Finding Value in Unsuspected Places

Investigating the effects of growing location on micronutrient content in Native Andean Potatoes

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ABSTRACT

Native potatoes are a staple crop in the highlands of Peru where the intake or consumption levels of potato can reach up to 200g in children approximately two years of age and 800g in women of fertile age per day (Burgos, 2007). The topic of this study was to evaluate the micronutrient composition of native Andean potatoes as affected by growing location. Evaluating the effects of growing location on the concentration of micronutrients in potatoes will further allow a recommendation of which growing locality is found to be the most beneficial in positively contributing to the nutrient levels in potatoes grown there. Analysis of the vitamin C content, total anthocyanin levels, and iron and zinc mineral levels of 12 different potato varieties grown in three distinct localities were performed. It was demonstrated each growing locality produced potatoes with different elevated micronutrient levels for each independent micronutrient analyzed. However, one locality did not produce elevated micronutrient levels overall.

METHOD

The experimental design was a randomized complete block design, where 12 varieties were grown in 3 locations with three replications in each location. Data collected included iron, zinc, vitamin C and total anthocyanin concentration expressed in milligrams per 100 grams of potato in fresh and dry weight. The design allowed the assessment of the variability of Fe, Zn, vitamin C and total anthocyanin concentrations among native varieties and the effect of environment and the genotype × environment interaction (G × E) considering 'genotypes' as fixed and 'sites' as random effects (Burgos, G., et al. 2007).

RESULTS

The mean concentration of vitamin C in fresh potato tubers in three repetitions of 12 native varieties of potato is shown in Figure 1. Overall, the potatoes grown in the locality of Quilcas exhibited the highest average concentration of vitamin C with 14.37 mg/100g FW and the highest concentration reported overall with 19.02 mg/100g FW in the variety "Amarilla del Centro." The localities of Pumaranra and Castillapata reported a mean average concentration of 13.61 and 11.00 mg/ 100g, respectively. The lowest mean concentration reported was from the locality Castillapata in the variety "Añil" with 6.25 mg/100g FW of vitamin C.

The average content of the minerals Fe and Zn in peeled, freeze dried, and milled potatoes is shown in Figure 2 and Figure 3. Quilcas reported the lowest average content of Fe and Zn with 15.89 and 9.04 mg/kg dry weight (DW), respectively. The locality of Pumaranra reported the highest overall mean content of Fe with 20.76 mg/kg DW, while Castillapata reported the highest overall mean content of Zn with 14.81 mg/kg DW. The highest individual reported average Zn content was in the variety "Camotillo" grown in the Castillapata locality with 19.49 mg/kg DW. Additionally, the variety "Yawar Manto" exhibited the highest individual Fe content grown in the Pumaranra locality with 25.82 mg/kg DW.

The mean total anthocyanin content of four potato accessions each with three repetitions, respectively, with red or purple flesh color previously known to contain anthocyanins are shown in Figure 4. The locality of Quilcas reported the highest average total anthocyanin content, producing 795.51 mg/100g DW. Pumaranra reported a slightly lower average with 718.77 mg/100g DW. Additionally, Castillapata reported a significantly lower average content with only 594.70 mg/100g DW. The variety "Añil" reported the highest average anthocyanin content overall when grown in the Quilcas locality, reporting 1393.67 mg/100g DW. Further, the variety "Alcaraz" produced the lowest average anthocyanin content when grown in the Castillapata locality reporting 343.69 mg/100g DW.

REFERENCES

Burgos, G.; Amoros, W.; Morote, M.; Stangoulis, J.; Bonierbiere, M. 2007. Iron and zinc concentration of native Andean potato cultivars from a human nutrition perspective. *J Sci Food Agric.* 87, 668–675.
Horton D. La Papa: Producción, comercialización, y programas. Potato: Production, marketing, and programs. Co-publication of the International Potato Center, Lima, Perú. Editorial Agropecuaria Hemisferio Sur, 1992: p. 1–270.

