Abstract
Changes in Plasma and Liver Lycopene Concentrations, Body Composition and Gut Bacteria Following ‘Red’ versus ‘Moonglow’ Tomato Feeding in Ovariectomized Rats†

Umani S. Walallawita 1, Frances M. Wolber 1, Ayelet Ziv-Gal 2, Marlena C. Kruger 3 and Julian A. Heyes 1,*

1 School of Food and Advanced Technology, Massey University, Palmerston North 4442, New Zealand; u.walallawita@massey.ac.nz (U.S.W.); f.m.wolber@massey.ac.nz (F.M.W.)
2 College of Veterinary Medicine, University of Illinois at Urbana-Champaign, Urbana, IL 61802, USA; zivgal1@illinois.edu
3 School of Health Sciences, Massey University, Palmerston North 4442, New Zealand; m.c.kruger@massey.ac.nz
* Correspondence: j.a.heyes@massey.ac.nz
† Presented at the Nutrition Society of New Zealand Annual Conference, Online, 2–3 December 2021.

Abstract: Cis- isomers of lycopene have been reported to be more bioavailable than all-trans-lycopene. ‘Moonglow’ (MG) is an orange heirloom tomato variety with >90% of its lycopene in the more bioavailable cis-isomeric form, compared to ‘Red’ (R) tomatoes with all trans- lycopene. Oestrogen deficiency after menopause changes the body composition and gut microbes. This study evaluated the plasma and liver lycopene concentration and the effect of lycopene on body composition and gut microbiota in female ovariectomised rats following ‘Red’ versus ‘Moonglow’ tomato feeding. Female Sprague Dawley rats underwent no surgery (Sham) or ovariectomy (OVX) surgery at the age of 16 weeks to induce a menopause-like status. Sham-C and OVX-C groups received a daily dietary supplement containing no tomato powder; ‘post-R’ and ‘post-MG’ received dietary supplements containing tomato powder for 8 weeks post-surgery; ‘pre-R’ and ‘pre-MG’ received dietary supplements containing tomato powder for 8 weeks prior to and post-surgery (N = 12–15/group). Each dietary tomato supplement contained 0.172 mg of lycopene (~0.35 mg lycopene/kg body weight/day). After 8 or 16 weeks of tomato supplementation, the mean plasma lycopene concentrations in ‘pre-MG’ and ‘post-MG’ groups were ~8X higher than ‘pre-R’ and ‘post-R’ groups, but liver lycopene stores did not differ between the groups. Caecal pH ranged from 6.79 ± 0.08 to 7.05 ± 0.11 and was not significantly different among the groups. Ovariectomy reduced the abundance of gut bacteria compared to Sham-C. Both ‘pre-MG’ and ‘post-MG’ restored the numbers of Lactobacillus, Enterococcus, Bacteroides and E. coli, whereas the ‘post-R’ group only increased Lactobacillus. A significant increase in fat mass and reduction in lean mass was found in all OVX rats compared to Sham-C after 16 weeks, and individual fat pad weights strongly correlated with total body fat, with no benefit from lycopene supplementation. These results demonstrate that ‘Moonglow’ cis-lycopene is significantly more bioavailable than ‘Red’ trans- lycopene and that ‘Moonglow’ tomato has a greater prebiotic-like effect.

Keywords: lycopene; ovariectomy; gut bacteria; body composition; menopause


Funding: This research was funded by Heritage Food Crops Research Trust (HFCRT) Whanganui, New Zealand (PR40335) and U.S.W. is supported by a Massey University doctoral scholarship.
Institutional Review Board Statement: The animal study protocol was approved by the Massey University Animal Ethic Committee (Protocol code: 19/12 on 4 February 2019).

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.