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# Papaya Fruit Supply Chain System in Surabaya City: Towards a Better Food and Nutrition Urban Governance

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## ABSTRACT

Papaya *(Carica papaya Linn)* is a tropical fruit with high economic and nutritional value. Indonesia was the fourth biggest papaya producer in the Asian continent from 2008 to 2018, and East Java was the primary contributor. Papaya has complex chemical components such as protein, carbohydrates, fat, fiber, minerals, and vitamins. However, its supply chain system faces challenges such as postharvest issues, processing and transportation, and low consumption. This study aimed to determine the papaya fruit supply chain system in Surabaya City to reform the existing food and nutrition action plan, which has not yet been fully implemented. With a toolkit from FAO called RUFSAT (Rapid Urban Food System Assessment Tool), the food system was developed with a primary concern on papaya commodities. Results indicated that the papaya supply chain in Surabaya is comprised of three channels: farmer to collector, wholesaler/distributor, retailer, and consumer. Acquisition and distribution of papaya still suffered from losses, food safety, transportation handling, packaging issues, and quality assurance practices. In terms of consumption, most households ingested papaya within 1-3 times per week, which is considered inadequate. Effective collaboration among city government agencies is pivotal for addressing supply chain complexities. In addition, integrating papaya with other fruits into urban farming initiatives can help to improve the nutritional status of Surabaya citizens.

**Keywords**: Papaya supply chain; Food and Nutrition; Action plan; Surabaya city

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## INTRODUCTION

Papaya *(Carica papaya Linn)* is a tropical fruit with a sweet flavor, musky aroma, and smooth, butter-like texture.(1) Papain, an enzyme found in papaya, can enhance digestive metabolism. Besides, papaya has complex chemical components such as protein, carbohydrates, fat, fiber, minerals, and vitamins, which are crucial for human health. (2) Each 100 grams of papaya contains 47 µg Vitamin A (RAE), 60.9 mg of Vitamin C, 20 mg of Calcium, 21 mg of Magnesium, 182 mg of Potassium, 0.08 mg of Zinc, and various other micronutrients. (2,3) Increasing the consumption of papaya by Recommendation Nutrient Intake (RNI) guidelines can help address common nutritional deficiencies, for instance, VAD (Vitamin A Deficiency) and IDA (Iron Deficiency Anemia), which are prevalent in developing nations. (4) In addition, aside from food product uses, papaya is widely utilized in the cosmetic industry, contributing to its high demand.(5)

Indonesia is the fourth biggest papaya producer in the Asian continent from 2008 to 2018**Error! Reference source not found.**, and East Java is the largest papaya producer, with a total production of 235,370 tons per annum.(6) Although the production is abundant, it faces challenges such as postharvest issues due to its short shelf life (7), processing, and transportation (9)**Error! Reference source not found.** According to secondary data from BPS Surabaya, papaya consumption has declined from 2015 to 2017.

Furthermore, while food security and nutrition action plans have been developed for decades in Indonesia, their comprehensive implementation, particularly concerning nutritional value, remains challenging.(10) With the new state administration, there is a commitment to address health and nutritional issues, with a particular focus on combating stunting. On the other hand, urban areas also suffer from the other side of the double burden issue; the obesity prevalence at the national level has risen from 10.5% in 2007 to 21.8% in 2018.(11)**Error! Reference source not found.** Therefore, this requires a national program reformation that aligns with the Presidential Regulation No. 83 of 2017 about Food and Nutrition Strategic Policy (KSPG), which contains five pillars: 1. Food availability, 2. Food affordability, 3. Food utilization, 4. Improved nutrition of the community, 5. It is strengthening food and nutrition institutions. (2) Identifying the food supply chain system, particularly for selected food item representatives, in this case, papaya, will aid in establishing the baseline for the food and nutrition regulation, which can enable policymakers to make well-informed decisions that safeguard public health, enhance food security, and promote sustainable food systems. Therefore, the main goal of this study was to determine the food supply chain system of papaya commodities in Surabaya City, East Java, as a first step towards a better food and nutrition action plan.

## METHOD

This study used an FAO toolkit to analyze the papaya supply chain in Surabaya City. The study focused on the distribution aspect of the supply chain, as papaya producers are located outside of the city. The supply chain system in this study includes acquisition, distribution, and consumption. The acquisition/procurement and distribution were conducted using a RUFSAT (Rapid Urban Food System Assessment Tool) questionnaire.[12] This tool was initiated in the NADHALI (NAirobi, DHAka, and LIma) project with the aim of developing

sustainable food systems for respective urban areas. In the present study, not all the variables within RUSFAT were presented, considering the scope of the journal requirement, particularly omitting the business outlook and the social-based program. This study was a pilot as part of the big project from the Global Alliance for Improved Nutrition (GAIN), which teamed up with Institut Teknologi Sepuluh Nopember Surabaya (ITS) and collaborated with the Surabaya government to improve the nutritional status by assessing the food system. The acquisition and distribution actors in this study were wholesalers and retailers. For consumption, the adjusted Food Frequency Questionnaire (FFQ) was utilized, which was squeezed into eight food items for the overall project, but in this study, papaya was the ultimate concern representing fruit items. FFQ was used to identify eating frequency within individual levels of family members. It was assessed on a weekly basis based on last month's consumption.

