In-Vitro Evaluation of Cholesterol Assimilation by Yeasts Isolated from Traditional Idly Batter and Commercial Baker's Yeast

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ABSTRACT
The assimilation of cholesterol by microorganisms has gained significant interest as a safe way to control dietary cholesterol levels. Fermented foods are good sources of beneficial microorganisms that may have a significant role to play in this respect. This study was conducted to evaluate the assimilation potential of yeast isolated from fermented idly batter and compare it with that of commercial baker's yeast variety of *Saccharomyces cerevisiae* . Yeast strains were isolated by using microbiological methods, and the tests were carried out under lab conditions. The egg yolk was utilized as a medium for the experiment, as it is rich in cholesterol, simulating the presence of dietary cholesterol.
The decrease in the amount of cholesterol content after incubation was studied to check the ability of the yeast strains to absorb the cholesterol content. Though there was a variation in the efficiency of the yeast strains, it was found that the yeast used in Idlies and the yeast used in bakeries could absorb the cholesterol content.
Keywords:
Cholesterol assimilation; Yeast; Fermented food; Idly batter; Saccharomyces cerevisiae; Probiotic potential; Egg yolk medium; Microbial cholesterol reduction.

I. INTRODUCTION

Even though it is vital for the composition and metabolism of the cell, high levels of blood cholesterol have a close relationship with cardiovascular diseases, which remain one of the major reasons for morbidity and mortality in the world [1]. As hypercholesterolemia is a result of a combination of genetic, dietary, and lifestyle factors, it remains a major concern for controlling levels of cholesterol. There is a growing interest in the use of alternative and biologically based approaches for lowering levels of cholesterol, as pharmacological agents like statins have a tendency for long-term use, which has shown some adverse effects [2]. Because of their ability to interact with cholesterol in vitro, microorganisms have found a place in this setting. Because of their metabolic flexibility and ability to absorb cholesterol through biological processes such attaching to the cell surface, integrating into the cell membrane, and enzymatic metabolism, yeasts stand out among all of these [3]. Yeasts have become a viable option for research on functional foods and microorganisms that lower cholesterol because of the following traits: Yeast bacteria with distinct physiological and metabolic characteristics are among the diverse microbial flora that can be found in traditional meals [4]. The texture, taste, and nutritional composition of idly batter, which is a fermented food product, have an important correlation with the complex consortia of bacteria responsible for the natural fermentation process [5]. The functional characteristics and significance of lactic acid bacteria in fermented foods have been extensively studied, while yeast and its functional characteristics have not yet been extensively researched. Among the yeast species that have been studied and utilized considerably by the food and fermentation industry is Baker's yeast *Saccharomyces cerevisiae.* As a reference microorganism for the study of cholesterol metabolism, yeast has been proved in numerous studies that it has the capability to absorb cholesterol [6]. Regarding these, the species, metabolic, and safety characteristics of the yeasts derived from conventional fermented foods may change, which could affect the capacity for cholesterol absorption. Thus, the goal of this paper is to examine, assess, and contrast the ability of yeasts derived from commercial baker's yeast and traditional idly batter to assimilate cholesterol.

The study focuses on how non-commercial and potentially harmful yeast strains absorb cholesterol through experimental methods, processes, and safety considerations.

II. YEASTS IN TRADITIONAL FOODS

Traditional foods are fermented by yeasts, which not only give them taste, texture, and scent but also improve their health by absorbing cholesterol. Some naturally fermented foods, like tempeh, idly, dosa, and sourdough, are fermented using local yeast in several nations [1, 2]. Lactic acid bacteria and yeasts, which are primarily obtained from grains, pulses, and the environment, live in a complex microbial community that primarily takes part in fermentation [3]. Research has mostly shown that the metabolic activities of the yeasts isolated from traditional fermented foods differ greatly from those of commercial strains of yeast. One type of yeast that is frequently used as baking yeast is *Saccharomyces cerevisiae*. However, the naturally fermented batters typically contain non-Saccharomyces species like *Candida*, *Trichosporon* and *Pichia*. These are the native yeast strains that lower cholesterol levels in addition to improving the quality of fermented foods. The ingredients, time, temperature, and sanitary conditions that influence the bacteria' heterogeneity are the primary causes of these variations in fermented foods. Consequently, distinct strains of yeast are present in the geographical distribution of the fermented foods. Therefore, the separation of yeast strains from conventional fermented foods enables the study of novel yeast strains that have the potential to improve consumer health by lowering cholesterol.

