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# A comparative assessment of specified nutrients and biochemicals in kimchi before and after freeze drying and powdering

J. Webster[1], K. Gordon-Smith[1], KR Ahmadi[1], H. Mathur[2], J. Leech[2] and T. Grassby[1]
[1]*School of Biosciences and Medicine, FHMS, University of Surrey, Guildford, GU2 7XH*
[2]*Teagasc Food Research Centre, Moorepark, Fermoy, 61 C996 Co. Cork, Ireland*

Our diet and its impact on the human gut microbiota in terms of composition and function are key determinants of human health across the life-course(1). Fermented vegetables can have enhanced functional and nutritional properties through substrate transformation by microbes and production of biochemicals during the fermentation process(2). Kimchi is a traditional Korean vegetable ferment produced via spontaneous lactic acid bacteria fermentation. Plant nutrients and biochemicals, microbial metabolites and microbial cell components are present in kimchi(3). As live products, fermented vegetables present challenges to commercial producers who need shelf/transport stability to deliver consistent products to consumers. We hypothesise that fermented vegetable health advantages will be preserved by freeze-drying, while enabling product stability, extended shelf and storage life, stable transportation and utility as food ingredients.

Utilising existing kimchi physiochemical data, we identified kimchi biochemicals (KBs) (benefit health but not essential to it) and kimchi nutrients (KNs) (essential to health). We quantified these components in 3-day old fresh kimchi (T3) and in 3-day old fresh kimchi that had been freeze-dried and powdered (T3 FDP). We sampled technical triplicates and calculated P values using an unpaired 2 tailed t-test.

The hypothesis that KBs and KNs in T3 FDP are preserved at levels not statistically significantly different to those in (T3) ($P > 0.005$) was disproved. Components of kimchi were affected differently by the FDP process, with decreases in some and increases in others. As a result, the overall profile of KBs and KNs in T3 FDP was different to T3. Based on a daily portion of fresh kimchi being ~50 g, there was 2.64 g KBs and KNs in 50 g T3 and 2.28 g KBs and KNs in equivalent portion T3 FDP (7.5 g), a reduction of 13.64% after FDP in KBs and KNs combined. Unexpectedly, soluble fibre and iron were significantly lower in equivalent sample T3 FDP compared to T3 ($P = 0.003$ and $P < 0.0001$ respectively) and vitamin B9 was significantly higher in T3 FDP compared to T3 ($P < 0.0001$). For KBs, acetic acid and lactic acid were significantly lower in T3 FDP ($P = 0.020$ and $P = 0.046$ respectively), but propionic acid was undetectable in T3 and the equivalent sample T3 FDP contained 1.44 g. Capsaicinoids were not detectable in T3, but were notably present in T3 FDP.

This study represents a critical first step in understanding the extent to which the functionality of fresh kimchi is preserved in its freeze dried and powdered form (termed a Fermentceutical™). Improving health through fermented foods is a critical concept for consumers, food manufacturers and healthcare professionals, alike.

## References

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