

Antagonistic Activity of Bifidobacteria Against Microbial Pathogens

Ibtisam R. Mowafi^{1*} and Rafat Khalaphallah²

¹Department of Agriculture, Food Science and Dairy Technology, South Valley University, 83523 Qena, Egypt

²Department of Agriculture, Agricultural Botany (Microbiology), South Valley University, Qena, Egypt

Abstract

Nowadays, Reports have revealed that intestinal bifidobacteria produce antimicrobial substances that are active against pathogenic bacteria or microflora such as *Pseudomonas aeruginosa* and *Enterococcus faecalis*. Many mechanisms have been postulated by which Bifidobacteria could produce antimicrobial activity. In addition to their competitive inhibition of the epithelial and mucosal adherence of pathogens and inhibition of epithelial invasion by pathogens, and Bifidobacteria also show antimicrobial activity by producing antimicrobial substances (bacteriocins), H₂O₂, organic acids and or stimulating mucosal immunity. In this study the isolates of *Bifidobacterium* strains (*Bifidobacterium longum* ATCC 15707, *Bifidobacterium bifidum* LMGD 10645, *Bifidobacterium animalis* and *Bifidobacterium angulotum*) were screened for antibacterial activity against pathogenic bacteria. According to their inhibitory effects on pathogens, *Bifidobacterium* strains were differentiated into three classes: strong inhibitor, weak inhibitor and with no significant inhibitory effect.

Keywords: Bifidobacteria • Pathogenic • Antimicrobial • Bacteriocins

Introduction

Probiotics are the microorganisms that including; yeasts, bacteria and moulds that confer many health benefits to the host, when it consumed in sufficient amounts. As probiotic bacteria strains belonging to the genus *Bifidobacterium* in the (GIT) Gastro-Intestinal Tract of humans at the time of birth. They are found in adult as well as in young individuals in the great numbers. They can interact with the development of enteric infections by the production of antimicrobial metabolites. *Bifidobacterium* strains are able to prevent the adhesion of pathogens by means, like production of bacteriocins, organic acids and synthesis of substances that induce immunological responses [1]. Reports nowadays have revealed that intestinal bifidobacteria produce antimicrobial substances that are active against pathogenic bacteria or microflora such as *P. aeruginosa* and *E. faecalis*. Bacteriocins it's a bactericidal proteinaceous molecule, that produced by probiotic bacteria, the primary target for many of bacteriocins is the cytoplasmic membrane of the sensitive bacteria, and there are other compounds that produced from probiotic bacteria that affect on pathogenic bacteria [2].

Clinical studies showed that usage of antibiotics on neonates causes increasing of risk of colonisation by pathogenic bacteria, *Bifidobacterium* strains such as (*B. longum*, *B. bifidum*, *B. animalis*) have found to be useful in treating different clinical conditions. And they have the ability to reduce the gut-derived lipopolysaccharide which is related to metabolic diseases and chronic inflammatory. Bifidobacteria is also reported to exhibit the effect of probiotic against Crohn's disease [3]. Among the mechanisms suggested by which the *Bifidobacterium* strains may act against microbial pathogens, Bifidobacteria

is used as biotherapeutic agents. Pharmaceutical preparations of probiotic that contain Bifidobacteria and Lactobacilli are used as biotherapeutic agents. These pharmaceutical preparations have the advantage of providing a stable and reproducible preparation of bacteria, that correspond to the pharmacologically established dose-efficacy of Bifidobacteria [2]. The aim of this study is show the antagonism activity of some *Bifidobacterium* strains (*B. angulotum*, *B. bifidum* LMGD10645, *B. animalis* and *B. longum* ATCC 15707) against pathogenic bacteria such as *P. aeruginosa* and *E. faecalis*.

Materials and Methods

Sample collection

Two bacterial strains were used as indicators to evaluate the antibacterial activity of Bifidobacteria, involving; *P. aeruginosa* and *E. faecalis*, the antibacterial activity test was performed using the method described by Armanious AH [4], where, the strains were streaked on the appropriate agar medium for *Bifidobacterium* strains at Petri dish, cultures were incubated at 37 °C for 3 days. Linear growth of the tested bacteria was recorded. If clear zones of inhibition were present on the plates, it is considered a positive result. Untreated control plates were plated with pathogen plugs only. All plates were incubated on adequate growth temperature of the pathogenic bacteria [5].

