



# CAUSE OF SHRUNKEN SHOULDERS IN 'TOMMY ATKINS' FRUIT GROWN IN DIVERSE PRODUCTION AREAS IN MEXICO

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## INTRODUCTION

In 'Tommy Atkins', it is common to find a high percentage of fruit with 'shrunken shoulders', which can be caused by several factors. Packers note that partially ripe fruit is more susceptible to present this problem. In addition, during the last few seasons this anomaly has been present in ripe fruit harvested in certain production areas in Mexico. Brecht *et al.* (2011) stated that this disorder can be present in unripe mango fruit subjected to quarantine hot water treatment (QHWT) or that has exceeded time or recommended temperature under QHWT. However, Osuna (2015) stated that if QHWT is applied according to protocol, only slight external damage is found and quality and shelf life is maintained. On the other hand, hydrocooling immediately after QHWT is recommended, because it reduces pulp temperature faster than just leaving the fruit at room temperature, which in turn prevents some of the possible injury caused by QHWT (Brecht *et al.*, 2011). Concerning resting period after QHWT and/or hydrocooling, packers argue that waiting for 24 to 48 hours before classification and packing is very useful to detect fruit with shrunken shoulders. Nevertheless, this can be a harmful practice that increases the percentage of damaged fruit, since letting fruit remain hot for 24 to 48 h at packinghouse ambient conditions (higher than 86 °F), increases the speed of physiological processes, such as respiration and ethylene production, which in turn accelerates ripening and deterioration processes. Finally, it seems that nutritional conditions influence the presence or absence of shrunken shoulders. Growers debate that there are certain production zones where this disorder is frequently seen and attribute it to the nutritional status of the orchard. Fruit with a low content of calcium and potassium and high in nitrogen are potentially in higher risk of presenting the disorder (Romero-Gomezcaña *et al.*, 2006). The objectives of this work were to study if fruit ripening degree, QHWT, hydrocooling, resting period after hydrocooling, and nutritional status of the orchard influence the incidence of shrunken shoulder in 'Tommy Atkins' fruit.

## MATERIALS AND METHODS

The study was conducted during the 2017 season with fruit harvested in Jalisco, Nayarit and Sinaloa states, Mexico. Treatments included: 1) Production site; 2) Ripening degree (partial ripe and ripe); 3) Time of QHWT (75 or 90 min); 4) Hydrocooling (immediate, after 30 min and without) and; 5) Resting period (without or fruit resting for 24 h). Once the treatments were applied, fruit were stored for seven days under refrigeration (53.6 ± 1.5 °F; 90 ± 5 % RH) and then under marketing simulation (71.6 ± 3 °F; 75 ± 10 % RH) until consumption stage. Sampling was done at the beginning and end of the refrigerated storage and at the consumption stage. Variables measured were percentage of shrunken shoulders, weight loss, firmness, pulp color, and total soluble solids content. A completely randomized design with a factorial arrangement was used.

## RESULTS AND DISCUSSION

Results showed almost 30 % of fruit with shrunken shoulders. Fruit harvested in Jalisco did not show the disorder, whereas fruit from Nayarit and Sinaloa had 27.1 and 28.3 % damage, respectively (Figure 1).

