Reply to the Letter: Increased bioavailability of plasma polyphenols via the intestinal fermentation of soybean fibers: a role for gut microbiome?

Aphichat Trakooncharoenvit[1], Seiya Tanaka[1], Erika Mizuta[1], Tohru Hira[1,2] and Hiroshi Hara[1,2]

[1] Graduate School of agriculture, Hokkaido University, Sapporo 060-8589, Japan

[2] Research faculty of Agriculture, Hokkaido University, Sapporo 060-8589, Japan

Hiroshi Hara

E-mail: hara@chem.agr.hokudai.ac.jp

Firstly, we really thank you for your comments on our recent paper and suggested us with many interesting references. At the first point, we also agreed that quercetin might act as molecular ignition for gut microbiome to release such catabolites. From your suggestion and evidence, quercetin degraded products related with formation of propionic and other organic acids [1]. We agree with this suggestion, but we would like to add some opinion that quercetin catabolites are not main portion of cecal organic acids when compare to organic acids produced from fermentation of dietary fiber [2,3]. This statement is confirmed by our cecal organic acids result. Organic acids concentration of Q group is lower than that of soybean fiber treated (QS) group especially on propionic concentration [4] suggesting that mainly occurred of cecal organic acids caused by cecal fermentation of dietary fibers, not quercetin degradation. However, we planned to perform another experiment by feeding rat with normal diet or normal diet with soybean fiber or normal diet with soybean fiber and quercetin. Results from this experiment might give us more evidences to fulfill an explanation for the effect from this fiber on enhancement of quercetin bioavailability.

From your suggestion, gut microflora has important roles for quercetin metabolism and the flavonol bioavailability in plasma. We hypothesized that cecal bacteria might be upregulated the expression of several genes related to carbohydrate-metabolizing enzymes, resulted in using dietary fibers as substrate during their growth [5-7]. Consequently, quercetin and its metabolites escaped from bacteria degradation and elevated plasma concentrations.

As your suggested on analytical statistic method, Iglewicz and Hoaglin's robust test for multiple outliers. We used this statistical method by follow the formulation from Iglewicz and Hoaglin’s handbook [8] on our data. The outlier was not observed in this calculation from our raw data. So, we can confirm that our set of data can be used.

References

1. Kawabata K, Yoshioka Y, Terao J (2019) Role of Intestinal Microbiota in the Bioavailability and Physiological Functions of Dietary Polyphenols. *Molecules*. 24(2): 370
2. Henningsson Å, Björck I, Nyman, M (2001) Short-chain fatty acid formation at fermentation of indigestible carbohydrates. *Näringsforskning*, 45(1), 165-168.
3. Dhingra D, Michael M, Rajput H, Patil RT (2011) Dietary fibre in foods: A review. *J Food Sci Technol* 49(3), 255-266.
4. Trakooncharoenvit A, Tanaka S, Mizuta E et al (2019) Water-soluble dietary fibers enhance bioavailability of quercetin and a fiber derived from soybean is most effective after long-term feeding in rats. *Eur J Nutr*.
5. Hervert-Hernández D, Goñi I (2011) Dietary polyphenols and human gut microbiota: a review. *Food Rev Int* 27:154–169.
6. Palafox-Carlos H, Ayala-Zavala JF, González-Aguilar GA (2011) The role of dietary fber in the bioaccessibility and bioavailability of fruit and vegetable antioxidants. *J Food Sci* 15:76.
7. Flint HJ, Scott KP, Duncan SH et al (2012) Microbial degradation of complex carbohydrates in the gut. Gut Microbes 3:289–306.
8. Boris Iglewicz and David Hoaglin (1993), "Volume 16: How to Detect and Handle Outliers", The ASQC Basic References in Quality Control: Statistical Techniques, Edward F. Mykytka, Ph.D., Editor.