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Ionic liquids modifications with oligosaccharides as potential drugs anticancer; molecular docking enhanced the result

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INTRODUCTION & AIM

Cancer is one of the leading causes of mortality globally, posing a significant challenge to public health. Current treatments, such as chemotherapy and medical radiation are often hampered by their non-specific cytotoxicity, resulting in debilitating side effects and the emergence of multidrug resistance [1,2]. This clinical problem is pressing to underscore the critical need for the development and discovery of novel therapeutic candidates with enhanced selectivity with improved safety profiles [1]. The natural products continue to be acritical prolific source of anticancer agents. Lactoferrin, a multifunctional glycoprotein prominent in human milk, has garnered considerable attention due to its broad-spectrum bioactivities, including an immunomodulatory, demonstrated antimicrobial and antitumor effects [3]. The isolated oligosaccharide from lactoferrin (O-GLcs)) is hypothesized to play a key role in mediating its biological interactions; however, its full therapeutic potential may be constrained by inherent physicochemical limitations [2]. To pass the limitations of native biomolecules, strategic chemical modification presents a powerful approach to augment their drug-like properties. In this context, ionic liquids (ILs)—a class of low-melting-point salts with designer functionality—offer a novel and versatile platform for biomolecule engineering. ILs tailored to enhance the functionality of therapeutic compounds. Among these, derivatives of the methylimidazolium cation are particularly prominent due to their ability to improve solubility and facilitate interaction with biological membranes, potentially leading to increased bioavailability and altered bioactivity. We hypothesized a derivatives of methylimidazolium-based ionic liquid reacted the isolated oligosaccharide from human milk lactoferrin would yield a novel derivative (O-GLc-SMol-ILs) with enhanced anticancer activity. This modification was anticipated to improve the molecule's solubility and its ability to interact with cancer cells [3]. Therefore, the aim of this study was to isolate the oligosaccharide from lactoferrin, chemically modify it using a methylimidazolium ionic liquid derivative, and evaluate the potential of this new conjugate as a candidate anticancer agent in vitro. Molecular docking is used for enhancing the interaction and results [4,5]. Particularly, the modified products (O-GLc-SMol-ILs) a small molecule is synthesized as anticancer activity, protein kinase B selected as a good target for interaction. New binding to protein kinase B was investigated through their probable anticancer activity and molecular docking is evaluated the anticancer potential of this new candidate against e.g., Kinas B and a specific cancer cell line HePG2.

METHOD

a) Synthesis of Small Molecule (O-GLc-SMol-ILs) Conjugate

Preparation of Lactoferrin Oligosaccharides (Lf-O-GLcs):

We focused on pure lactoferrin as subjected to enzymatic hydrolysis, using a specific glycosidase (e.g., PNGase F) to release the N-linked glycans. The resulting of the oligosaccharide mixture was purified by using PCR-exclusion chromatography to obtain a defined fraction of Lf-O-GLcs)

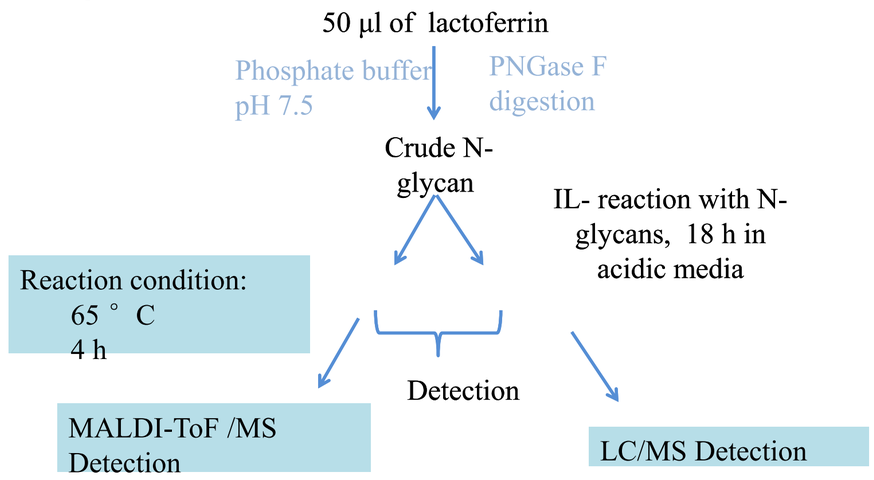
b) Synthesis of Functionalized Ionic Liquid IL(1-(4-minophenethyl)-3-methyl-1H-Imidazol-3-ium:

