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Oligosaccharides, Antioxidants, Amino Acids, and Pufas Each had Different Effects on Heat- And Hypoxia-Induced Epithelial Injury in the Caco-2/Ht-29 Co-Culture Model

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Abstract

When cells in the intestinal epithelium are subjected to

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Nutritionalointegrity are junctional complexes between adjacent intestinal epithelial cells. A collection of proteins from the tight junction (TJ), adherens junction (AJ), and desmosome all control paracellular transport, stability, and epithelial tightness of this barrier. In a co-culture model utilizing two human colonic epithelial cell lines, Caco-2 and HT-29, our previous research demonstrated that expression of the TJ protein signi cantly decreased a er two hours of exposure to heat (40 or 42 °C) and hypoxia (5% oxygen), while expression of the AJ protein E-cadherin was elevated. A er hypoxia and heat treatment, epithelial permeability increased and trans-epithelial electrical resistance (TEER) decreased.

e increased permeation of luminal antigens, endotoxins, and bacteria into the local tissues and blood circulation is facilitated by leaky or dysfunctional intestinal epithelial tight junction barriers, which may outcome in severe local and systemic in ammatory conditions. HS-induced intestinal injury and associated disorders may be alleviated by any treatment that restores epithelial integrity or prevents the abnormal expression of TJ/AJ proteins [**2**-**5**].

Some of the nutritional supplements that have the potential to e ectively treat and prevent intestinal disorders brought on by HS include antioxidants, non-digestible oligosaccharides, polyunsaturated fatty acids (PUFAs), and amino acids. ese supplements alter immune responses as well as stress resilience pathways, in addition to restoring the expression of TJ/AJ proteins. In HS-exposed Caco-2 cells and chickens, our group demonstrated that galacto-oligosaccharides

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epithelial injury. Non-digestible oligosaccharides GOS, FOS, and COS, antioxidants ALA and RES, amino acids Glu and Arg, and PUFAs DHA and EPA may be potential candidates to support intestinal homeostasis and prevent HS/hypoxia-induced alterations in the integrity of the intestinal epithelial barrier, according to our review of potential promising nutritional intervention strategies [**10**].

To replicate the human intestine, our co-culture model uses 90% Caco-2 cells and 10% HT-29 cells. Goblet cells and other specialized secretory cells in the intestinal epithelium are represented by the mucus-producing HT-29 cells. Goblet cells, which make up 10–20 percent of the intestinal cells in the epithelium, form the mucosal layer, a crucial physical and chemical barrier that keeps the intestinal epithelium intact. Caco-2 cells, human intestinal absorptive enterocytes, form columnar monolayers that are well-polarized and resemble a closed intestinal epithelial barrier. e best Caco-2 has been the subject of numerous studies: HT-29 ratio for in vitro studies that mimic the anatomy and physiology of the intestinal in vivo model. It is thought that the most physiologically relevant ratios are those between 9:1 and 7:3 (Caco-2/HT-29), where TEER, a measurement of the monolayer's barrier properties, reaches values that are very similar to those found in the human intestine. 25% of HT-29 cells signi cantly decreased the TEER values of the Caco-2 monolayer and increased paracellular permeability, whereas 10% of HT-29 cells had no e ect on epithelial integrity, in contrast to Caco-2 cells alone. All of the proteins and genes associated with mucins, TJ/AJs, heat shock, and oxidative stress were present in the 9:1 Caco-2/HT-29 monolayer. erefore, this Caco-2/HT-29 co-culture model can be utilized to investigate how the intestinal barrier is a ected by heat and/or hypoxia.

Conclusion

By maintaining TEER values, decreasing paracellular LY permeability, and increasing tight junction protein expression, the non-digestible oligosaccharides, particularly GOS and FOS, the antioxidant ALA, and the PUFA EPA were able to protect Caco-2/HT29 cells from heat/hypoxia-induced intestinal injury. Amino acid Arg behaved more like a "double-edged sword" because its bene cial e ect on intestinal barrier function (TEER) was only limited to its physiological level. Higher concentrations further enhanced the heat/hypoxia-induced