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Valorization of Wine Lees in the Production of Reduced-Lipid Nutritive Muffins

Aurica Chirsanova [1,*], Alina Boiștean [1], Xenia Pascari [2], Rodica Siminiuc [1] and Ecaterina Gore [3]

[1] Department of Food and Nutrition, Faculty of Food Technology, Technical University of Moldova, 9/9 Studentilor St., MD-2045 Chisinau, Moldova; alina.boistean@toap.utm.md (A.B.); rodica.siminiuc@adm.utm.md (R.S.)
[2] Reference Centre for Food and Feed Analysis, German Federal Institute for Risk Assessment (BfR), Max-Dohrn-Straße 8-10, 10589 Berlin, Germany; xenia.pascari@bfr.bund.de
[3] Laboratoire URCOM, Université Le Havre Normandie, 25 Rue Philippe Lebon, BP 1123, 76063 Le Havre, France; ecaterina.gore@univ-lehavre.fr
* Correspondence: aurica.chirsanova@toap.utm.md; Tel.: +373-79770751

Abstract

The valorization of winemaking by-products is a sustainable strategy consistent with circular bioeconomy principles and current public health priorities. This study aimed to evaluate residual oenological yeast sediment from local Moldovan grape varieties, Viorica and Fetească Regală, as a multifunctional ingredient and partial fat replacer in muffins. Sunflower oil was replaced with wine lees (WL) at 20%, 35%, and 50%, and the obtained products were analyzed in terms of physicochemical, nutritional, microbiological, colorimetric, and sensory characteristics. WL incorporation reduced the caloric value by up to 10% and decreased lipid content, while contributing to higher protein and dietary fiber levels. Moisture values remained within acceptable limits, whereas titratable acidity increased with the substitution level ($p < 0.05$). Muffin density showed a slight increase, and water absorption capacity improved markedly, reaching 269%, mainly due to the fiber-rich composition of WL. Color analysis indicated reduced lightness and increased redness, associated with yeast pigments and thermal reactions during baking. Microbiological results showed lower total viable counts with increasing WL addition; however, the 50% substitution level exceeded the permissible limits for yeasts and molds. Sensory evaluation indicated that the muffin with 20% WL was the most acceptable sample. Overall, WL may be considered a promising sustainable ingredient for developing reduced-fat muffins with improved nutritional value.

Keywords: residual wine yeast; fat replacement; nutritional enhancement; sustainable bakery products

Academic Editor: Alina Kunicka-Styczyńska

Received: 18 May 2026
Revised: 4 June 2026
Accepted: 9 June 2026
Published: 11 June 2026

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