A primary amino-functionalized imidazolium ionic liquid was synthesized. For example, IL=(1-(4-minophenethyl)-3-methyl-1H-Imidazol-3-ium was prepared by reacting methyl methylimidazole with 4-bromophenyl amine, reaction mixture reacted with stirred magnetic in MeCN solvent, 18 h.

c) Conjugation via reductive amination Coupling:

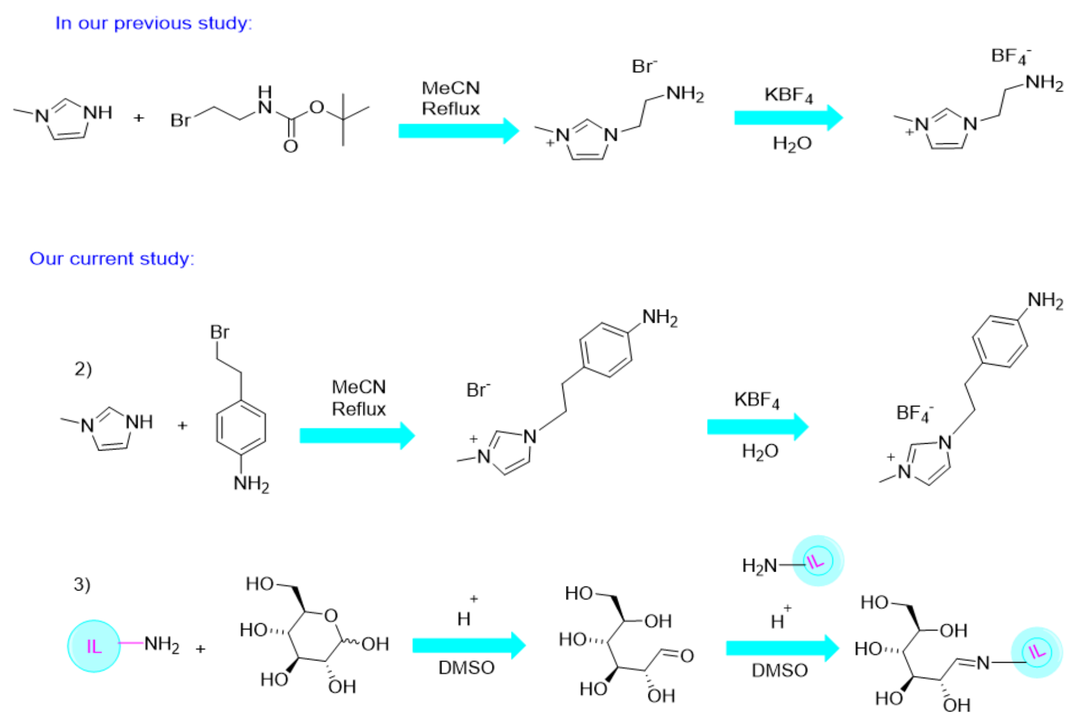
The novel IL=(1-(4-minophenethyl)-3-methyl-1H-Imidazol-3-ium react with N-linked glycans in sample at 25-40 0C, or derivatization/incubated in acidity medium ACOH/MDSO from the reducing-end glucosamine, lysine, galactose, or mannose residues in any attached with oligosaccharides') were conjugated to the carbonyl group by the functionalized IL using a standard amine coupling reagent.

The final IL(1-(4-minophenethyl)-3-methyl-1H-Imidazol-3-ium conjugate was purified and characterized by techniques like TLC and LCMS/ Mass Spectrometry to confirm the successful formation of a novel ionic liquid.



