

Components of Food Matrices With Inhibitory Effect on Bacterial Sialidases

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INTRODUCTION

Sialidases (E.C.3.2.1.18) are enzymes present in the metabolism of animals and some microorganisms. For some bacteria they are pathogenicity factors (Table 1.).

Table 1. Examples of sialidase producing pathogenic bacteria

Species	Disease	Enzyme action
<i>Vibrio cholerae</i>	cholera	Sialidase breaks down the mucosa, exacerbates the inflammatory process, reveals receptors for toxins, enhances biofilm formation.
<i>Clostridium perfringens</i>	gas gangrene	
<i>Streptococcus pneumoniae</i>	pneumonia sinusitis	
<i>Corynebacterium diphtheriae</i>	diphtheria	
<i>Salmonella typhimurium</i>	typhus	

The development of microbial sialidase inhibitors is of great importance to science and health care. Viral sialidase-inhibiting drugs, such as Tamiflu® and Relenza®, are already in use, while bacterial sialidases do not yet have effective inhibitors. Dairy foods rich in oligosaccharides, such as functional foods based on lactic acid bacteria (LAB) fermentation can have an inhibitory effect.

AIM

Testing LAB cultures and their food matrices for the presence of natural components inhibiting *V. cholerae* sialidase.

Fig. 1. 3D model of *V. cholerae* sialidase, Moustafa et al., 2004

Materials and Methods

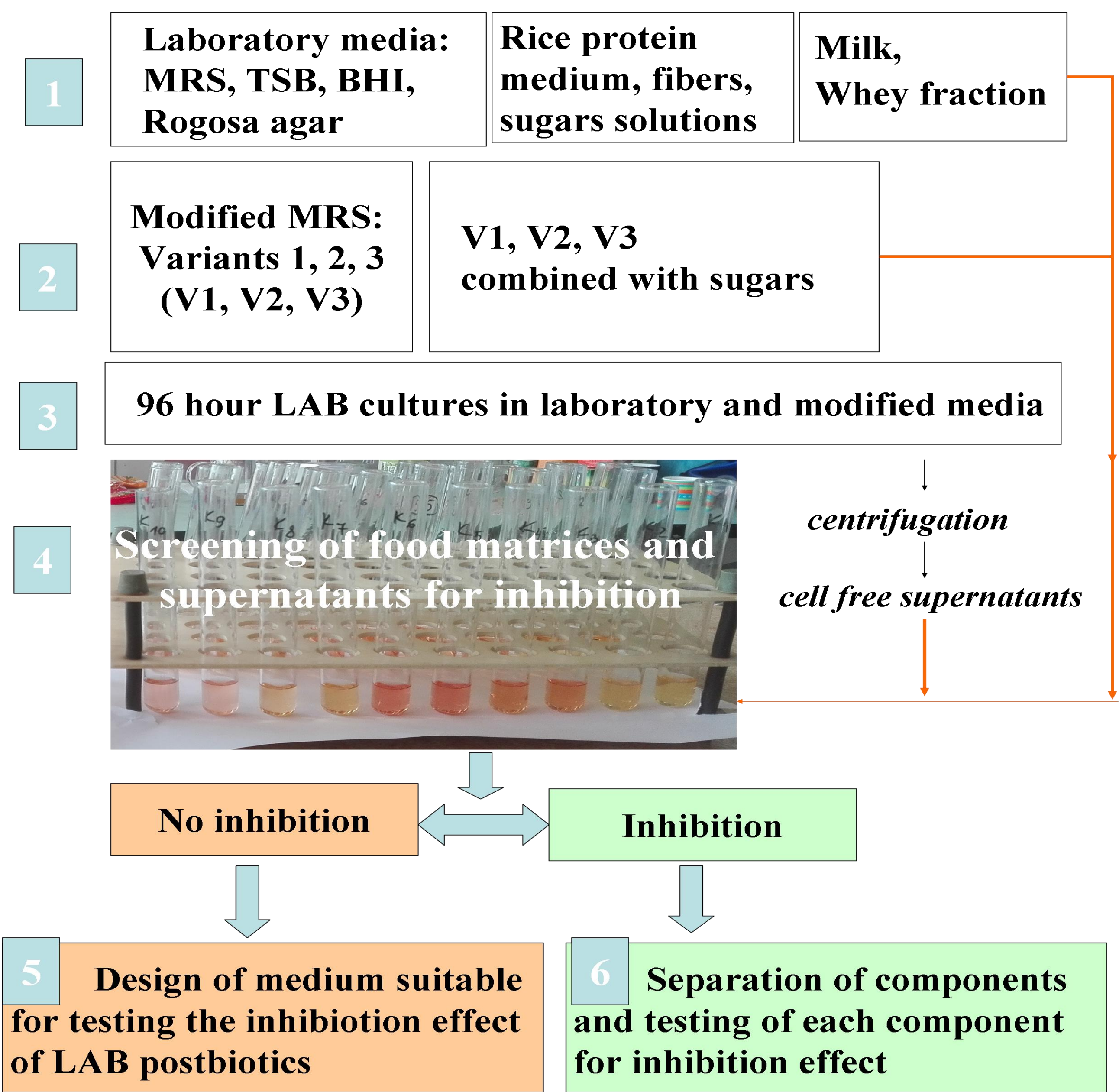


Fig. 2. Experimental design: **1.**Selection of nutrient media for the cultivation of LAB strains, for the detection of their metabolites inhibiting the sialidase activity of *V. cholerae*; **2.** Modification of nutrient matrices - variants V1, V2, V3 of MRS and its combination with different carbon sources (sugars); **3.** Preparation of 96-hour cultures of LAB in nutrient matrices, centrifugation and preparation of cell-free supernatants; **4.** Screening of the influence of nutrient matrices and culture supernatants of LAB strains on the enzyme sialidase. **The colorimetric method called Aminoff's thiobarbiturate method, a modification of Ushida, 1977,** was applied; **5.** The lack of inhibition allows the development of a suitable culture medium that allows the production of natural bacterial sialidase inhibitors by LAB to be objectively assessed; **6.**Search for food matrix components affecting sialidase activity.

RESULTS and DISCUSSION

Screening samples of food matrices and LAB cultures

Residual enzyme activity:

