ASSESSMENT of PAPAYA POSTHARVEST LOSS at WHOLESALER and RETAILER LEVELS in JIMMA TOWN, SOUTH WESTERN ETHIOPIA

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Due to its perishable nature, papaya has a high post-harvest loss and limited shelf life. Assessment of papaya postharvest loss was conducted in Jimma town at wholesalers and retailers’ levels using semi-structured questioners followed by an interview and personal observation in 2017. Eighty-one respondents were participated in this survey. The majority of the people participated in papaya selling activities at the retailer were women whereas, men dominated in papaya wholesalers’ market. The major source of papaya for Jimma town market was from Dedo woreda (34.57%). All of the wholesalers (100%) transported papaya fruits by truck and also, some retailers (35.29) use trucks to transport the fruits from nearby Woredas. The main cause of papaya fruit losses at Jimma town was fruit softening, rotting, wounding, and compact due to inappropriate transporting, storage condition, and lack of appropriate marketing place. The papaya post-harvest losses at wholesalers’ level were 21.75% which was 12.5% and 9.25% during transporting and storage respectively. There were about 15.6% of losses at retailers’ level. In general, about 37.35% of papaya fruit was lost in Jimma town only at the two marketing channels. To fulfill the demand and to minimize the loss of papaya fruit, training, and marketing facilities should be facilitated.

Keywords: Deterioration, Postharvest, Respondents, Storage, Transportation

INTRODUCTION

Papaya (Carica papaya L.) belongs to the Caricaceae family which is native to tropical America and is now cultivated in every tropical and sub-tropical country of the world due to its economic importance (Samson, 1986). The global papaya production is led by Asian countries followed by South America, Africa, Central America, and Caribbean countries, respectively (Evans et al., 2012). In Ethiopia also it is one of the economically important fruits grown in different parts of the country. It is produced in home gardens and semi-commercial levels by farmers as well as commercial level by state farms for home consumption and local market (for fresh fruit and juice making) in the country (Shafi et al., 2014).

Papaya is largely known for its nutritive and medicinal values. It is consumed as fresh fruit and processed as juice form. It is also used for medicinal purposes by extracting the substances from different parts of papaya which have shown protective effects against many diseases such as intestinal worms’ infection and different types of wounds (Elgadir et al., 2014).

Despite the nutritional and health benefits of papaya, the postharvest loss of the fruit is higher than the most fruit crops due to its perishable nature. The fruit has a limited shelf life of less than a week under ambient tropical conditions (30°C) (Desai and Wagh, 1995; Sankat and Maharaj, 2001).
It is very susceptible to mechanical damage, insect pest attack, and diseases. Also, inadequate attention has been paid by many producers to the method of harvesting, stage of maturity at harvest, use of fungicidal treatments, proper packaging and storage methods (Sankat and Maharaj, 2001). Hence, the fruit is often of poor quality and there are considerable wastages before arriving at the consumers’ table. One of the major causes of papayas being rejected at local and export markets is mechanical injuries which can be easily reduced if the fruits are properly packaged and handled. As a result, different intermediaries engaged in papaya marketing have been challenged by postharvest losses that result in economic reduction at the final (Mashau et al., 2012). Different reports suggested that the postharvest loss of most horticultural crops started at the farmers’ field immediately after they harvested and continued at the wholesaler, retailers, and consumers level (Irtwange, 2006). At the field level, the losses are caused mainly due to harvesting immature and small size of fruits, malformation, and harvesting injury (Kader and Płocharski, 1997), whereas at the market level, bruises and pressing injury caused transit loss at this point (Kader, 2002). These Highest postharvest losses are not only reducing the availability of fruits but also result in an increase in per-unit prices of the products and thus limit the accessibility by the majority of community segments. According to Kughur et al. (2015) multiple effects of postharvest loss as going beyond the loss of the actual crop to include loss in the environment, resources, and labor needed to produce the crop and livelihood of the individual involved in the production process.

