Strong post-harvest infrastructure reduces import costs and protects the nation from losses while putting it in a position to earn significant foreign exchange. The survey results and analysis go into greater detail about the nuances of post-harvest procedures in the sections that follow, providing a thorough grasp of the difficulties and possible solutions in the Islamabad Fruit Market. We will examine the essential procedures for ideal post-harvest handling in this extensive guide, with an emphasis on post-harvest loss reduction, packaging, and transportation. We will also talk about how appropriate handling affects market value and offer suggestions for raising market prices.

At a substantial 21% share, the agriculture sector is a cornerstone of Pakistan's economy and contributes significantly to the country's GDP. Notably, this industry employs 45% of the labor force in the nation and provides a living for 60% of rural residents, making it a crucial source of jobs (GOP State, 2012). Beyond its effects on the economy, agriculture is essential for maintaining food security, promoting economic expansion generally, lowering poverty, and advancing industrialization.

Pakistan's diverse agroclimatic conditions, which span from tropical to temperate zones, foster an atmosphere that is ideal for growing a wide range of crops. The country claims to be able to grow 30 different kinds of fruit and 40 different kinds of vegetables. The following are especially important: spinach, radishes, apples, bananas, raisins, tomatoes, carrots, cabbages, turnips, and apples (GOP State, 2018; Ahmad et al., 2018). In recent decades, the government has given horticulture priority due to its recognition of its importance. A little over 0.85 million hectares are planted with fruit, making up 69% of the total fruit production; on the other hand, 0.39 million hectares are planted with vegetables, making up 31% of the total vegetable production (GOP, 2019). About 6.9 million tons of fruits and vegetables are produced in the nation overall, with fruits making up a noteworthy 53% and vegetables making up the remaining 47% (GOP, 2019).

The government's dedication to the horticultural sector has been further highlighted by the establishment of the Pakistan Horticulture Development and Export Board (PHDEB). As it transformed into an independent organization, the PHDEB prioritizes exporting and industry expansion. It accomplishes this by assisting farmers in implementing cutting-edge technologies, creating export-focused plans to draw in domestic and foreign capital, and building strong ties with pertinent domestic and international research and development organizations (GOP, 2008). Regardless the potential and the efforts of the government, Pakistan's fruit and vegetable production sector still faces significant obstacles. Low productivity, notable yield discrepancies between large and small farms, and a notable deviation from global productivity levels are among the main problems. Poor farm management, perishability issues, inadequate cold chain facilities, stockpile problems, and reliance on conventional advertising mechanisms are some of the factors that contribute to these challenges. These factors all result in post-harvest losses and quality-related issues. In addition, unstable pricing is caused by inadequate cold storage facilities and undeveloped manufacturing markets, which makes it difficult to enforce laws, register legally, and trace products for access to foreign markets (Vorley et al., 2016).

The difficulties facing the fruit and vegetable industry are further highlighted by the intricacies of the supply chain. The supply chain includes a range of tasks necessary to move goods or services through different stages of production, such as actual distribution and mechanisms for receiving feedback from particular supplier services.

As this review of the literature shows, Pakistan's agriculture industry, especially horticulture, has a lot

of potential, but realizing that potential will require overcoming these obstacles. In order to provide focused insights and suggestions for long-term advancements in the postharvest handling of fruits, the following sections of this study conduct a thorough survey and analysis of postharvest practices in the Islamabad Fruit Market.

## **MATERIALS AND METHODS**

### **Longitudinal Data Collection**

The study covered a large temporal range, carefully investigating the subject for six months at a rate of four visits per month. The purpose of this purposeful, extended interaction was to document the dynamic, ever-changing postharvest practices in Islamabad's Fruit Market. The study attempted to account for possible variations influenced by market dynamics, seasonal fluctuations, and other temporal factors by making sure that observations were made on a regular and repeated basis.

### **Targeted Variables and Retailer Engagement**

A purposeful focus on key variables led to a thorough understanding of postharvest practices for both imported and local fruits. Retailers actively participated in the data collection process because they are important middlemen in the fruit distribution chain. A strong tool, the six-question structured questionnaire probed into important areas such as cost, mode of transportation, packing, origin of production, quality (grade), and storage.

### **Questionnaire Design and Standardization**

Careful thought went into designing the questionnaire to make sure that every question made a significant contribution to the overall goals of the study. Standardization was essential in guaranteeing uniformity amongst responses, which improved the validity and dependability of the information acquired. This method made it easier to fully comprehend the viewpoints of individual retailers and made it possible to aggregate data and identify broad trends and patterns.