Results and Discussion

Antibacterial activity

Bifidobacteria strains were screened for antibacterial activity against pathogens including *P. aeruginosa* and *E. faecalis*. According to their inhibitory effects on pathogens, *Bifidobacterium* strains were differentiated into three classes: strong inhibitor, weak inhibitor and with no significant inhibitory effect. The result showed that all of strains have inhibitory effect against *P. aeruginosa*, among them *B. angulotum* has strong inhibitory effect against *P. aeruginosa*, this result; none of the previous studies tried to study it, *B. bifidum* LMGD10645, have strong inhibitory effect against *P. aeruginosa*, and *B. animalis* and *B. longum* ATCC 15707 have weak inhibitor against *P. aeruginosa*. These results are agreement with Korshunov VM, et al. [6], Choi YJ and Shin HS [7], Verruck S and Prudencio ES [8], Bevilacqua L, et al. [1] But for *E. faecalis*, *B. angulotum*

*Address for correspondence: Ibtisam R. Mowafi, Department of Agriculture, Food Science and Dairy Technology, South Valley University, 83523 Qena, Egypt; E-mail: Ibtisam.mowafi@agr.svu.edu.eg

Copyright: © 2024 Mowafi IR, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Received: 30 December, 2023, Manuscript No. Jfim-23-124169; Editor Assigned: 02 January, 2024, PreQC No. P-124169; Reviewed: 13 January, 2024, QC No. Q-124169; Revised: 19 January, 2024, Manuscript No. R-124169; Published: 26 January, 2024, DOI: 10.37421/2572-4134.2024.10.313



Figure 1. *Bifidobacterium angulotum*.



Figure 4. *Bifidobacterium bifidum* and *Enterococcus faecalis*.

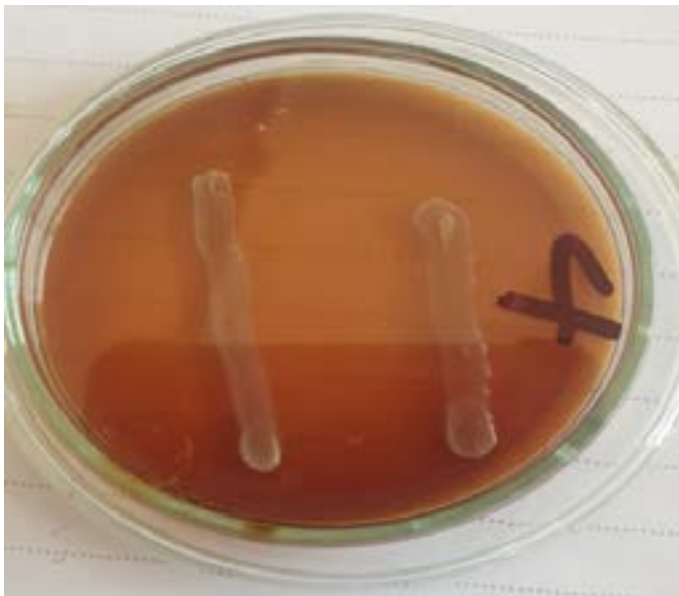


Figure 2. *Bifidobacterium bifidum*.



Figure 5. *Bifidobacterium bifidum* and *Enterococcus faecalis*.

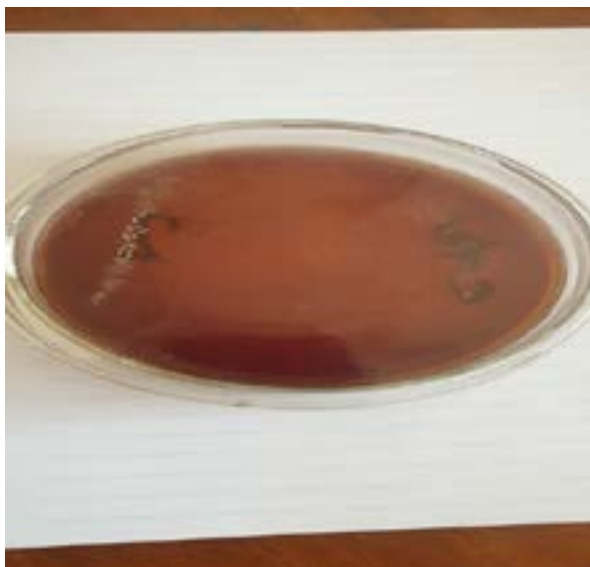


Figure 3. *Bifidobacterium angulotum* and *Enterococcus faecalis*.