With the population sample ($Np$) 768,932 Surabaya people, and took a 50/50 proportion ($p$), margin error 5% ($B$), and 95% CI, consequently, the completed total sample required were 384 respondents. By taking budget and time into consideration, the number of respondents was reduced to 300 households. The respondents were then assigned proportionally in all subdistricts in Surabaya city, but mostly to the areas that suffered from food insecurity and that had nutritional issues with indicators including anemia, stunting, wasting low birth weight, and obesity. The selected areas were identified through the GIS based on the data from the local Health Official. Further, 100 retailers were surveyed and categorized into Wet Market Retailers (WMR), Mobile Street Vendors (MSV), Minimarket (MM), and Supermarkets (SM). Meanwhile, 50 wholesalers or distributors (W/S) participated. The data collection took approximately three weeks. The analysis used a descriptive quantitative approach based on the field survey in every phase of the supply chain system. It is important to note that missing values were omitted.

## RESULTS

### Acquisition and Distribution

Only one sells papaya among wholesalers (W/S) who participated in the project. Meanwhile, 22 retailers reported participation, with the majority being wet market retailers (Shown in Table 1). Generally, the chain of papaya in the city of Surabaya encompasses farmers, collectors, wholesalers/distributors, retailers, and ends to consumers. Besides the grower, there is also a source of papaya imported from abroad (Figure 1).

Table 2 presents combined variables, including the source of purchase, region of source, frequency of purchase, mode of transport, and quantity of purchase. Generally, the wholesaler acquired the papaya from collectors, farmer groups, or cooperatives. In contrast, retailers mainly obtain papaya from traders, wholesalers, importers/distributors, or directly from farmers. Papaya is primarily sourced from the Lumajang region, located 76 km from Surabaya. All traders purchased papaya daily or 2-3 times a week. The mean quantity purchased papaya by the wholesaler was 42,000 kg/day, transported via 6-8 wheeler trucks and pick-up trucks. Wet market retailers typically procure 556.42 kg from importers/distributors using pick-up trucks, motorbikes/sidecars. Mobile market retailers usually buy 100 kg/day, also utilizing motorbikes/sidecars. Minimarkets purchased 22.5 kg/day or 2-3 times per week, transported to the shop via van, while the supermarket brings 700 kg from farmers

and importers and 50 from wholesalers by van and pick-up truck.

Table 1. Traders who buy or sell papaya

| | n | % |
|---|---|---|
| Wholesaler | 1 | 4.35 |
| Wet market retailer | 14 | 60.87 |
| Mobile street vendor | 1 | 4.35 |
| Minimarket | 3 | 13.04 |
| Supermarket | 4 | 17.39 |

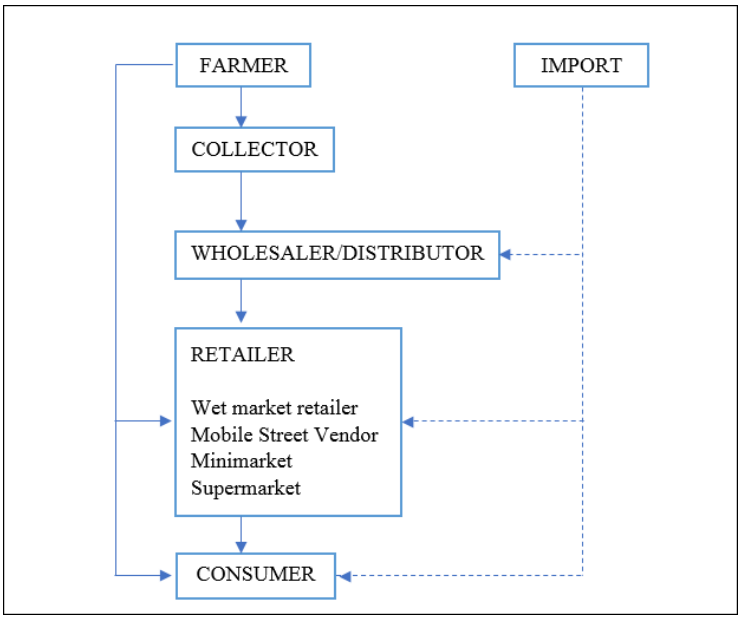


Figure 1. Papaya supply chain in Surabaya

Table 3 indicates that Lumajang is the only region with papaya wholesaler constantly supplying to retailers across Surabaya over the years. Conversely, 50% of wet market retailers experienced inconsistency over time, with the low season starting from March to June and the high season extending until March of the following year.