III. CHOLESTEROL ASSIMILATION BY YEAST

Cholesterol assimilation by yeasts has been recognized as a promising strategy for the biological reduction of cholesterol in foods and in vitro systems. Some of the yeast strains are capable of incorporating cholesterol into their cell membranes or metabolizing it during growth, resulting in lowering its availability in the medium [1,2]. *Saccharomyces cerevisiae* is the prevalent yeast used in baker's yeast that has been extensively studied for cholesterol-lowering potential, whereas non-Saccharomyces yeasts, namely Candida tropicalis, *Candida krusei*, and *Trichosporon asahii*, have exhibited considerable cholesterol assimilation abilities in laboratory conditions [3,4].

These mechanisms of cholesterol removal by yeasts involve physical adsorption on the yeast cell surface and enzymatic degradation of cholesterol, depending on the potential of different species and environmental conditions [5]. The parameters that affect cholesterol assimilation by yeasts include yeast origin, composition of growth medium, incubation time, and pH [6]. However, it is worth noting that in traditional fermented foods, yeasts are able to form natural interactions with cholesterol during fermentation, which suggests potential functionality aside from leavening and flavouring [7]. The evaluation of cholesterol assimilation by yeasts in vitro is a standardized approach for assessing cholesterol assimilation by different yeast strains, including yeasts of traditional fermented foods and baker's yeast [8, 9]. There are some studies that offer information on selecting yeast strains for cholesterol management in functional foods, which is a link between traditional fermentation and modern nutritional science.

IV. COMPARATIVE CHOLESTEROL ASSIMILATION BY TRADITIONAL AND COMMERCIAL YEAST

Evaluation of the assimilation of cholesterol for the traditional sources of yeasts, such as idly batter and baker's yeast, would provide useful insights into the potential. Earlier studies have shown that though Saccharomyces cerevisiae, the baker's yeast, has the ability to assimilate cholesterol, the indigenous yeasts such as *Candida tropicalis*, *Candida krusei*, and *Trichosporon asahii* have similar, if not better, cholesterol-lowering potential [1, 2]. The variation found in the assimilation of cholesterol can be due to the metabolic activities, cell wall composition, and growth pattern of the different species [3].

In order to properly interact with the cholesterol present in the medium, the traditional fermented yeasts have developed certain adaptive features, which are the result of extensive adaptation to natural fermentation conditions [4, 5]. On the contrary, commercial yeasts are mostly bred for their rapid rate of fermentation and leavening properties.

To measure the reduction in a specific period, standardized in vitro models using cholesterol-rich medium are commonly employed in experimental comparisons. The results of these experiments indicate that both commercial and conventional yeasts can cause a reduction in cholesterol concentration, although the extent of reduction depends on the type of yeast, the volume of inoculum, and the incubation conditions [7, 8].

These findings suggest the potential for conventional fermented food yeasts as a source for strains, especially in reducing cholesterol.

V. MECHANISMS OF CHOLESTEROL REMOVAL BY YEAST

In vitro, yeasts eliminate cholesterol through a number of interrelated biological processes. The physical adsorption of cholesterol molecules onto the yeast surface is one of the primary ways that yeast eliminates cholesterol. It has previously been determined that the chitin, mannoproteins, and β-glucans that make up the yeast cell wall act as binding sites for the interaction of the cholesterol molecules [5,6]. Therefore, another important activity that takes place during the active growth of yeast is the assimilation and integration of cholesterol. As a result, the cholesterol in the cell membrane is assimilated by the production of sterols in the yeast cell membrane during growth, which reduces the quantity of free cholesterol in the medium. When the yeast is in the logarithmic development phase, this assimilation of cholesterol in the cell membrane is more noticeable. In addition to the assimilation of cholesterol through adsorption, certain species of yeast have the ability to enzymatically assimilate the cholesterol in the medium to intermediate products through an oxidizing or reducing action, though this assimilation of cholesterol is restricted to the yeast cell membrane.

It is hypothesized that the assimilation of cholesterol in the cell membrane of yeast is affected by the metabolic potential of various species of yeast.

Nevertheless, the enzymatic assimilation of cholesterol in various species of yeast has not been extensively studied. Environmental factors like pH values, incubation periods, oxygen levels, and nutrient content have a bearing on these mechanisms. In conclusion, it can be said that the assimilation of cholesterol does not take place with the intervention of a single mechanism but with a series of physical, biochemical, and physiological changes.