RESULTS & DISCUSSION

In Scheme (2); shown the synthesis of the ionic liquid in the laboratory, 3 derivatization reaction and production the potential effectiveness of LfO-GLc-SMol-ILs)



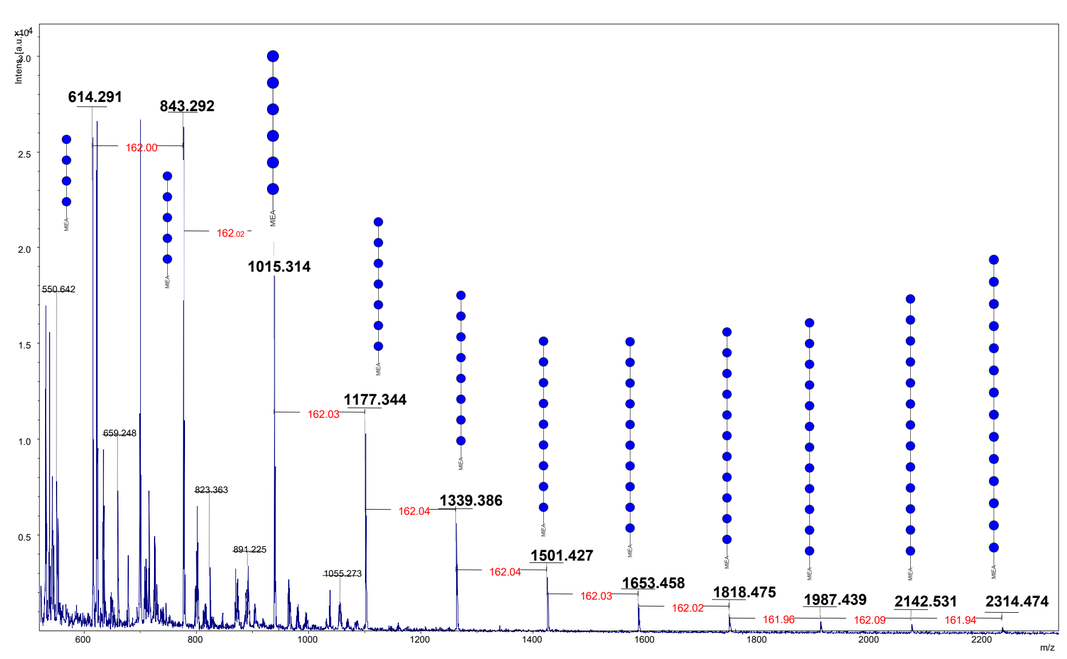


Figure: LCMS/MS of Modification of Lf-o-GLcs with ionic liquid

CONCLUSION

Based on this study, we hypothesized that modifying the isolated oligosaccharides from H-lactoferrin HLf-o-GLcs with a methylimidazolium ionic liquid would create a novel conjugation (O-GLc-SMol-ILs) with enhanced anticancer efficacy. This study aimed to (1) isolate the oligosaccharide from lactoferrin, (2) synthesized and characterized methylimidazolium ionic liquid derivatives by using LCMS/MS. 3) the ionic liquid synthesized in the laboratory. In derivatization reaction, it's illustrated a good result with human lactoferrin -oligosaccharides (HLf-oGLcs) and the production hypotheses the potential effectiveness a glints cancer LfO-GLc-SMol-ILs). New binding to protein kinase B was investigated through their probable anticancer activity. Evaluate the anticancer potential of this new candidate against e.g., Kinas B and a specific cancer cell line HePG2.

FUTURE WORK / REFERENCES

Biological Evaluation: In Vitro Anticancer Activity:

The cytotoxic effects of (LfO-GLc-SMol-ILs) are good and applicable with various human cancer cell lines (e.g., MCF-7 breast adenocarcinoma, A549 lung carcinoma, HeLa cervical cancer) and a normal cell line (e.g., HEK-293) using the MTT assay.:

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