The price range of papaya being purchased by each trader, where the wholesaler spent between 1,500 to 3,500 Rupiah/kg, wet market retailers bought with high prices from traders in the range from 7,500 to 10,000 Rupiah/kg. Mobile street vendors spent 3,500 to 5,000 Rp/kg. In contrast, minimarkets and supermarkets obtained papaya at similar price ranges between 7,050 to 7,450 Rupiah/kg (Table 4).

Table 2. Source, region, frequency, transport mode, quantity of purchase of papaya in Surabaya city

| | W/S | WMR | MSV | MM | SM |
|---|---|---|---|---|---|
| **From where they buy [n]** | | | | | |
| Direct from farmers | 0 | 0 | 0 | 1 | 1 |
| Farmer groups/cooperatives | 1 | 0 | 0 | 0 | 0 |
| Traders | 0 | 1 | 0 | 0 | 0 |
| Wholesalers | 0 | 4 | 1 | 0 | 1 |
| Importers/distributors | 0 | 7 | 0 | 2 | 1 |
| Supermarkets | 0 | 0 | 0 | 0 | 0 |
| **Region of source** | **Mean distance [km]** | | | **SD distance [km]** | |
| Lumajang | 76 | | | 97.5 | |
| **Frequency of purchase [%]** | **W/S** | **WMR** | **MSV** | **MM** | **SM** |
| Everyday | 100 | 61.5 | 100 | 66.7 | 50 |
| 2-3 times a week | 0 | 38.5 | 0 | 33.3 | 50 |
| once a week | 0 | 0 | 0 | 0 | 0 |
| 2-3 times a month | 0 | 0 | 0 | 0 | 0 |
| Once a month | 0 | 0 | 0 | 0 | 0 |
| **Mode of transport [%]** | | | | | |
| 6-8 wheeler | 50 | 0 | 0 | 0 | 0 |
| Pick-up | 50 | 35.7 | 0 | 0 | 25 |
| Van | 0 | 0 | 0 | 100 | 75 |
| Becak | 0 | 0 | 0 | 0 | 0 |
| Motorbike/sidecar | 0 | 57.2 | 100 | 0 | 0 |
| Motorbike | 0 | 0 | 0 | 0 | 0 |
| Bicycle | 0 | 0 | 0 | 0 | 0 |
| Pushcart | 0 | 0 | 0 | 0 | 0 |
| **Mean quantity purchased [kg]** | | | | | |
| Direct from farmers | 0 | 0 | 0 | 0 | 350 |
| Farmer groups/cooperatives | 42,000 | 0 | 0 | 0 | 0 |
| Traders | 0 | 50 | 0 | 0 | 0 |
| Wholesalers | 0 | 150 | 100 | 0 | 50 |
| Importers/distributors | 0 | 556.42 | 0 | 22.5 | 350 |
| Supermarkets | 0 | 0 | 0 | 0 | 0 |

Table 3. Seasonality of supply by wholesaler and retailers

| | **Percent** | | **Months** | | | |
|---|---|---|---|---|---|---|
| Wholesaler: | Supply consistent | | Low season | | High season | |
| | Yes | No | Begins | End | Begins | End |
| Lumajang | 100 | 0 | 0 | 0 | 0 | 0 |
| Retailers: | Supply consistent | | Low season | | High season | |
| | Yes | No | Begins | End | Begins | End |
| Wet market retailers | 42.8 | 50 | March | June | June | March |
| Mobile street vendors | 100 | 0 | 0 | 0 | 0 | 0 |
| Minimarkets | 100 | 0 | 0 | 0 | 0 | 0 |
| Supermarkets | 100 | 0 | 0 | 0 | 0 | 0 |

Table 4. Price range at which papaya is purchased by each market intermediary

| | **Mean [Rp/kg]** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **W/S** | | **WMR** | | **MSV** | | **MM** | | **SM** | |
| | Low | High | Low | High | Low | High | Low | High | Low | High |
| Direct from farmers | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Farmer groups/cooperatives | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Traders | 0 | 0 | 7,500 | 10,000 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wholesalers | 1,500 | 3,500 | 5,750 | 6,500 | 3,500 | 5,000 | 0 | 0 | 0 | 0 |
| Importers/distributors | 0 | 0 | 4,842 | 0 | 0 | 0 | 7,050 | 7,450 | 7,050 | 7,450 |
| Supermarket | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

The amount of papaya thrown away, the reason why it is discarded, actions taken, and activities to reduce wastage are aggregated in Table 5. Notably, mobile street vendors did not report their discarded quantities. Wet market retailers dispose of an average of 19 kg of papaya post-purchase, while wholesalers discard the least amount. Reasons for disposal vary, including product quality mismatches, damaged packaging, biological contamination, expired products, and excessive pricing.