Figure 6. *Bifidobacterium bifidum* and *Pseudomonas aeruginosa*.

has strong inhibitory effect against *E. faecalis*, *B. bifidum* LMGD10645 and *B. longum* ATCC 15707 have weak inhibitor against *E. faecalis* but *B. animalis* has no inhibitory effect against *E. faecalis*. These results are agreement with Korshunov VM, et al. [6], Choi YJ and Shin HS [7], Verruck S and Prudencio ES [8], Bevilacqua L, et al. [1]. This antibacterial activity exhibited by the strains towards pathogenic bacteria may be due to the production of antimicrobial molecules such as bacteriocins (or bacteriocins - like substances), H₂O₂, lactic, acetic and hydrochloric acids (organic acids), Servin AL [2] and Bevilacqua L, et al. [1]. And by production surfactants – like compounds, Bevilacqua L, et al. [1]. As illustrated in Figures from (1 to 6), where Figures 1 and 2 these showed the bifidobacteria alone without pathogenic bacteria, where the bacteria Figure 3 is *B. angulotum* but Figure 4 is *B. bifidum* LMGD10645. The Figures 3-5 are showed the antagonism between bifidobacteria against *E. faecalis*. Where Figure 6 is showed the antagonism between bifidobacteria against *P. aeruginosa* [9].

Conclusion

The inhibition activity exhibited by bifidobacteria as illustrated from results exhort that bifidobacteria could be employed as an effective control for nosocomial pathogenic bacteria, and reduce the risk of the devolvement of pathogenic bacteria (*P. aeruginosa* and *E. faecalis*).

Acknowledgement

None.

Conflict of Interest

None.

References

1. Bevilacqua, Lorella, Monia Ovidi, Elena Di Mattia and Luigi Daniele Trovatelli, et al. "Screening of Bifidobacterium strains isolated from human faeces for antagonistic activities against potentially bacterial pathogens." *Microbiol Res* 158 (2003): 179-185.
2. Servin, Alain L. "Antagonistic activities of lactobacilli and bifidobacteria against microbial pathogens." *FEMS Microbiol Rev* 28 (2004): 405-440.
3. Sarkar, Amrita and Santanu Mandal. "Bifidobacteria—Insight into clinical outcomes and mechanisms of its probiotic action." *Microbiol Res* 192 (2016): 159-171.
4. Armanious, Ayad Haleem. "Studies on some cotton diseases." B.Sc. Agric. Sci. El Minia University (1995).
5. Tagg, John R. and AR377313 McGiven. "Assay system for bacteriocins." *Appl Microbiol* 21 (1971): 943-943.
6. Korshunov, V. M., Z. A. Urtaeva, V. V. Smeianov and B. A. Efimov, et al. "The antagonistic activity of bifidobacteria *in vitro* and *in vivo* studied by using gnotobiological technology." *Zh Mikrobiol Epidemiol* 5 (1999): 72-77.
7. Choi, Yae Jin and Hea Soon Shin. "Antibacterial effect of eight probiotic strains of bifidobacterium against pathogenic *Staphylococcus aureus* and *Pseudomonas aeruginosa*." *J Bacteriol Virol* 51 (2021): 128-137.
8. Verruck, S. and E. S. Prudencio. "Survival of *Bifidobacterium* ssp. during gastrointestinal passage and their mechanism of action for pathogenic bacteria inhibition in the gut: A concise review." *Food Biol* (2019): 01-06.
9. Alkalbani, Nadia S., Tareq M. Osaili, Anas A. Al-Nabulsi and Amin N. Olaimat, et al. "Assessment of yeasts as potential probiotics: A review of gastrointestinal tract conditions and investigation methods." *J Fungi* 8 (2022): 365.

How to cite this article: Mowafi, Ibtesam R. and Rafat Khalaphallah. "Antagonistic Activity of Bifidobacteria Against Microbial Pathogens." *J Food Ind Microbiol* 10 (2024): 313.