




## Abstract

# Short-Term Effects of Fruit Juice Enriched with Vitamin D3, n-3 PUFA, and Probiotics on Glycemic and Insulinemic Responses: A Randomized Controlled Clinical Trial on Healthy Adults <sup>†</sup>

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**Abstract:** Introduction: The health benefits of eating fruits have been well established. Fruit juice is the product of the extraction or pressing of the natural liquid contained in fruits. The glycemic index (GI) is a tool developed to systematically classify carbohydrate-containing foods according to the time-integrated effects on postprandial glycemic responses. This study aimed to determine the effects of consuming a mixed commercial fruit juice (containing apples, oranges, grapes, and pomegranates) fortified either with two probiotic strains (*Lactocaseibacillus casei* Shirota and *Lactocaseibacillus rhamnosus* GG), or with vitamin D3, or with n-3 polyunsaturated fatty acids (PUFA), or with a combination of all of the aforementioned biofunctional ingredients versus the same control fruit juice without biofunctional ingredients on the postprandial glycemic and insulinemic responses. Methods: Eleven healthy, normal-weight volunteers (25–2 years; five females; BMI = 23 ± 1 kg/m<sup>2</sup>) participated in this randomized, double-blind, crossover clinical trial and were randomly assigned to receive five types of fruit juices (the fruit juice control, fruit juice with 50 µg vitamin D3, fruit juice with 8.33 g n-3 PUFA, fruit juice with 10<sup>8</sup> cfu/mL probiotics, and fruit juice with vitamin D3, n-3 PUFA, and probiotics, all tested once) and D-glucose as a reference drink, which was tested two times. They all contained 50 g available carbohydrates, and the fruit juices were administered at different weeks in a random sequence according to the recommended glycemic index methodology. Capillary blood glucose and salivary insulin samples were collected at the baseline and for 180 min post consumption. Results: All the fruit juices provided low GI values (control: 54; vitamin D3: 52; n-3: 51; probiotics: 50; vitamin D3-n-3 PUFA-probiotics combination: 52, on the glucose scale). All the fruit juice types provided lower peak glucose values, smaller mean glycemic and insulinemic responses, and were more pleasurable than glucose was. Discussion: All the fruit juice types, regardless of the added biofunctional ingredients, attenuated the postprandial glycemic responses, which may offer advantages for glycemic control.

**Keywords:** fruit juice; glycemic responses; glucose; vitamin D3; n-3 PUFA; probiotics



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