Table 5. Amount of papaya discarded, reason why papaya is being thrown away, activities to reduce wastage

| | **W/S** | **WMR** | **MSV** | **MM** | **SM** |
|---|---|---|---|---|---|
| **Amount of papaya discarded [kg]** | | | | | |
| Mean | 4 | 19 | 0 | 8 | 7.5 |
| SD | 0 | 7.76 | 0 | 0 | 3.53 |
| **Reason papaya to be discarded [%]** | | | | | |
| Delivery time does not meet the agreement | 0 | 0 | 0 | 0 | 0 |
| Product quality does not match with agreement | 13.3 | 52.9 | 0 | 0 | 43 |
| Damaged packaging | 40 | 23.5 | 100 | 100 | 28.5 |
| Biological contamination | 20 | 5.8 | 0 | 0 | 0 |
| Products are expired | 6.6 | 17 | 0 | 0 | 0 |
| Too expensive | 0 | 0 | 0 | 0 | 14.2 |
| Other | 20 | 5.8 | 0 | 0 | 0 |
| **Action for discarded papaya [%]** | | | | | |
| Throw it away | 37.5 | 37.5 | 0 | 25 | 25 |
| Return to supplier | 12.5 | 12.5 | 0 | 75 | 75 |
| Regrade/reprocess | 12.5 | 25 | 100 | 0 | 0 |
| Give it to needy people | 0 | 0 | 0 | 0 | 0 |
| Ask for replacement | 0 | 25 | 0 | 0 | 0 |
| Other | 37.5 | 0 | 0 | 0 | 0 |
| **Activities to reduce wastage [%]** | | | | | |
| Talk to suppliers | 100 | 66.6 | 100 | 75 | 50 |
| Improved packaging | 0 | 0 | 0 | 0 | 0 |
| Change supplier | 0 | 0 | 0 | 0 | 0 |
| Predict the quality of product | 0 | 16.6 | 0 | 0 | 0 |
| Other | 0 | 16.6 | 0 | 25 | 50 |

Wholesalers commonly cite damaged packaging as the primary cause, while wet market retailers attribute it to product quality agreement mismatches. Mobile street vendors and minimarkets primarily cite damaged packaging. Interestingly, 14.2% of supermarkets highlight high prices as a significant factor. About 37.5% of wholesalers and wet market retailers opt for disposal, while mobile street vendors prefer regrading or reprocessing rejected papaya. Minimarkets and supermarkets typically return rejected papaya to suppliers. Traders address waste through discussions with suppliers as a common response.

Storing (Table 6) is a critical part of the supply chain. It ensures product longevity and minimizes postharvest losses. On average, wholesaler stores around 1,500 kg, while retailers store between 16.7 and 24.3 kg. Storage duration vary, with wholesaler storing papaya for up to 3 days, wet market retailers for 2 days, and minimarkets for 7 days. Some retailers did not report their storage practices. Losses during storage are prominent among retailers; minimarkets experience the highest loss rate at 30% on average, and the least is mobile street vendors (5%).

Table 7 illustrates that among traders, supermarkets have the highest sales of papaya to consumers, while wet market retailers have the lowest sales. Additionally, almost all traders conduct transactions in cash, although wholesaler transactions are spread evenly between credit, cash, and payment after the papaya is sold. Papaya demand has remained consistent over the years for most types of traders, except wet market retailers, who experience inconsistency. The low season typically occurs in May, extending until June or July, while high demand begins in early June and usually lasts until April of the following year.

Table 8 highlights various food safety concerns reported by traders, including expired products, rotten fruits, and environmental effects, categorized under "other." These issues are attributed to factors such as weak supervision, unhygienic handling processes, and counterfeit products. Traders have taken several measures to address these concerns. Wholesalers prioritize sourcing from reliable suppliers, while retailers focus on cleaning storage facilities to minimize food safety risks. Some traders, particularly wet market retailers, minimarkets, and supermarkets, have received food safety management training and undergone audits conducted by the government and other entities. Findings from these audits revealed issues such as harmful substances in products and a lack of awareness among traders. Third-party quality assurance audits have also been conducted, resulting in certifications for minimarkets and supermarkets from organizations such as BPOM (Agency of Drug and Food Control) and the Indonesia Council of Ulama. However, wholesalers and mobile street vendors have not obtained certificates due to the complexity, and wet market retailers cite it as non-compulsory.

**Consumption**

Out of 300 households surveyed in Surabaya, papaya consumption was found to be infrequent. Most family members reported consuming papaya 1-3 times weekly or 1-3 times per month. Interestingly, biological children showed a higher intake than other family members (Figure 2). Generally, the households frequently purchased papaya once a week and once a month. The quantity per purchase was 1.22 kg (Table 9).