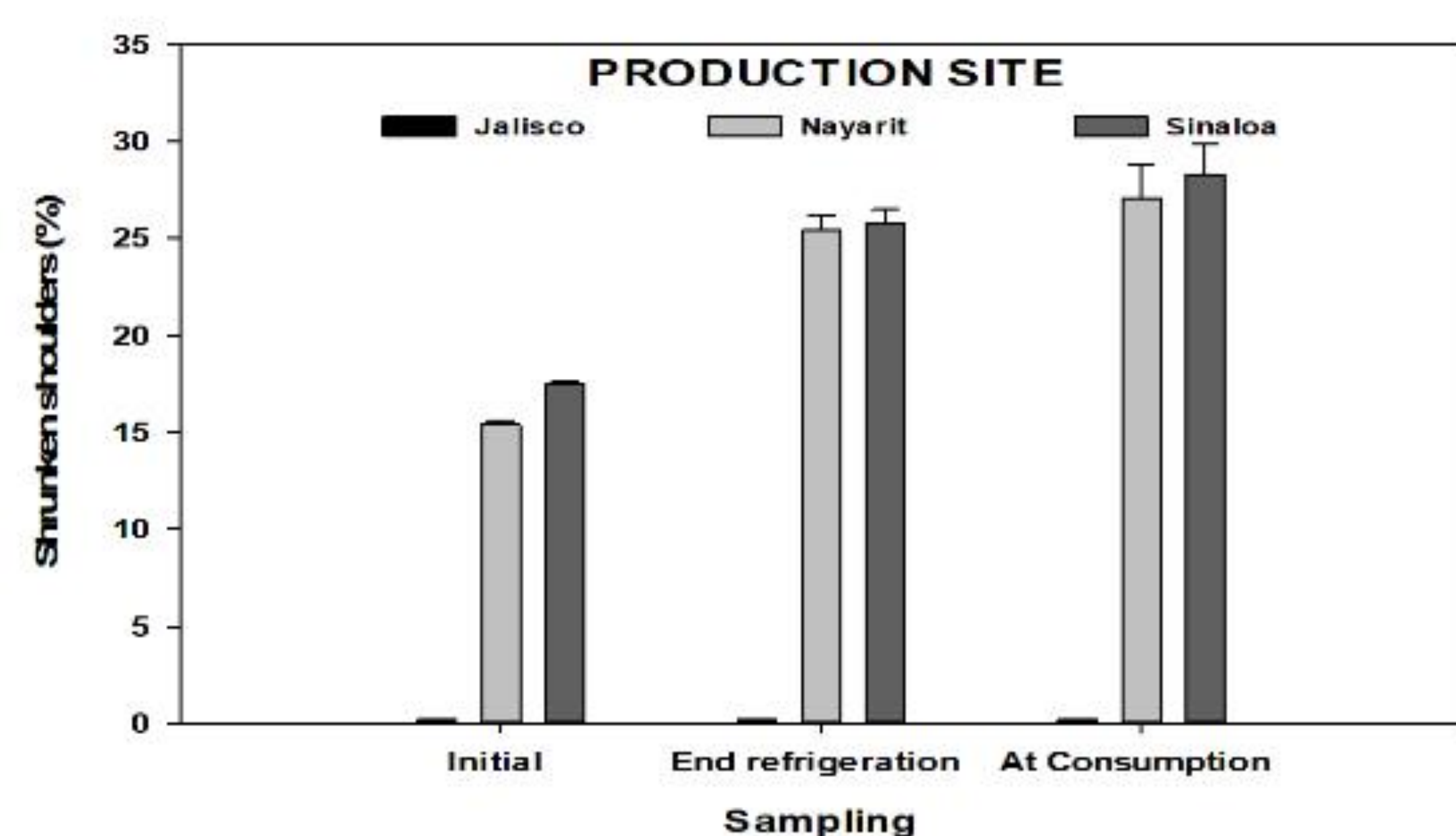


Figure 1. Effect of production site on fruit with shrunken shoulders (%) of 'Tommy Atkins' harvested at different production areas in Mexico.

The factors that most influenced presence of shrunken shoulders symptoms were ripening degree at harvest and resting period. Fruit harvested partially ripe showed a statistically higher percentage of this anomaly in all the samplings. At the beginning, the partially ripe fruit showed 18.1 % of fruit with shrunken shoulders, as compared to only 3.9 % of the ripe fruit.

At the end of refrigeration, partially ripe fruit increased shrunken shoulders incidence to 25.3 %, while ripe fruit showed only 8.9 %. At consumption stage, the partially ripe fruit had 25.6 % of fruit with symptoms, while ripe fruit only 11.4 % (Figure 2).