DISCUSSION

It is well known and discussed in literature that in the instance of poor nutrition, poor health often follows (Gwatkin, 2000). For the 40% of the world's population who are anemic, consumption and proper absorption of the minerals Fe and Zn are crucial to proper body function. Further, vitamin C is essential to the absorption of Fe in the body in addition to protecting against oxidative stress. The presence of anthocyanins in potatoes contributes to the body resisting oxidative stress. The instance of potatoes with low nutrient levels are even more detrimental to the health of those living in the Peruvian highlands where the principal food consumed is potatoes.

The discovery that growing locality can have an influence on micronutrient levels of potatoes is be an integral component in improving the overall health of those living in the Peruvian highlands. While it was not discovered any one locality was able to produce potatoes with elevated levels of all four micronutrients analyzed, the knowledge discovered will allow farmers to tailor their agricultural practices to provide crops with the most beneficial nutrients for the populations who consume them.

CONCLUSIONS

In conclusion, when comparing recorded micronutrient levels as they correlate to growing location, there is no one locality which produced high levels overall. However, there are correlations between individual micronutrient levels and growing locality. There exists a strong correlation between elevated vitamin C levels as well as total anthocyanin content in the varieties grown in the Quilcas locality. Moreover, the locality which produced the highest overall Zn levels was Castillapata. The highest recorded Fe levels were found in the Pumaranra locality.

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FIGURES + DATA

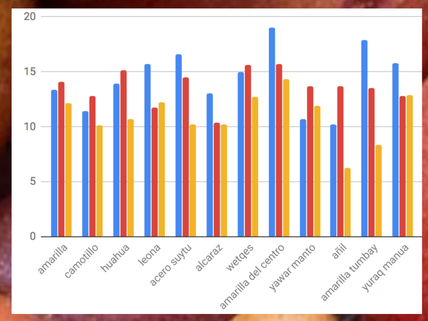

Figure 1. Average total vitamin C levels by growing locality in each variety in mg/100g fresh weight.

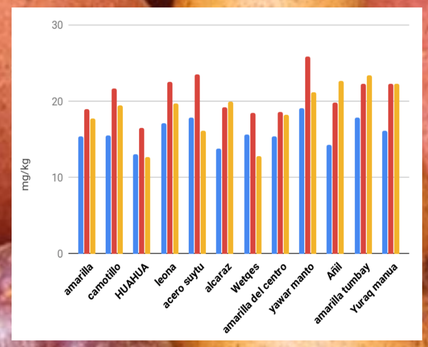

Figure 2. Average iron (Fe) content by growing locality in each variety in mg/kg dry weight.

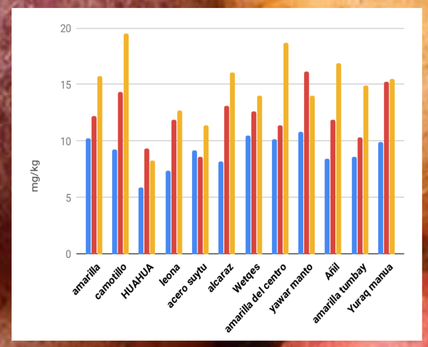

Figure 3. Average zinc (Zn) content by growing locality in each variety in mg/kg dry weight.

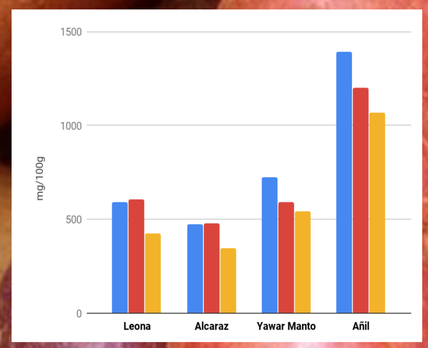

Figure 4. Average total anthocyanin content by growing locality in each variety in mg/100g dry weight