Table 6. Storing of papaya in Surabaya, Indonesia

| | W/S | WMR | MSV | MM | SM |
|---|---|---|---|---|---|
| **Storage of product after purchase [n]** | | | | | |
| Yes | 1 | 7 | 1 | 3 | 0 |
| No | 0 | 6 | 0 | 0 | 4 |
| **Quantity stored [kg]** | | | | | |
| Mean | 1,500 | 24.3 | 20 | 16.7 | 0 |
| SD | 0 | 32.36 | 0 | 0 | 0 |
| **Storage period [days]** | | | | | |
| Mean | 3 | 2 | 0 | 7 | 0 |
| SD | 0 | 1.1 | 0 | 0 | 0 |
| **Losses after storage [%]** | | | | | |
| Mean | 2 | 23.3 | 5 | 30 | 0 |
| SD | 0 | 12.57 | 0 | 0 | 0 |

Table 7. Total selling monthly, transaction method, seasonality of demand by market intermediary.

| | W/S | WMR | MSV | MM | SM | |
|---|---|---|---|---|---|---|
| **Total Selling monthly [Rp]** | | | | | | |
| Mean | 30,000,000 | 20,384,864 | 35,678,571 | 23,826,500 | 90,188,000 | |
| SD | 0 | 34,970,330 | 58,748,842 | 15,164,336 | 148,808,217 | |
| **Transaction method with buyers [%]** | | | | | | |
| Credit | 33.3 | 0 | 0 | 0 | 50 | |
| Cash | 33.3 | 85.7 | 100 | 100 | 50 | |
| Payment after products is sold out | 33.3 | 14.3 | 0 | 0 | 0 | |
| Invoice [30 day] | 0 | 0 | 0 | 0 | 0 | |
| **Seasonality of demand by market intermediary [n]** | **Supply consistent** | | **Low season** | | **High season** | |
| | Yes | No | Begins | End | Begins | End |
| Wholesalers | 1 | 0 | 0 | 0 | 0 | 0 |
| Wet market retailers | 4 | 9 | May | June to July | June | April |
| Mobile street vendors | 1 | 0 | 0 | 0 | 0 | 0 |
| Minimarkets | 3 | 0 | 0 | 0 | 0 | 0 |
| Supermarkets | 4 | 0 | 0 | 0 | 0 | 0 |

Table 8. Food safety of papaya in Surabaya, Indonesia

| | W/S | WMR | MSV | MM | SM |
|---|---|---|---|---|---|
| **Food safety concerns [n]** | | | | | |
| Chemical residues | 0 | 0 | 0 | 0 | 0 |
| Contamination by chemicals | 0 | 0 | 0 | 0 | 0 |
| Physical contamination | 0 | 0 | 0 | 0 | 0 |
| Expired products | 0 | 1 | 0 | 0 | 0 |
| Other*(rotten/not sold, not fresh) | 1 | 11 | 2 | 3 | 3 |
| **Source of contamination [%]** | | | | | |
| Unhygienic handling process | 0 | 33.3 | 0 | 0 | 0 |
| Expired products | 0 | 26.6 | 100 | 100 | 50 |
| Chemical application on farm | 0 | 0 | 0 | 0 | 0 |
| Counterfeit product | 0 | 33.3 | 0 | 0 | 25 |
| Weak supervision | 100 | 0 | 0 | 0 | 0 |
| Contamination during transport | 0 | 0 | 0 | 0 | 0 |

| Activities being undertaken to reduce a food safety incident [%] | W/S | WMR | MSV | MM | SM |
|---|---|---|---|---|---|
| Regular hand washing | 0 | 0 | 0 | 25 | 25 |
| Improve sanitation | 0 | 0 | 0 | 0 | 0 |
| Clean the storage | 33.3 | 45.45 | 50 | 50 | 25 |
| Buy products from reliable suppliers | 66.6 | 9.09 | 50 | 0 | 25 |
| Other | 0 | 45.45 | 0 | 25 | 25 |
| **Food safety training [%]** | | | | | |
| Yes | 0 | 38.9 | 0 | 57.14 | 80 |
| No | 100 | 61.1 | 100 | 42.85 | 20 |
| **Food safety audit [%]** | | | | | |
| Yes | 0 | 14.3 | 0 | 66.7 | 100 |
| No | 100 | 85.7 | 100 | 33.3 | 0 |
| **An organization who undertook the audit [n]** | | | | | |
| Retailer Association | 0 | 0 | 0 | 0 | 0 |
| Other | 0 | 0 | 0 | 1 | 0 |
| **Issues audit organization found [n]** | | | | | |
| Expired product | 0 | 0 | 0 | 0 | 0 |
| Damaged packaging | 0 | 0 | 0 | 0 | 0 |
| Unhygienic product | 0 | 0 | 0 | 0 | 0 |
| Product containing harmful substances | 0 | 1 | 0 | 0 | 0 |
| Other | 0 | 1 | 0 | 2 | 3 |
| **Does the firm operate under a third party quality assurance system [%]** | | | | | |
| Yes | 0 | 0 | 0 | 100 | 100 |
| No | 100 | 100 | 100 | 0 | 0 |
| **Third-party certified quality assurance system operating [n]** | | | | | |
| Agency of drug and food control | 0 | 0 | 0 | 1 | 0 |
| Indonesia council of ulama | 0 | 0 | 0 | 0 | 1 |
| Trade office | 0 | 0 | 0 | 0 | 1 |
| Other | 0 | 0 | 0 | 2 | 1 |
| **The reason the firm doesn't operate under a third-party certified quality assurance system [n]** | | | | | |
| Not compulsory | 0 | 5 | 0 | 0 | 0 |
| Complicated process | 1 | 0 | 1 | 0 | 0 |
| Expensive | 0 | 1 | 0 | 0 | 0 |
| None ask | 0 | 2 | 0 | 0 | 0 |
| Business scale to small | 0 | 2 | 1 | 0 | 0 |
| Other | 0 | 1 | 0 | 0 | 0 |

