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Awareness and Consumption Patterns of Probiotic Foods Among School Children Aged 10–13 Years

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Abstract: ***This study assessed awareness and consumption patterns of probiotic foods among school children aged 10–13 years and evaluated factors influencing intake and the impact of nutrition education. A cross-sectional study was conducted among 375 school girls from two schools in Chennai. Data were collected using a structured questionnaire, food frequency questionnaire, and 3-day dietary recall. Knowledge, attitude, and practice (KAP) scores were assessed and analyzed statistically. Most participants (56.3%) had poor knowledge of probiotics, while only 13.1% had good knowledge. Traditional probiotic foods such as curd and idli/dosa were commonly consumed, whereas commercial probiotic product consumption was low. Significant positive correlations were observed between knowledge, attitude, and practice scores. Attitude showed the strongest association with influencing factors. Knowledge regarding probiotics was inadequate despite regular consumption of traditional probiotic foods. Nutrition education and supportive environments may improve awareness and promote appropriate probiotic consumption among school children.***

Keywords: Adolescents; Awareness; Dietary practices; Knowledge; Nutrition education; Probiotics; School children.

I. INTRODUCTION

Adolescence represents the transitional phase from childhood to adulthood, typically coinciding with the onset of puberty and concluding with the attainment of legal independence from parents or guardians, referred to as 'adulthood' [10]. This stage is pivotal in life, marked by significant biological, psychological, emotional, and social development. The swift rate of physical and cognitive growth during adolescence is surpassed only by that of infancy, categorizing this period as the second 'developmental phase' [11]. The categorization of adolescent phase can differ, with the United Nations defining it as the life stage between the ages of 10 and 19, while the World Health Organization extends this definition to include individuals aged 10 to 24 years [17]. To safeguard the human body against specific infections and diseases, the immune system is essential. A nutritious well-balanced diet can bolster immune function by supplying vital nutrients and minimizing inflammation [13]. A significant factor that contributes to intestinal health is the necessity of a nutritious and balanced diet, which fosters regular bowel movements. Probiotics play a vital role in sustaining intestinal health [12]. Probiotics, conversely, when consumed in larger quantities, provide numerous health benefits to the host. They enhance digestion, strengthen immune function, sustain a proper balance of gut bacteria, and may also offer further beneficial effects on overall health. A diet rich in probiotics consists of fermented foods that inherently contain live beneficial bacteria. Examples of-rich foods include kefir, yoghurt, sauerkraut, tempeh, kimchi, and certain varieties of cheese [15] [19]. Despite the broad availability of traditional foods rich in probiotics, such as yoghurt, buttermilk, and other fermented foods, children's knowledge and consumption remain poor. Previously done research has primarily targeted adults, mothers, or clinical populations, creating a significant gap in the understanding of probiotic awareness and consumption patterns among early adolescence. This research provides empirical data on the knowledge, attitudes, and consumption practices regarding probiotic rich foods. Research indicates that girls are more likely than boys to have gastrointestinal distress, irregular bowel movements and nutritional deficiencies. These conditions are linked to hormonal changes, a higher tendency for restricted eating, and a lower intake of foods rich in fiber. Evaluating probiotic consumption and awareness may be especially important for this population because probiotics may improve immunological and digestive health. Enhancing their knowledge of functional foods at a young age may have an impact on both their future family dietary habits and personal health.

II. REVIEW OF LITERATURE

A. Definition of probiotics

The FAO/WHO definition, "live microorganisms which, when administered in adequate amounts, confer a health benefit on the host," has been broadly adopted by global regulatory and scientific organizations [9]. The U.S. Food and Drug Administration (FDA) similarly advises that foods containing probiotics should provide at least 10^6 CFU/mL. The viable number of added probiotic organisms in food shall be ≥108 CFU in the recommended serving size per day [7].