VI. FACTORS AFFECTING CHOLESTEROL ASSIMILATION BY YEAST

The capacity of yeasts for assimilating cholesterol is a complex process that is influenced by a number of factors. These factors affect the metabolic activity of the yeasts and their capacity for assimilating cholesterol in the medium. The yeast strain and species, composition of cell walls, growth phase of yeasts, and size of inoculate are some of the key parameters that affect the capacity of yeast cells for adsorbing cholesterol [1,2]. The pH of the medium, temperature, oxygen content, and nutrition content are some of the key environmental factors that affect the capacity of yeasts for assimilating cholesterol. For example, at optimal levels of pH and nutritional content of the medium, it is found that the capacity of yeasts for absorbing cholesterol is higher. However, the viability of yeasts is reduced under such conditions of stress [3,4]. However, the co-fermentation method using lactic acid bacteria shows that the presence of other microorganisms can either increase or decrease the assimilation of cholesterol through a competitive action [5]. It's interesting to note that both the starting cholesterol level and the incubation period affect the elimination capability; longer incubation times allow yeasts to digest cholesterol more effectively [6,7]. Knowing all of these elements will help you choose strains that consistently lower cholesterol and optimize yeast-based systems for the creation of functional foods. This information combines modern applications for specialized health benefits, such cholesterol control, with old methods of using fermented systems. [8, 9].

VII. SAFETY CONSIDERATIONS OF INDIGENOUS YEAST STRAINS

Despite the fact that various native yeast strains, especially those from traditional fermented foods, have shown good cholesterol assimilation ability, it is of prime importance to test their safety before their application in food products. For example, in certain clinical conditions, various non-Saccharomyces yeast, especially Candida spp., have been observed to act as opportunistic pathogenic pathogens [3, 9]. It is of prime importance to identify the strain to negate the possibility of harmful microorganisms, even though their presence in fermented foods is considered to be safe in healthy individuals. Species identification and differentiation between pathogenic and non-pathogenic strains can be carried out through molecular characterization techniques such as PCR for ITS or 18S rRNA regions [4].For the confirmation of the product for functional food purposes, evaluation of virulence factors, biofilm forming ability, hemolytic characteristics, and antifungal resistance profile may be necessary. Due to regulatory acceptance, Saccharomyces cerevisiae, a commercial strain, has a proven safety record for use in the food and beverage industries [4]. However, the indigenous strains recently isolated must undergo stringent testing before they

can be commercialized. In addition to ensuring the safety of the customers, safety validation also makes the cholesterol assimilating functional meals more acceptable to the regulatory authorities. Future research should include safety validation besides the functional validation.

VIII. APPLICATIONS OF CHOLESTEROL-ASSIMILATING YEASTS IN FUNCTIONAL FOODS

The yeasts that are able to assimilate cholesterol possess potential applications in the preparation of function foods that are directed toward improving cardiovascular health. The application of such yeasts in fermented foods like idly, dosa, bread, yogurt, and cereal/legume-based foods could possibly reduce the cholesterol content of foods while retaining desirable sensory properties [1, 2].

The application of traditional and commercial yeast strains has also been examined for this potential application. The application of indigenous yeasts from fermented foods could possibly provide additional benefits, such as unique flavour profiles and probiotic properties, and natural fermentation processes [3, 4].Commercial strains of *Saccharomyces cerevisae*, which have been used mainly for leavening, have been found to be useful for the reduction of cholesterol when properly employed in the formulation of functional foods [5].Optimization of the process conditions of the process of fermentation, including the size of the inoculum, time of incubation, and the medium, is essential in the maximization of the rate of assimilation of cholesterol without compromising the quality of the final product [6]. In addition, the use of a blend of cholesterol-assimilating yeasts and lactic acid bacteria will improve the functional properties of the final product [7]. The use of the mentioned strains will satisfy the requirement for natural, low-cholesterol, and healthy foodstuffs, as it is based on traditional knowledge and nutritional science [8, 9]. Continued research in the area will open up more avenues in the functional food industry.

IX. CONCLUSION

It has been observed that strains of yeast from traditional sources of fermented foods and commercial sources have shown a large potential for assimilating cholesterol, thus re-emphasizing the importance of these microorganisms as health promoters. Yeast strains of idly batter, such as *Candida tropicalis*, *Candida krusei* and *Trichosporon asahii* have been observed to consistently exhibit special metabolic capabilities, which are better and more effective than those of commonly used commercial strains of *Saccharomyces cerevisiae* for reducing cholesterol levels in vitro [1, 2].

The capacity for the assimilation of cholesterol by the yeasts depends on the factors of the species of the yeast, growth conditions, the medium, and the parameters of the fermentation process. By analysing these factors, it is possible to optimize the system without compromising the quality of the food product. Up taking cholesterol-assimilating yeasts into traditional and modern food products presents a promising strategy for natural cholesterol management. This approach links the past practice in old-age fermentation with the current emphasis on health food innovations, with the potential benefits of cardiovascular and nutritional aspects in mind [5, 6].

Future research on strain characterization, safety assessment, and industrial applications will add to the potential of using these yeasts in the development of low-cholesterol functional foods.

X. REFERENCES

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