### **Comparative Analysis Framework**

An essential component of the methodology involved implementing a strong framework for comparative analysis. This required a thorough examination of data related to both domestic and imported fruit commodities. We carefully compared every variable of interest, including price, quality, packaging, origin, mode of transportation, and storage. This method attempted to identify subtle differences and similarities between postharvest procedures related to domestic and imported fruits.

### **Extended Review of Transportation Facilities**

In addition to the market, the study included a thorough analysis of transportation infrastructure. This entailed a thorough inspection of fruit-transporting vehicles, paying particular attention to their state, the availability of refrigeration units, and the presence of protective lining to guard against injuries sustained during travel. The research sought to capture the complex relationships between postharvest outcomes and transportation practices by expanding its scope beyond market boundaries.

### **Quantitative Analysis and Statistical Rigor**

To uncover important insights, a thorough quantitative analysis of the gathered data was conducted using statistical techniques. A thorough analysis of trends, patterns, and notable deviations was the hallmark of this analytical phase. The goal of applying statistical rigor was to both clarify the numerical aspects of postharvest practices and offer a strong basis for drawing reliable and useful conclusions.

### **Quality Assessment and Perceived Value**

The methodology included a qualitative evaluation of product quality, which included aspects like grade and packaging. The emphasis shifted from quantitative measurements to the more individualized domain of perceived value. The study aimed to investigate how packaging affects consumers' perceptions of fruit quality in order to better understand the complex interactions between tangible and intangible factors that shape consumer perceptions.

### **Synthesis of Results and Holistic Understanding**

The process culminated in the synthesis of findings from the quality assessment, transportation facilities review, and comparative analysis. This synthesis was a deliberate attempt to bring disparate threads together into a coherent narrative, rather than just a collection of findings. The study used a

holistic methodology in an effort to provide a complex and comprehensive picture of postharvest procedures in Islamabad's Fruit Market.

**Identification of Trends and Challenges**

The comprehensive and multi-tiered approach made it easier to spot new trends, identify enduring problems, and investigate possible areas for development. In this stage, quantitative data were interpreted qualitatively to give the patterns that were found more nuance and context. The ensuing realizations established the foundation for well-informed suggestions and actions in later study sections.

Essentially, the research methodology used in this study was a careful and deliberate framework intended to capture the richness and complexity of postharvest practices in the Fruit Market of Islamabad, rather than just following procedural formalities. The purposeful length and scope of the methodology was to reflect the breadth of investigation and analytical care used during the research process.

**Results and Discussion**

**Local and Imported Fruits: A Comparative Analysis**

Comparative study of domestic and imported fruits in Islamabad's Fruit Market revealed complex insights into the various postharvest practices related to these commodities. To identify trends and differences, the study carefully investigated factors like cost, quality, packaging, origin, mode of transportation, and storage.

**Pricing dynamics**

The prices of local fruit varieties varied widely, indicating the influence of postharvest practices in addition to the diversity of produce as shown in figure 1 and 2. Fruit imports, particularly those from developed countries like France and New Zealand, showed a premium positioning in terms of price as shown in figure 3. The impact of superior postharvest handling on market value was highlighted by the significantly higher price of Granny Smith apples imported from France as opposed to local varieties.



Figure 1: Pricing difference between the local and imported fruits.



Figure 2: Quality and pricing of local commodities.

### Quality Grading and Packaging

The qualitative evaluation of product quality and packaging revealed significant differences between fruits that are imported and those that are local. Local fruits were frequently discovered packaged in shoddy cardboard boxes and wooden crates with inconsistent size and shape as shown in figure 2 and 3. On the other hand, imported fruits were distinguished by eye-catching, robust, and personalized packaging that improved the way the product was presented and added to the impression of higher quality as shown in figure 3. The differences in packaging between the two categories highlighted the need for improved postharvest procedures in the region's fruit industry.

### Origin and Traceability Protocols

Fruit origin has been shown to have a significant impact on postharvest procedures. Fruit imports, particularly those from France and New Zealand, followed traceability guidelines and gave detailed information about the origin of the product such as shown in figure 4. On the other hand, traceability was frequently hampered by the lack of sufficient origin information for local fruits. This discrepancy made it clear that uniform traceability procedures were required in the neighborhood fruit market in order to increase openness and foster customer confidence.