## DISCUSSION

This paper observed that the supply chain system of papaya commodities in Surabaya City, in general, started with farmers and imports. Before reaching consumers, the collectors distributed the product to the wholesaler and further forwarded it to retailers. This finding was consistent with a study from Callista et al. that the papaya supply chain in East Java was obtained from Lumajang city with the channel as follows: Farmer→ collector→ Distributor → Retailer.[13]

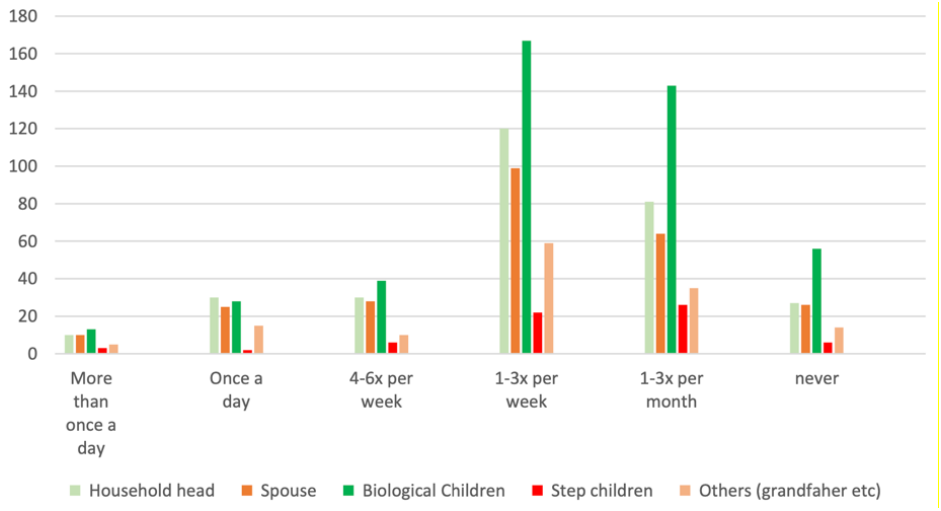


Figure 2. Number of papaya consumed by family members in Surabaya City

Table 9. Frequency of shopping

| | **Daily** | | **2-3x week** | | **Once a week** | | **2-3x month** | | **Once a month** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | n | % | n | % |
| Papaya | 30 | 10.3 | 53 | 18.2 | 98 | 33.7 | 31 | 10.7 | 73 | 25.1 |
| **Quantity of purchased papaya per week in kg (mean [SD])** | | | | | | 1.22 [0.8] | | | | |

Another study by Prihatiningtyas et al. specifically focused on Calina papaya and found that the chain started from the farmer to the processor, then to the retailer, ending with the consumer. The processors were the food industries, and retailers could be wholesalers, semi-wholesalers, wet markets, distribution centers, supermarkets, minimarkets, and fruit outlets.[4]

Papaya cultivation offers year-round employment opportunities, making it a favorable choice from a socio-economic standpoint in producing countries.[15] According to FAO, Indonesia extensively cultivates papaya across the nation, ensuring year-round production. National output remained relatively stable at around 500 thousand tons annually from 1998 to 2002, with Java emerging as the primary producing region, notably East Java contributing 54% to the national gain.[16] This aligns with the findings of the present study, where nearly all traders reported consistent yearly supplies.

Papaya's price is affordable. The price range was highest especially in minimarket and supermarkets, which was between Rp 7,050 and Rp 7,450 per kg. This range was within the range of a commercial website for food commodities [17], which ranged from Rp.5,500 to Rp. 13,000 each kilo in accordance with their variety. Several significant challenges were evident in the development of papaya cultivation. These include agricultural production practices, post-harvest handling, distribution management, and the absence of an integrated system to ensure consistent high-quality and food safety standards.[18] However, the current study highlighted specific issues encountered by papaya suppliers, mainly price instability, primarily affecting wholesaler. For other

traders, damaged packaging emerged as the most prevalent concern, alongside challenges such as inconsistent supply, delayed product delivery, and issues related to product freshness.

