Characterization of Novel Milk Oligosaccharides: A Qualitative Analysis across Species

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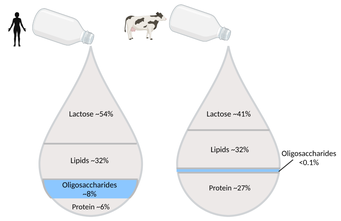
ABSTRACT & REFERENCES

INTRODUCTION

1. What are milk oligosaccharides?

Oligosaccharides are short sugars that contain 2-20 monosaccharides. Such structure can be found in free form or attached to protein. There are only ten variations of simple monosaccharides in animals. However, they can be arranged in thousands of distinct ways. The specific way monosaccharides connect to form oligosaccharides dictates their biological activities and digestibility, in the case of dietary sources such as milk. Oligosaccharides are the third most abundant component in human milk. Thus, establishing the structure-function relationship is of great importance when elucidating the role of milk oligossacharides in neonatal diets.

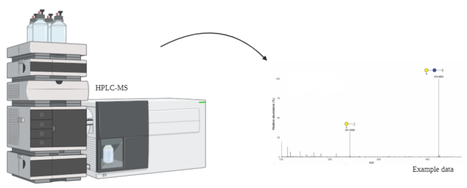


2. Novel Milk Oligosaccharides

A current study has identified 170 unique oligosaccharides in cow milk, in which 14 are glucuronic acid (GlcA) containing trisaccharides[1]. More interestingly, a major part of oligosaccharides with GlcA were also sulphated. It is known that sulphated oligosaccharides enhance the gut resistance to bacterial metabolism[2]. Moreover, they have an impact on immunity as they are able to bind and guide immune cells to the lymphoid tissue[3]. Consequently, the combination of GlcA and sulfate can be recognized and alter immune cells functions[4].

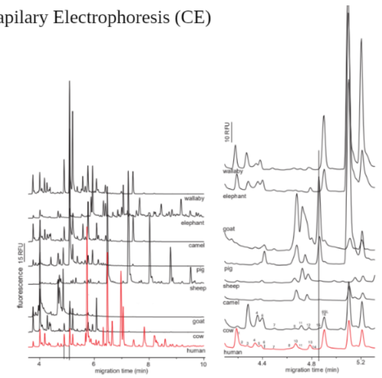
METHODS

The analysis was based on past data acquired by former students in the Zandberg lab. High-resolution Mass Spectrometry (MS) was performed in every sample to collect the abundance and retention time of all sugars present.



VARIATION BETWEEN SPECIES

A. Capilary Electrophoresis (CE)



B.

Monosaccharide Composition

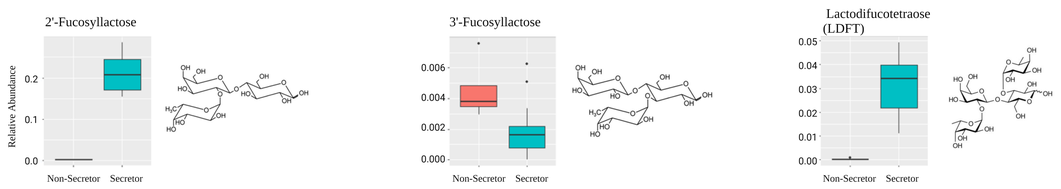
HexNac	Hex	Fuc	Neu5Ac	Neu5Gc	GlcA	Suf
0	2	0	0	0	1	0
0	2	1	0	0	1	0
1	1	0	0	0	1	0
1	1	0	0	0	1	1
0	2	0	0	0	1	1
1	1	1	0	0	1	0
0	2	1	0	0	1	1

Present
Absent

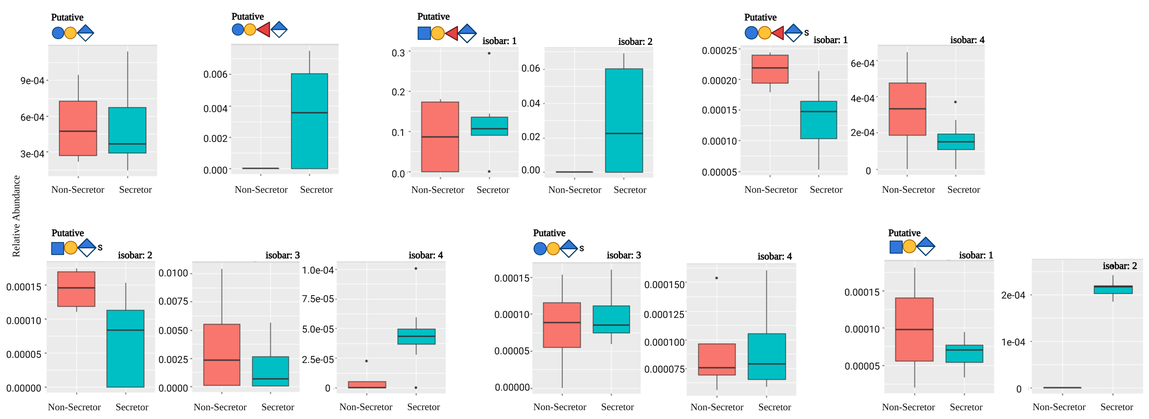
Human	Cow	Camel	Goat	Sheep	Elephant	Pig	Horse
	3 isobars						
		3 isobars					
4 isobars							
3 isobars							
10 isobars	10 isobars	2 isobars					
2 isobars							
4 isobars							

HUMAN VARIATION: SECRETORS VS. NON-SECRETORS

A. Common Milk Oligosaccharides



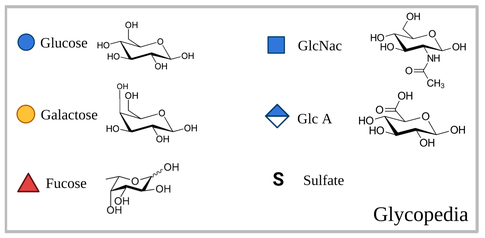
B. Novel Milk Oligosaccharides: Uronic Acid



Genetic factors influence Human Milk Oligosaccharide (HMO) concentration and diversity.

Lewis gene

Non-Secretor	Secretor gene (-)	About 20% of mothers	Major HMO: Lacto-N-tetraose (LNT)
Secretor	Secretor gene (+)	Majority of mothers (~80%)	Major HMO: 2'-Fucosyllactose (2'-FL)



CONCLUSION

We identified 25 glucuronic-acid-containing oligosaccharides. When contrasting with other species, human milk was the only one that presented all of them. However, we observed significant variations between secretor mothers and non-secretor mothers.

ACKNOWLEDGEMENTS

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