Growing and marketing for fresh fruits in Ethiopia are complicated by postharvest losses both in terms of quality and quantity between harvest and consumption (Asmaru et al., 2013). This is might be due to high perishable nature of the fruit, lack of storage facilities, mechanical injuries due to improper handling, improper packaging materials, inconvenient transportation method, and microbial infection are the major reasons for the losses in the country (Devkota et al., 2014). According to the study of Said et al. (2013), postharvest loss of the horticultural crops in South Wollo of Ethiopia were 1.5%, 1%, and 3.3% at farm level, transport level, and storage level, respectively. Thus, a considerable quantity of papaya is wasted before it has reached the target markets due to limited shelf life of the fruit and poor handling problems (Emana and Gebremedhin, 2007).

In Ethiopia, the fruit of papaya is produced in different parts of the country including various districts of Jimma Zone which mainly a source of fruit supply to the Jimma town market. As a result, papaya is one source of economy for the traders (wholesalers and retailers) in Jimma town (Jimma zone Agriculture Office, personal communication). However, the extent and magnitude of the postharvest loss of papaya in Jimma town at retailers and wholesalers’ levels are not studied and well known. So, the objective of this work was to assess papaya postharvest loss in Jimma town southwestern Ethiopia at wholesalers and retailers’ levels.

MATERIALS AND METHODS

Description of the study area

This assessment study was carried out in Jimma town, which is located in the southwestern part of Ethiopia and found at about 345 km away from Addis Ababa. The city is found at an elevation of 1,559 mm with maximum and minimum temperatures of 26.8 and 13.6 °C, respectively as of 2017 report from Jimma metrological station.

Method of sampling, data collection, and analysis

Eighty-one respondents were randomly selected among fruit (papaya) retailers and wholesalers operating in Jimma town. The survey was conducted in January 2017 using a semi-structured questionnaire following the individual interview method. Both qualitative and quantitative data including sex, age, and education level of respondents, types of packaging material, transportation methods, storage facilities, sources of fruit, percentage of fruit losses, causes of fruit losses, percentage fruit losses in different seasons, possible uses of over-ripen (unusable) papaya fruit, and measures taken by respondents to reduce postharvest losses were collected using the questionnaire and analyzed using Excel software.

RESULTS AND DISCUSSIONS

Socio-economic characteristics of respondents

As indicated in table 1, all the peoples participating in papaya fruit selling at wholesalers’ level were men. However, at retailers’ level, females were dominantly engaged in papaya selling which accounts about 76.5%. Based on the survey of an overall participant of papaya sellers in Jimma town in terms of sex ratio, the women have more participation than men (61 out of 81 respondents) which contradicted with Desalegn et al. (2016) findings in which an equal number of women and men are participated on fruit retailer in Bahir Dar city.
This disagreement might be because of the socio-cultural differences between the two cities. In case of age distribution, the middle age (20-40) year old respondents participated in papaya wholesaling and retailing which accounts about 64.7% and 50%, respectively. Almost 64.7% of papaya retailing participants were educated. From them about (47.1%) attended elementary school and (17.6%) secondary school whereas the entire wholesalers have attended elementary school (30%) and secondary school (70%) education. This indicates that most of the respondents have an educational background. Most of the papaya demander in Jimma town is the individual people from the town and juice makers. But the wholesaler’s sale their products to the retailers and the restaurants found in the town.

The major sources and demands of papaya in Jimma town

The major sources of papaya fruit in Jimma town were diverse (Table 2). The supply rate of fruit varied based on the season. It was highly supplied during the winter and low in summer season. According to the respondents (wholesalers and retailers) of Jimma town market papaya sellers, the majority of papaya supplied to the market were from Dedo Woreda (34.57%) followed by Shabe (27.16%) and Omo nada (12.3%) mainly during the winter season, respectively. Ammaya was the least supplier among the listed districts (3.70%) to Jimma town market. During the summer season, the supply of papaya significantly reduced due to seasonal dependent production of the crop. Because of these fluctuations of production in the mentioned districts, the price also varied based on the supply of the product to the market.