Ripe papayas should be handled properly to slow down the ripening process. Nearly all traders in this study utilized storage systems such as refrigerators or rooms with controlled temperatures. However, half of the wet market retailers and supermarkets did not employ such systems. Particularly for supermarkets, the less ripe fruits, including papaya, are often put in the normal temperature in a fruit section, while the ripe are put in the colder temperature section. However, it is essential to note that supermarket temperature, in general, is lower than other retailers, and hence, some products might have prolonged shelf life. The storage duration ranged from 2 to 7 days, aligning with the findings of Kitinoja and Kader, who reported that papayas can remain fresh for 1-3 weeks when stored at temperatures between 7-13ºC and humidity levels of 45-55%.[19]

Food safety has gained prominence among international retailers, leading to the development of Good Agricultural Practices (GAP). The initiative originated from the Euro-Retailer Produce Working Group (EUREP), which acquired agreement from all European delegation partners across the fruit and vegetable supply chain. [20] Through EUREPGAP, producer organizations worldwide can adopt integrated solutions and allocate budgets effectively to obtain food safety certification. Local food safety organizations also play a role in providing assurance. However, food safety issues persist among local retailers in Surabaya, including concerns about rotten or unfresh products. Among all traders, only some supermarkets, minimarkets, and a few wet market retailers have undergone government audits or third-party quality assurance checks.

Papaya demand remains consistent for traders throughout the year in Surabaya city, with the exception of nine wet market retailers who experienced fluctuations. However, for household consumption, according to a food frequency questionnaire, most family members in Surabaya consumed papaya 1-3 times a week, with children being the primary consumers, which was considered low. This study is in line with an extensive scope survey of the Indonesia Basic Health Research (RISKESDAS 2018) that 95.3% of East Java citizens still ate less fruits and vegetables. [21]**Error! Reference source not found.** Fruit intake recommendation, according to the Ministry of Health of Indonesia, was 150 gr or 2 to 3 portions of fruit per day (e.g., two medium pieces of papaya).[22] It is certainly not adequate when assuming the respondents ingested fruit only 1 to 3 times a week. Nevertheless, other fruit intake was not recorded to validate this finding, and hence, further investigation is required.

The present study has some strengths. First, it is the pioneering investigation into the papaya supply chain system within Surabaya City, extending its analysis to the consumer level. Second, this interdisciplinary research bridges the fields of Economics and Nutrition with the engagement of multiple stakeholders. Nonetheless, this study also encounters limitations. Firstly, being a pilot study, it necessitates further implementation and monitoring of the action plan. Secondly, some variables within the RUFSAT questionnaire were omitted due to relevancy concerns in this journal. Thirdly, the FFQ did not record portion size to follow with other food items across the entire project, and a survey with other fruit commodities would be crucial for validation.

## CONCLUSIONS AND RECOMMENDATION

The papaya supply chain in Surabaya city comprises three channels: 1. Farmer, Consumer. 2. Farmer, Retailer, Consumer. 3. Farmer, Collector, Wholesaler/Distributor, Retailer, Consumer. The food frequency questionnaire measured the demand for papaya, making average papaya consumption relatively low for most family members in Surabaya City. Efforts to reduce losses and ensure food safety in the papaya supply chain should include implementing cold chain systems or a proper temperature and humidity handle, proper packaging, and quality assurance practices.

## REFERENCES

1. Luthfunnesa B, Parvez H, Absar N, Haque ME, Khuda MIIE, Pervin MM, et al. Nutritional Analysis of two Local Varieties of Papaya (Carica papaya L.) at Different Maturation Stages. Pakistan Journal of Biological Sciences. 2006 Jan 1;9(1):137–40; doi:10.3923/pjbs.2006.137.140

2. Pinnamaneni R. Nutritional and Medicinal Value of Papaya (Carica Papaya Linn.). World Journal of Pharmacy and Pharmaceutical Sciences. 2017 Aug 1;6(8):2559–78; doi:10.20959/WJPPS20178-9947

3. FoodData Central. USDA. Papaya Raw [Internet]. 2019 [cited 2019 October 23]. Available from https:// fdc.nal.usda.gov/fdc app.html#/food details/169926/nutrients

4. Mason J, Mannar V, Mock N. Controlling Micronutrient Deficiencies in Asia. Asian development review. 1999 Jan 1;17(01n02):66–95; doi.org/10.1142/S0116110599000032