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B. Probiotic Foods Commonly Consumed in India

A diverse range of traditional fermented foods is enjoyed throughout various regions of India. In South India, commonly consumed probiotic-rich foods include idli, dosa, koozhu, ambali, kallappam, mor kuzhambu, and dahi. In the northern regions, fermented food favorites consist of dhokla, bhatura, kadhi, and kanji [16]. The northeastern states are particularly famous for their rich fermented food traditions, featuring items like sauerkraut, khalpi, kinema, tungrymbai, chhurpi, and gundruk, many of which have demonstrated probiotic advantages [3] [16]. These foods are prepared by fermenting various substrates, including pulses, vegetables, meat, fish, and milk from cows or yaks.

C. Mechanism of Action of Probiotics

Probiotics have an effect on pathogenic bacteria through a variety of methods, including antimicrobial production, competitive adherence to epithelium and mucosa, fortification of the intestinal epithelial barrier, and immune system regulatory effects [1]. Figure 1 depicts the major methods of action for probiotics.

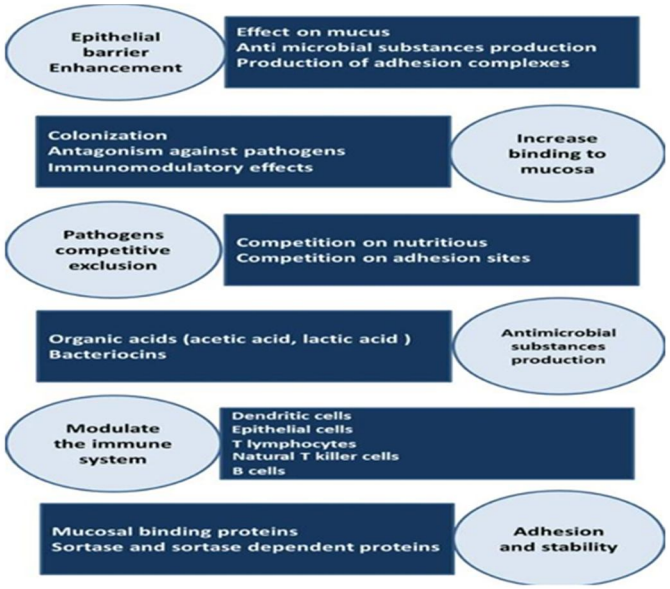


Fig.1 Major mechanisms of action for probiotics

D. Therapeutic Benefits of Probiotics

Probiotics have a vital role in managing microbial dysbiosis that leads to gut-associated microbiome disorders. A lack of good bacteria in the stomach has been connected to intestinal disorders such as celiac disease and irritable bowel syndrome (IBS). Beneficial probiotics in the gastrointestinal system restrict pathogenic microbes by competing for space and resources, so stopping them from entering and reproducing [2]. Clinical trials have been carried out to assess the therapeutic efficacy of probiotics in managing various conditions, such as antibiotic-associated Clostridium difficile diarrhea, irritable bowel syndrome, inflammatory bowel diseases, Helicobacter pylori infection, and allergic disorders [5].

E. Health Implications of Inadequate Intake of Probiotic Foods

Dysbiosis and inflammation of the gut have been linked to causing several mental illnesses including anxiety and depression, which are prevalent in society today. Probiotics have the ability to restore normal microbial balance, and therefore have a potential role in the treatment and prevention of anxiety and depression [4].

F. Consumption Patterns and Influencing Factors Affecting Intake of Probiotic Foods Among Children

While there are a few well-known probiotic foods, traditional fermented items are largely absent from the diets of most Indians today [18]. A population-based survey conducted in several nations similarly found that sociodemographic variables, such as education, income, personal habits, and geographical location, were associated with specific trends in the consumption of dairy and possibly fermented or dairy-derived products [8].

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G. Need to create awareness of probiotic foods among children

Nurturing healthy eating habits in primary school-aged children is essential for their overall well-being and growth. Schools can significantly contribute to teaching and encouraging healthy eating practices among students [6]. This objective can be met by equipping them with essential knowledge about nutrition, encouraging healthy snacking practices, and transforming their general perspectives on healthy eating habits [14].