### Table 2: Sources of papaya supply to Jimma town market.

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Source (Woredas)</th>
<th>No of Respondent</th>
<th>Percentage of age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papaya</td>
<td>Dedo</td>
<td>28</td>
<td>34.57</td>
</tr>
<tr>
<td></td>
<td>Gojeb</td>
<td>4</td>
<td>4.94</td>
</tr>
<tr>
<td></td>
<td>Kossa</td>
<td>8</td>
<td>9.88</td>
</tr>
<tr>
<td></td>
<td>Ammaya</td>
<td>3</td>
<td>3.70</td>
</tr>
<tr>
<td></td>
<td>Shabe</td>
<td>22</td>
<td>27.16</td>
</tr>
<tr>
<td></td>
<td>Omo nada</td>
<td>10</td>
<td>12.30</td>
</tr>
<tr>
<td></td>
<td>Danaba</td>
<td>6</td>
<td>7.41</td>
</tr>
</tbody>
</table>

In mid-winter, where there were highest supplies of papaya to Jimma town market, the cost of one kilo gram of papaya was reduced to four Ethiopian Birr, where as in summer season the cost raised to 10 Ethiopian Birr due to very low supply of the product to the market. The fruit was demanded during both of the Christians and Muslims fasting period and throughout the year by juice makers of the town.

### Transportation methods and types of packaging materials

Proper transportation methods and packaging materials are a very important factor to reduce postharvest loss by keeping the fruit from mechanical damage, physiological change, and pathological deterioration. During the assessment was carried out in the markets of Jimma town, there was some inappropriate fruit management practice that enhances postharvest losses of the fruits. According to table 3 and table 4 results showed, all wholesalers of papaya (100%) in Jimma town were used truck to transport the fruit from producer to the wholesaler of Jimma town and they simply loaded the fruits on one truck without using packaging materials while transportation. This might be due to papaya fruit takes a large space and need appropriate packaging materials which increase the cost of packaging to the wholesalers. Also, in the retailers’ market, about 21.3% of papaya were transported by using trucks from nearby Woredas to Jimma town. While transporting papaya at different stages, the postharvest loss was happened due to abrasion occurred between fruits and walls of the truck with fruits and overcrowding of the fruits which leads to the fruit compaction that later to become spoiled.
Table 3: Transportation method of papaya fruit used by wholesalers and retailers

<table>
<thead>
<tr>
<th>Transportation Method</th>
<th>Number of Respondents</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wholealers</td>
<td>Retailers</td>
</tr>
<tr>
<td>Cart</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Truck</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>Pack animal</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Human Head/Back</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 4: Types of packaging/transporting materials

<table>
<thead>
<tr>
<th>Types of Packaging Materials</th>
<th>Number of Respondents</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wholealers</td>
<td>Retailers</td>
</tr>
<tr>
<td>Wooden box</td>
<td>20</td>
<td>36</td>
</tr>
<tr>
<td>Freely loaded on truck</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Sacks</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

Fruit loss due to compaction is very high at a later in shelf life. They also transported the fruits without screening the ripened fruits from unripe which easily damaged on the truck. Most of the retailers in the town use carts to transport papaya from the wholesalers to the place where they were selling the product. Some retailers were used a human head/back and pack animals (24.6%) and (4.91%) respectively, to transport the fruits to the markets. These is because of, papaya fruits are inconvenient to carry by both human heads and pack animals to provide to the market places.