5. Devaki CS, Samreen F, Prakash J. A Review on Composition, Processed Products and Medicinal Uses of Papaya (Carica Papaya L.). International Journal of Food, Nutrition and Dietetics. 2015;3(3):99–117; doi.org/10.21088/ijfnd.2322.0775.3315.3

6. FAO (Food and Agriculture Organization). Major tropical fruits - Statistical compendium 2018 [Internet]. 2019. [cited 2019 June 2). Available from :https://www.fao.org/markets and trade/publications/detail/en/c /1438766/

7. BPS Provinsi Jawa Timur. Produksi tanaman buah dan sayuran tahunan (ton) 2014- 2016 [Internet]. 2018 [cited 2018 August 10]. Available from: https://jatim.bps.go.id/indicator/156/234/1/produksi tanaman bu ah-dan-sayuran-tahunan.html

8. Pratiwi HE, Suketi K, Widodo WD. Aplikasi Kalium Permanganat sebagai oksidan Etilen dalam peyimpangan buah pepaya IPB Callina. Prosiding Seminar Ilmiah PERHORTI 2013. [cited 2019 June 4]. Available from: http://repository.ipb.ac.id/handle/123456789/69140

9. Negi S, Anand N. Issues and Challenges in the Supply Chain of Fruits & Vegetables Sector in India: A Review. International Journal of Managing Value and Supply Chains. 2015 Jun 30;6(2):47–62; doi.org/10.5121/ijmvsc.2015.6205

10. Halliday J, Platenkamp L, Nicolarea Y. A menu of actions to shape urban food environments for improved nutrition [Online Report]. 2019 [cited 2019 January 20]. Available from :https://www.gainhealth.org/sites /default/files/publications/documents/gain-mufpp-ruaf-a-menu-of-actions-to-shape-urban-food-environments-for-improved-nutrition-october-2019.pdf

11. Kemenkes RI. Riset Kesehatan Dasar (RISKESDAS); 2018:1–100.

12. Audit Board of Indonesia. Regulation of the President of the Republic of Indonesia Number 83 of 2017. Strategic Food and Nutrition Policy [Internet]. 2017 [cited 2018 August 18].Available from: https://peraturan.bpk.go.id/Details/73141/perpres-no-83-tahun-2017%20(accessed%20June%2006,%202021)

13. FAO (Food and Agriculture Organization). Urban Food Systems Analysis [Internet]. 2018. [cited 2018 August 18].Available from: https://www.fao.org/urban food agenda/kenya/urban food systems analysis/n/

14. Calista TS, Suryanita F, Lonata D, et al. Simulasi Rantai Pasok Buah Pepaya di Jawa Timur [Internet]. 2013. [cited 2018 August 18]. Available from: https://prezi.com/gdlaxewuxbyv/simulasi-rantai-pasok-buah-pepaya-di-jawa-timur/

15. Prihatiningtyas R, S AS, Wijaya NH. Analisis Peningkatan Kualitas pada Rantai Pasok Buah Pepaya Cali na. Jurnal Manajemen Dan Organisasi. 2016 Jul 18;6(3):206; doi.org/10.29244/jmo.v6i3.12609

16. De Oliveira JG, Vitória ÂP. Papaya: Nutritional and Pharmacological Characterization, and Quality Loss Due to Physiological Disorders. An overview. Food Research International. 2011 Jun 1;44(5):1306 13; doi.org/10.1016/j.foodres.2010.12.035

17. FAO (Food and Agriculture Organization). Fertilizer Use by Crop in Indonesia [Internet]. 2005 [cited 2018 Jun 8]. Available from: http://inswa.or.id/wp content/uploads/2012/07/Fertilizer Use by Crop in Indonesia .pdf

18. HargaBulanIni.com. Harga pepaya per kg terbaru [Internet]. 2018. [cited 2018 August 18]. Available from: https://www.hargabulanini.com/harga-pepaya-per-kg-terbaru/

19. Purwadaria HK. Issues and solutions of fresh export in Indonesia. Department of Agriculture Engineering. Bogor Agriculture University. Indonesia; 2016. [cited 2018 August 18]: 24-33. Available from: https://www.unsam.org/sites/default/files/20211/issues%20and%20solutions%20of%20Fresh%20Fruit%20Export%20in%20Indonesia.pdf

20. Kitinoja L. & Kader AA. Small-scale post-harvest handling practices: a manual for horticultural crops, Fourth Edition, United States, Postharvest Technology Research and Information Center, University of California, Davis; 2003.

21. GLOBALG.A.P. history [Internet]. 2007. [cited 2018 August 18]. Available from: https://www.globalgap.org/about/history/

22. Kemenkes RI. Minister of Health Regulation of the Republic of Indonesia No. 41 of 2014 Regarding Balanced Nutrition Guidelines [Internet]. 2014. [cited 2018 August 18]. Available from: (https://peraturan.bpk.go.id/Details/119080/permenkes-no-41-tahun-2014