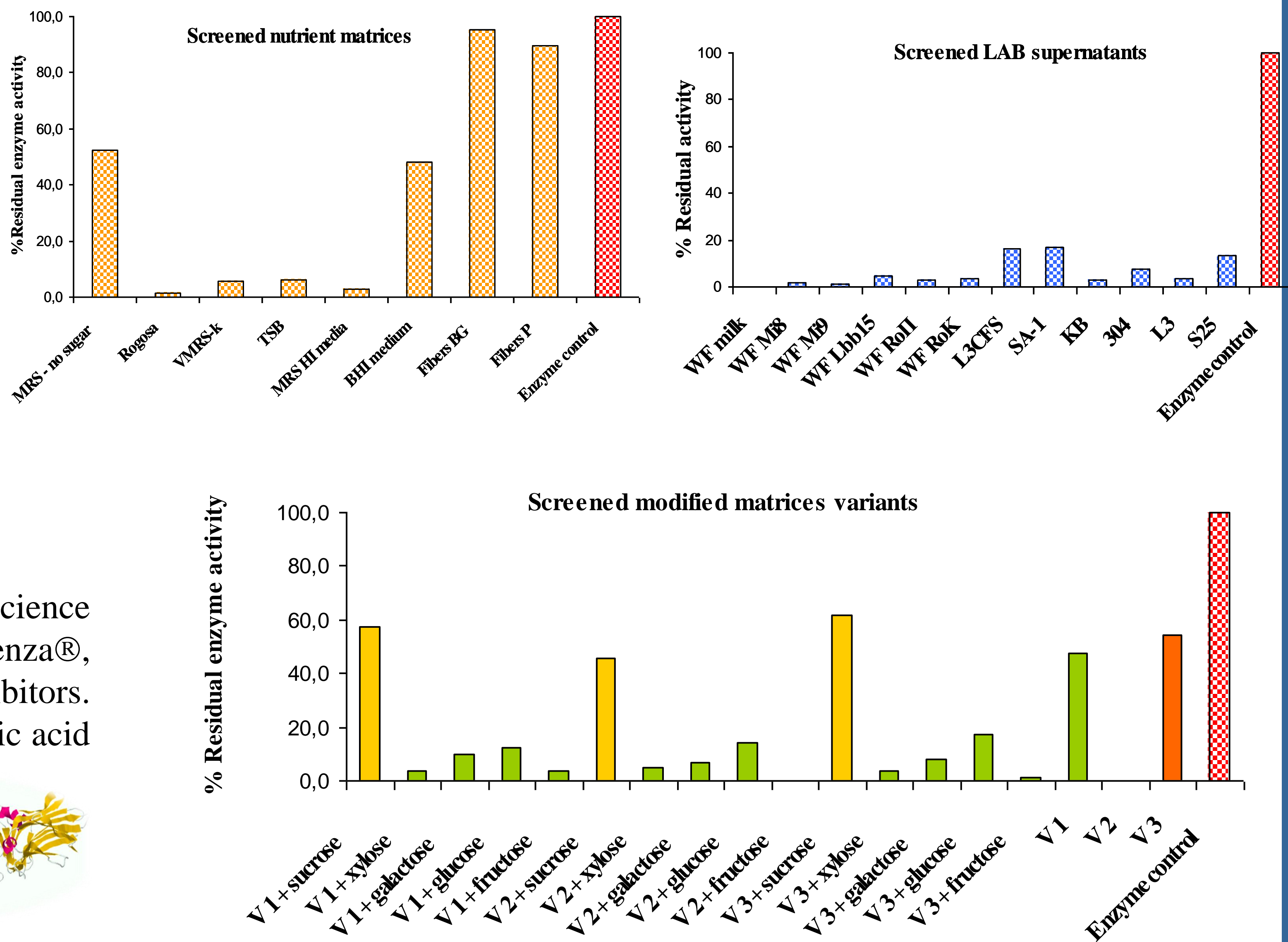


Fig 3. Inhibition effects of nutrient matrices, their modifications, and LAB culture supernatants on *V. cholerae* sialidase. Enzyme control activity is set as 100%

- Food matrices of milk origin contain salts and sugars (lactose), inhibiting the activity of bacterial sialidase.
- The tested media of non-dairy origin, containing fibers, have no inhibitory effect on the enzyme.
- The sialidase from *V. cholerae* is inhibited by lactose, and a number of other mono- and disaccharides such as glucose, fructose, galactose, xylose, maltose, and cellobiose.
- The disaccharide sucrose has no inhibition effect.