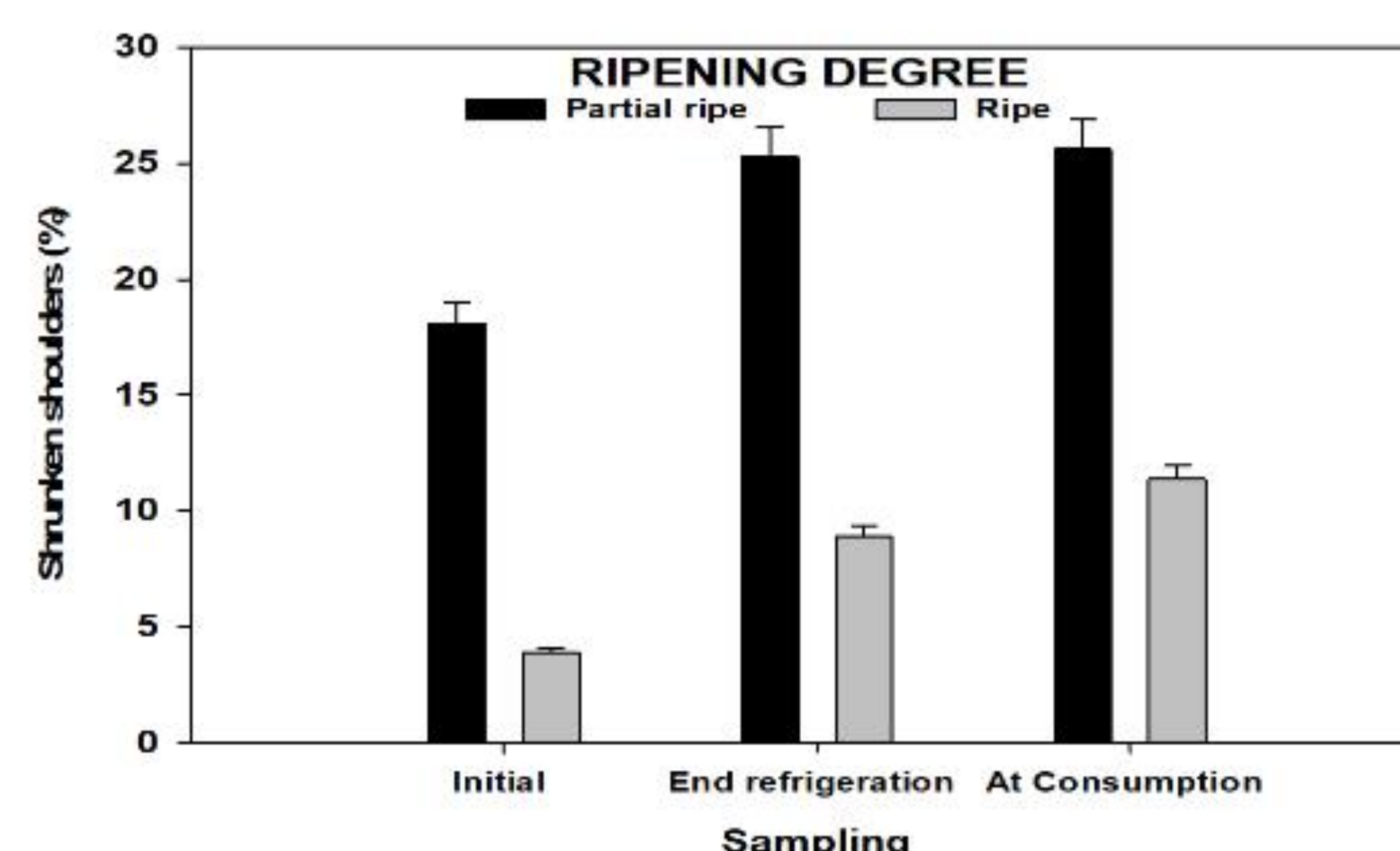


Figure 2. Effect of ripening degree on fruit with shrunken shoulders (%) of 'Tommy Atkins' harvested at different production areas in Mexico.

The other factor that significantly influenced the presence of fruit with shrunken shoulders was the resting period, mainly in the initial sampling, where the fruit with resting period of 24 h showed three times more fruit with symptoms (16.1 %) than those without rest (5.8 %) [Figure 3].