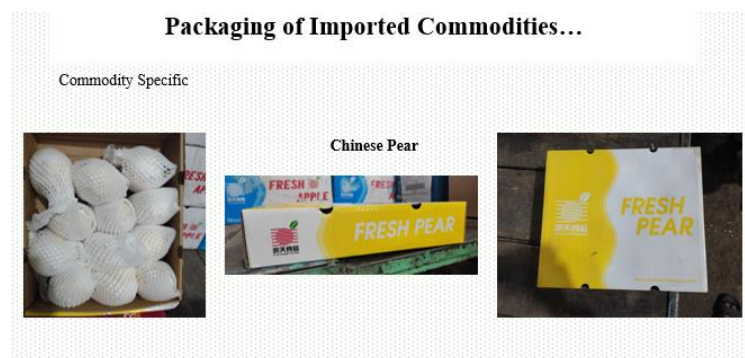


Figure 3: Packing and quality of imported fruits.



Figure 4: Traceability protocols of imported fruit commodities.

### Transportation Practices: A Critical Examination

The study thoroughly examined the transportation procedures related to both domestic and imported fruits, extending its examination beyond the market premises. The objective of this stage was to disentangle the complex relationships between modes of transportation and postharvest results.

#### Local fruit transportation challenges

Transporting local fruits presented difficulties since many cars lacked cooling systems and protective lining to guard against injuries sustained during the trip. These essential components were missing, which put the fruits' quality at risk when they were being transported and resulted in postharvest losses as shown in figure 5. The study made clear how urgently better transportation policies and infrastructure are needed to protect the quality of locally grown fruits.

#### Imported fruit transportation excellence

Conversely, fruits that were imported—especially those from developed countries—were shipped in

reefer containers as shown in figure 5. This kind of transportation, which had cooling capabilities, was essential in keeping the imported fruits fresh during the trip. The correlation between improved postharvest outcomes and superior transportation practices was further highlighted by the observation of transportation excellence in imported fruits.



Figure 5: Transportation for both domestic and imported fruits.

### **Synthesis of Findings: Unveiling Systemic Challenges and Opportunities**

The results were synthesized, and this allowed for a more nuanced understanding of the postharvest landscape of the Fruit Market in Islamabad, including potential opportunities and systemic challenges.

#### **Systemic challenges**

The local fruit market was found to be facing systemic issues, such as poor packaging, insufficient traceability procedures, and inefficient transportation methods. All these difficulties led to postharvest losses, lower quality products, and ultimately higher prices for customers. To tackle these obstacles, a comprehensive strategy that covers the complete value chain, from manufacturing to distribution, is required (Raheel et al., 2021).

#### **Opportunities for improvement**

Notwithstanding the obvious difficulties, the study also revealed areas that could be improved. The implementation of uniform packaging, improved tracking protocols, and the inclusion of refrigerated areas in regional fruit delivery have surfaced as crucial interventions. Additionally, spending money on cold storage facilities that are more capable and tailored to specific fruits could reduce postharvest losses and improve the general quality of locally grown produce.

#### **Implications for the Future: Elevating Local Competitiveness and Global Presence**

The research's conclusions have a significant impact on Islamabad's local fruit industry going forward. Improving postharvest procedures is a strategic necessity with far-reaching effects, not just a corrective action.

#### **Enhancing local competitiveness**

Through the implementation of interventions aimed at improving the identified challenges, the local fruit industry has the potential to increase its competitiveness. A more robust value chain can be achieved by standardizing packaging, enhancing traceability, and modernizing transportation infrastructure. This will guarantee that local fruits not only meet but also surpass consumer expectations in terms of quality and value. According to Ahmed et al. (2015), the installation of compact cold storage units in production centers would aid in lowering storage losses.

#### **Expanding global presence**

If local fruit growers follow international postharvest protocols, the global market offers them a lucrative opportunity. By making investments in superior packaging, traceability procedures, and efficient transportation, locally grown fruits can be made to compete on the global stage. Considering that the world's population is predicted to grow at a rapid rate—roughly 10.50 billion people by 2050—horticultural product demand per capita has increased. By reducing post-harvest losses, we can make up the difference (Raheel et al., 2021). This expansion enhances the nation's reputation as a

dependable and quality-conscious fruit supplier on the international scene in addition to boosting economic growth at home.

## CONCLUSION

In conclusion, it is impossible to exaggerate the importance of using good post-harvest handling techniques for fruits and vegetables. Ensuring product quality, safety, and market value requires careful execution of sorting, cleaning, safe packaging, pre-cooling, storage, and transportation. Together, these procedures reduce the risk of microbial contamination, shield produce from harm, increase its shelf life, and ensure that consumers receive their produce safely. Meeting customer expectations, charging more, and promoting market competition are all examples of how these practices have a significant impact. Growers who adopt and continuously improve these post-harvest procedures not only optimize market value but also significantly contribute to the development of a prosperous agriculture sector.

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