Also, concerning the packaging materials, all the wholesalers were used the wooden box for fruit storage. They also spread the fruit on the ground in the storehouse with other fruits like avocado and mango that make the fruit easily deteriorate by creating the unfavorable temperature to respire easily and facilitates the rate of deterioration. The retailers used both wooden boxes and sacks as packaging materials as illustrated in table 4. About 58.82% of the respondents used a wooden box and 41.18% used sacks as packaging materials. Said et al. (2013) also reported that peoples in South Wollo area use sacks as a major packaging material for papaya fruit. The survey conducted in Bahir Dar town by Desalegn et al. (2016) also agreed with these results in which a wooden box is most widely used as packaging materials. Thus, proper packaging material is very crucial to reduce the postharvest losses occur during transportation, storing, and marketing time. Hence, the traders who participated in papaya selling activity should use appropriate transportation systems and packaging materials and give proper care while loading and unloading the produce to reduce the postharvest loss of papaya at all the marketing channels.

Types of papaya postharvest loss

Papaya is one of perishable fruit that has a short shelf life among the fruit crops (Said et al., 2013). According to the obtained survey results on papaya postharvest loss assessments in the market of Jimma town, most of the retailers’ responded that the main types of papaya postharvest losses were fruit softening problem. These might be caused due to the retailers were sold their product in the open sun without making shade to their products. Thus, the sun strikes all the entire body of the products whole of the day that triggering the internal metabolic process of the product like the respiration rate due to high-temperature effect that enhances the fruit softening. Hence, the fruit softening in the market area was high as the product stayed for a longer period in the full sun light. Also, losses due to fruit rotting, wounding, and compact were the main types of papaya losses at retailers’ level in Jimma town markets (Fig 1). The postharvest losses at the wholesalers’ level mainly occurred during loading and unloading of the product. This improper care creates fruit compact and wounding which later lead to deteriorate and easily spoiled. At storage level, the percentage of papaya loss was high due to previously compacted and wounded fruits resulted in ethylene production that triggers the fruit ripening and finally fruit spoilage and deterioration before arriving at the retailers’ hand or consumers’ table. Also, fruit softening is a common problem of postharvest losses at the wholesalers’ level in Jimma town due to the uncontrollable temperature in the storage room as the product stayed for longer days.
Figure 1: Types of papaya postharvest loss in Jimma town market

Extent of papaya postharvest loss

The extents of papaya postharvest loss in the Jimma town market was showed higher results (Fig 2). The total losses at wholesalers’ level were 21.75% which was occurred during transportation (12.5%) and in the storage room (9.25%), respectively. This might be due to absence of appropriate transportation system that causes mechanical damages and later creates the physiological abnormality of the produce. Also, during loading and unloading of the product, a mechanical damage was occurred. Thus, transportation is a huge factor that contributes to postharvest loss of papaya. The product overlapping and delaying on the track were also another source of transportation problem at wholesalers’ level. All these problems together contributed to the high percentage loss of papaya at wholesalers’ level. Also, lack of appropriate storage facilities at the wholesaler’s level affects the shelf life of papaya by triggering the fruit physiological process like production of ethylene gas that hasten the rate of deterioration and creates the favorable condition for the microbes to rot the product easily. Furthermore, Lack of proper ventilation in the storage house also the main problem of papaya storage for longer time at wholesalers’ level in Jimma town market. Kasso and Bekele (2016) also, reported a huge postharvest loss occurred in the storage house at town of Dire Dawa, Ethiopia. However, Lack of proper storage conditions and, temperature and relative humidity managements are the crucial mechanism to lengthen the shelf life and to maintain quality of horticultural crops (Kitinoja and Kader, 2002).
At retailer level there was a loss of about 15.6% at marketing level. These losses are due to the fruit softening, wounding and rotting. Because of lack of enough shade and the fruit was fully exposed to the sun light, the degree of fruit softening has been high in Jimma market. Also, the loss is due to rotting of fruit due to previously wounded of the product while transportation and in appropriate fruit handling. In general, there was high postharvest loss of papaya fruit both in a wholesaler and retailer level which accounts 37.35% in Jimma town only. The level the assessed loss has been higher than that reported in Bahir Dar which is 29.2% at retailer market (Desalegn et al., 2016). This great difference probably due to lack of awareness of retailers the postharvest handling of fruits between Bahir Dar and Jimma cities.
According to the respondents of Jimma town market, the shelf life of papaya fruit was higher in winter (dry) season than (wet) summer season (Fig 3). This might be due to in wet seasons there was a probability of increasing different disease because presence of higher moisture aggravates the disease occurrences. Thus, the loss occurred during the wet season was higher than the dry season. According to the survey result, the papaya fruit can stay averagely up to 4.25 days in dry season and only 3 days in wet season at wholesaler’s level and 3 days in dry season and 2.2 days in wet season at retailer’s level.