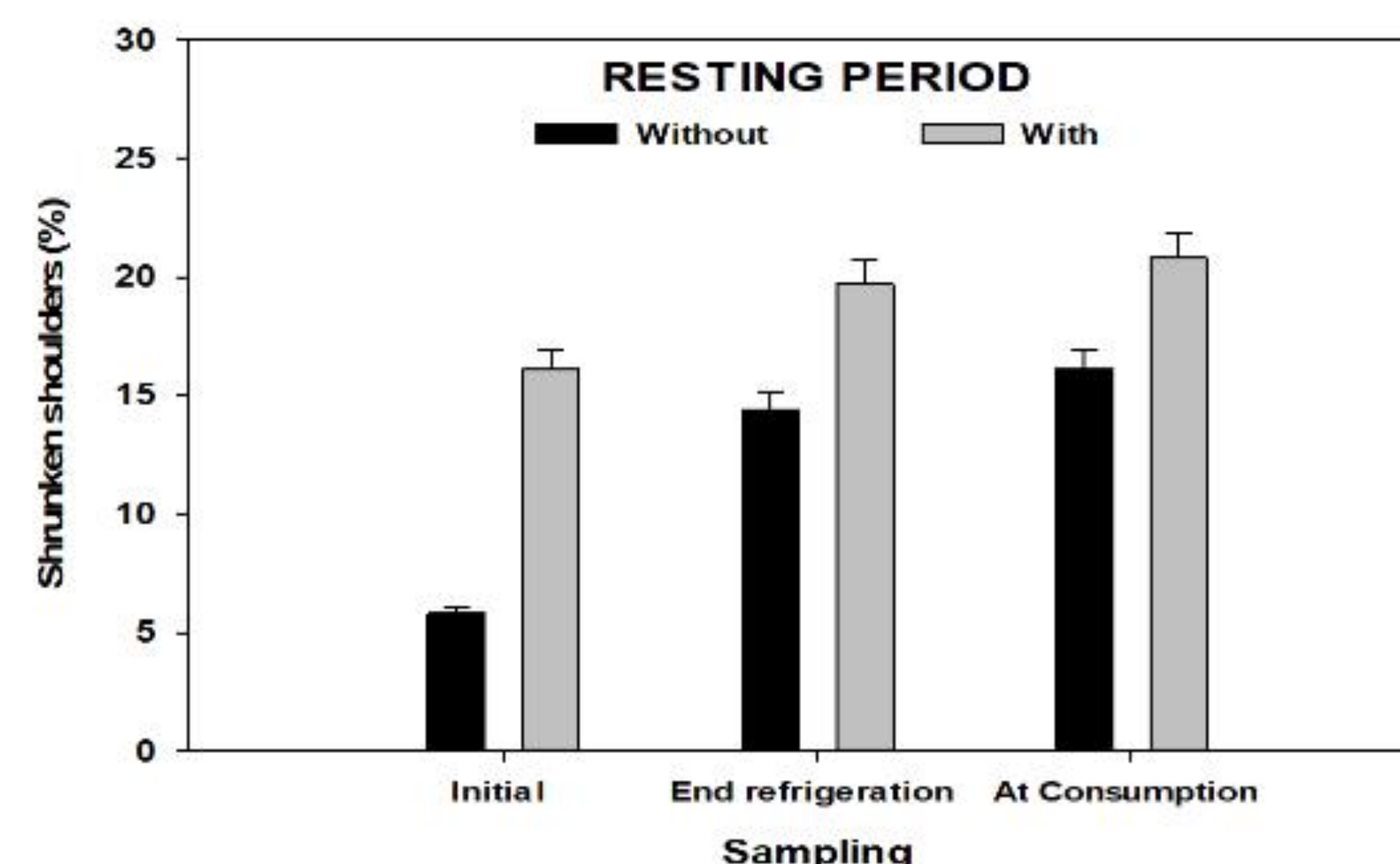


Figure 3. Effect of resting period on fruit with shrunken shoulders (%) of 'Tommy Atkins' harvested at different production areas in Mexico.

## CONCLUSIONS

To reduce or avoid the incidence of fruit with shrunken shoulders, it is recommended to harvest ripe fruit, as well as to avoid a resting period of 24 to 48 h as traditionally carried out by the packers.

## REFERENCES

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