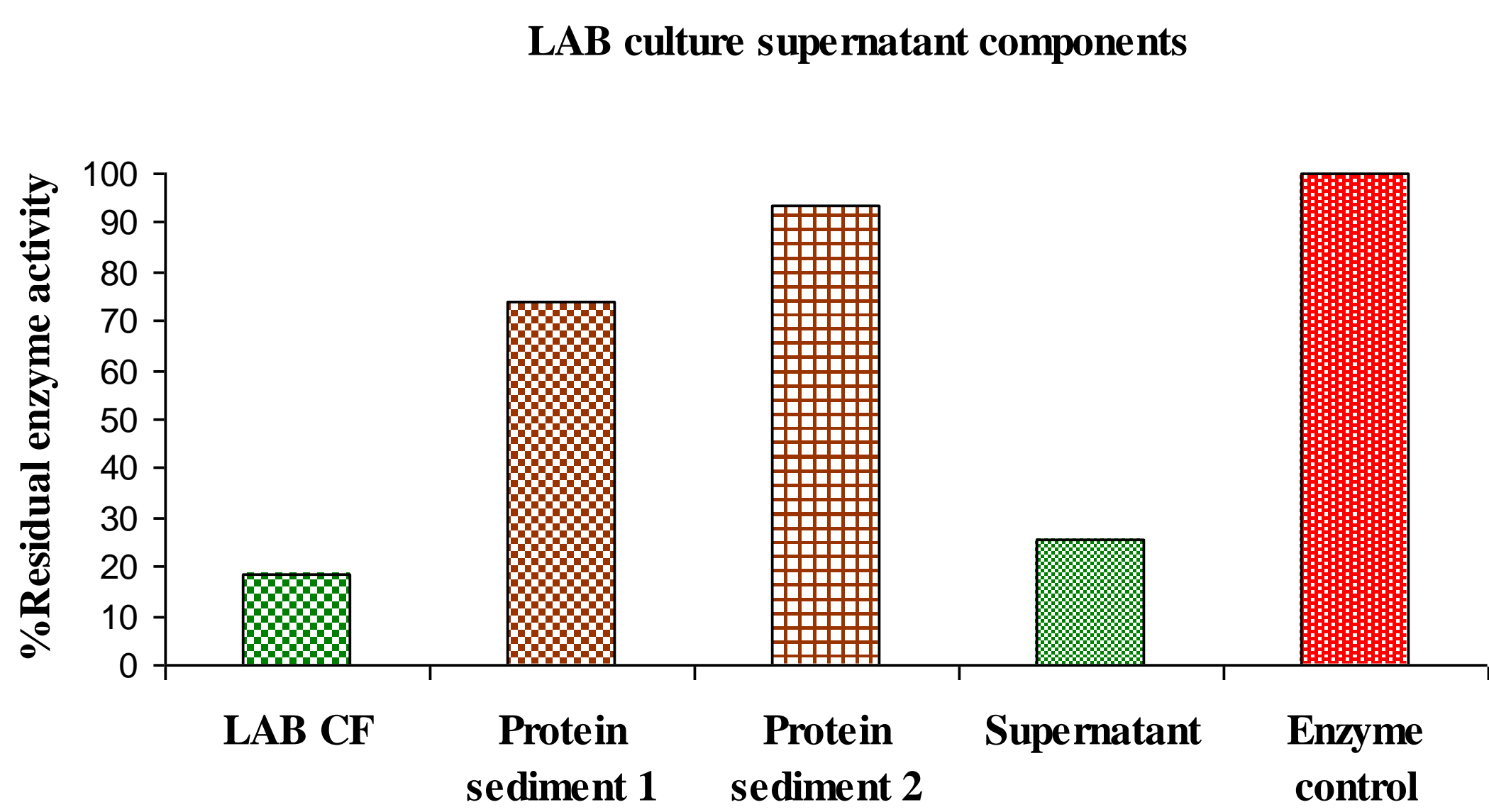


Fig. 4. Inhibition effect of food matrix components (step 6 of the experimenta design)

- The tested LAB strains produce low-molecular-weight postmetabolites, probably carbohydrate-based, which are promising for development as natural inhibitors of the enzyme sialidase from *V. cholerae*.

CONCLUSION

Data on the suppressive role of various mono- and disaccharides from the nutrient media are confirmed. The role of LAB in the same process was evaluated. Initial characterization of active postbiotics, as a result of LAB growth showed a promising effect. Dairy and non-dairy food matrices were evaluated for their influence on sialidase activity. Suppression by the very component composition of the environment was found. A model system with growth medium is developed allowing the production of natural sialidase inhibitors by LAB to be objectively assessed.