Mechanism of postharvest loss managements

Based on the market assessments in Jimma town of papaya marketing at wholesalers and retailers, the loss of papaya fruit was due to diverse reasons. The lost product was not properly managed and utilized in the market place. Most of the respondent’s hadn’t the proper waste disposal systems of postharvest products after the fruit loss has been occurred. Eighty one percent of them were thrown away the fruit after it became out of use and a few (19%) of them gave to the animal feedings (for the horse of cart) as shown in (Fig. 4). These shows as there was a poor waste handling technique by the respondents in Jimma market. In general, an awareness on proper handling system of the post-harvest losses of papaya fruit to the whole sellers and retailers by different stake holders should be given in order to manage the losses in the marketing channels. Also, it is very crucial to aware about the lost fruit can be used either for animal feed if it is appropriate or for utilization of compost preparation.

Figure 4: Waste management of papaya by wholesalers and retailers

Major consumers of papaya fruits in Jimma town

The major consumers of papaya fruits were the residents of the town, restaurants and juice makers and sellers in Jimma town. Most juice sellers and restaurants take the fruits from the wholesalers and some were buying from the retailers. The retailers sell their fruit to the individual persons of the town in large amount whereas the whole sellers have supplied the product to retailers and juice makers. The demand of the fruit product was raised during both Christians and Muslims fasting seasons.

Supports needed by the wholesalers and retailers

The amount of papaya produced hasn’t arrived to the consumers table due to a post-harvest loss occurred at different marketing channels. This might be due to lack of awareness on the characteristics of papaya fruit and its proper handling systems until it arrives to the markets. The entire respondents (wholesalers and retailers) did not take any training and advice on how to minimize postharvest losses of papaya fruits from the stake holders. Also, they have no proper facilities for storage to extend the shelf life of the fruit. They are simply store in the houses where wasn’t appropriate for fruit storage and hasn’t available air circulation in the storage. Above all, they were store several fruits together in the same place which is conducive to hasten losses of the fruits. Most of the retailers of the town were sold their produce along the road side due to absence of appropriate marketing area and their products were deteriorated in the open sun (without
shading). Therefore, the training for the fruit sellers on postharvest management and handling systems can alleviate this vividly observed postharvest losses of papaya fruit especially at market level. Therefore, the extension service should be focuses on the wholesalers and retailers in order to manage the loss of papaya fruit before it reaches the hand of consumer to save the loss occur which even contribute to the national economy.

CONCLUSIONS AND RECOMMENDATION

The extent of papaya fruit loss is higher due to the stated factors which accounts about thirty eight percent only at the marketing (wholesalers and retailers) level that indicates the loss of papaya is higher in Jimma market and need great attention to overcome the problem. So that: Jimma city administration being with Jimma University should give training and advice for both retailers and wholesalers concerning postharvest loss management and proper handling methods of papaya fruit. Small scale postharvest loss management systems and fruit handling technologies should be provided for both levels. The city administration should support and facilitate the place of selling especially for retailers’ in spite of selling the products on the road side which causes huge postharvest loss of the crop.

Generally, papaya postharvest loss in Jimma town market at wholesalers and retailers’ level was very high. This due to the different structured problems occurred starting from production period to consumption time. The loss accounts the big percentage which needs great attention by stake holders and city administration in order to overcome the problems and to save the losses occur that is important for produces, consumers and for even national economy development at large.

Conflict of Interests

The authors have not declared any conflict of interests.

REFERENCES


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