Leveraging fermented fruit peels with *Yarrowia lipolytica* to develop innovative and nutritious snack bars

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Consumers are increasingly concerned about the nutritional value, safety, and sustainability of new food products. As awareness of health and environmental issues grows, they seek options that provide essential nutrients while being free from harmful additives and produced in environmentally responsible ways. The search for healthier diets has instigated the exponential growth of the plant-based food industry. Microbial fermentation emerged as a promising approach to improve the nutritional profile of food products (e.g., increasing protein content and lowering sugar content) and represents an alternative to developing products that balance health benefits with safety and sustainability, meeting the evolving expectations of conscious consumers. This study evaluated the potential of solid-state fermentation (SSF) with *Yarrowia lipolytica*, a GRAS-status yeast approved as a novel food by EFSA, to improve the nutritional value of orange (OP) and banana (BP) peels. Both peels are a good source of carbohydrates (38% OP and 29% BP), minerals, and fibers, but are poor in protein (5% OP and 8% BP). After optimization of SSF, by studying medium supplementation, mixture, and peel pretreatments, protein content increased to 9.4% in OP and 10.2% in BP, and a significant reduction in carbohydrates (28% OP and 16% BP) and soluble sugars (2% OP and 0.2% BP) was observed. Fermented OP and BP (fruit peels+yeast) were used as the main raw material to develop two snack bars formulated with: (1) fermented BP, banana pulp, chocolate, and sliced almond; (2) fermented OP and BP, oat flakes, chocolate, peanut butter, toasted sunflower seeds, orange juice, agave syrup, and whey. A consumer taste test with 190 people demonstrated the good acceptability of the new snacks, particularly the formulation (1), and the willingness to buy this innovative product that stands out from existing market offerings. Fermented fruit peels with *Y. lipolytica* represent an advancement in food biotechnology, offering the potential to create innovative and nutritionally valuable products while promoting environmental sustainability by valorizing underutilized food-grade by-products.

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