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Exploring the nutritional properties and natural biofortification of yeasts when fermenting strawberries, beetroots, onions, and others

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Abstract

Products derived via fermentation, although heavily dominated by bacterial strains such as Lactobacillus, have now exponentially gained popularity with yeasts-based products in the last 7-8 years. This is well evidenced by the number of recent extensive reviews [1-4] and experimental studies [5, 6] that have emerged, exploring the yeast-product potential beyond the brewing and bakery industries. This raises research questions on its nutritional properties, considering that part of the nutrition field's aim as a discipline is the global prevention of diet-related diseases. Thus, this study reflects a collaboration between microbiology and human nutrition, delving into the quantification of yeast's response to modified fermentation environments.

Within these environments, our aims with their associated methods involved – quantifying growth, total protein, total nitrogen, and ascorbic acid content using the OD 600 nm spectrophotometer measurements, Bradford Assay, Kjeldahl process and the DCPIP assay respectively. Three yeasts were employed for these experiments - S. *cerevisiae* (SC), C. *utilis*(CU), and Y. *lipolytica* (YL). Six foodstuff media were initially used for growth measurements - onion, celery, strawberry, mushroom, beetroot, and commercial beetroot juice (CBJ). Alongside these quantifications, aims and further methods also included exploring ascorbic acid's protection against peroxide through spot tests and testing cellular components such as cell-free extract against peroxide using both growth measurements at OD 600 nm and viability assay.

Results primarily revealed strawberry and CBJ as the best media with the greatest growth observed at OD600 - Strawberry (4.95 ± 0.2) and CBJ (5.73 ± 0.4) (values quotes for SC strain but also representative of others). Amidst the strains, SC stands out over CU and YL with consistently optimal values for each respective media based on their individual growth trends, and thus was chosen for all further experiments. Next, a fourfold rise in total protein and nitrogen was detected in our samples after 24 hours of fermentation in CBJ, accounting to 40% of dry weight as protein. Meanwhile, the CBJ's cell-free extract addition led to a 3.6x lower death rate (7.9% versus 28.1% alive cells) after peroxide exposure, highlighting antioxidative inputs.

Primarily concerning S. cerevisiae yeast, our study managed to scrutinize the protein plus ascorbic acid content, and explore antioxidative action against peroxide, two of the main aims of our study. Additionally, our experiments led to a novel discovery of a certain CFE (cell-free extract) obtained post-fermentation in CBJ, demonstrating strong antioxidative properties against peroxide. The implications of this finding could be for a variety of demographics in the population in need of antioxidants and gut-associated benefits, subject to confirmation with further animal, and followingly human studies.

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