III. METHODOLOGY

The present study was conducted to assess the awareness and consumption patterns of probiotic foods among school children aged 10–13 years and to identify factors influencing their intake. The study also aimed to evaluate the effect of a nutrition education programme on participants' knowledge regarding probiotic foods. A descriptive cross-sectional research design was adopted for the study. A total of 375 school girls aged 10–13 years were selected from two schools in Chennai using purposive sampling. Participants who were willing to participate and whose parents provided consent were included in the study. A structured questionnaire was used to gather information about socio-demographic details, knowledge, attitudes, consumption habits, and factors affecting the intake of probiotic foods. A Food Frequency Questionnaire (FFQ) was used to assess the frequency of consumption of probiotic foods, and a three-day dietary recall was administered to obtain information on dietary intake. Following the baseline assessment, a nutrition education programme was conducted using appropriate teaching methods and educational materials. The programme focused on the concept of probiotics, their food sources, health benefits, and the importance of including probiotic foods in the daily diet. After the intervention, participants were reassessed using the same questionnaire to determine changes in knowledge and awareness. The collected data were coded, tabulated, and analyzed using suitable statistical methods. Frequency, percentage, mean, and standard deviation were used to describe the data, while correlation analysis was performed to examine the relationship between knowledge, attitude, practice, and influencing factors. The findings of the study were expected to provide valuable information on the awareness and consumption of probiotic foods among school children and contribute to the development of nutrition education strategies for promoting healthy dietary practices.

IV. RESULTS AND DISCUSSION

The tables are organized according to the Knowledge, Attitudes, Practice (KAP) framework, followed by the barriers and influencing factors.

A. General Information of the Participants

Table I shows that most participants were 12 years old (32.3%), followed by 13 years (26.7%), indicating that the majority were in the later stage of early adolescence. Most girls were studying in Class VII (29.3%) and Class VIII (26.7%). The majority were non-vegetarians (73.1%), while 26.9% were vegetarians. Regarding socio-economic status, most participants belonged to the Lower Middle class (40%), followed by Upper Lower (31.2%) and Upper Middle (25.6%) categories. These characteristics provide important context for understanding probiotic awareness and consumption patterns among the study population.

TABLE I
Distribution Of Participants Based On Age, Class, Diet Pattern And Socio-Economic Status

Characteristics		Frequency (n)	Percentage (%)
Age (years) n=375	10	87	23.2
	11	67	17.9
	12	121	32.3
	13	100	26.7
Class in grade n=375	V	82	21.9
	VI	83	22. 1
	VII	110	29.3
	VIII	100	26.7
Diet pattern n=375	Vegetarian	101	26.9
	Non-vegetarian	274	73. 1

Socio-economic status n=375 SES assessed using Modified Kuppuswamy Scale (2025).	Lower	7	1.9
	Lower Middle	150	40.0
	Upper	5	1.3
	Upper Lower	117	31.2
	Upper Middle	96	25.6

B. Awareness and Knowledge Regarding Probiotic Foods

Table II shows that more than half of the participants (56.3%) had poor knowledge of probiotics, while 30.7% demonstrated moderate knowledge. Only 13.1% of the participants had good knowledge scores. These findings indicate that awareness and understanding of probiotics were generally low among the study population, highlighting the need for nutrition education to improve knowledge regarding probiotic foods and their health benefits.

TABLE II
Distribution Of Participants Based On Knowledge Level

Knowledge level	n=375		
	Score range	Frequency (n)	Percentage (%)
Good knowledge	≥ 75% (8–10 marks)	49	13.1
Moderate knowledge	50–74% (5–7 marks)	115	30.7
Poor knowledge	< 50% (0–4 marks)	211	56.3
Total		375	100.0

C. Attitude Towards Probiotic Foods

Table III shows the distribution of participants according to their attitude towards probiotic foods. A positive attitude was observed among 42.4% of participants, while 41.6% exhibited a neutral or moderately positive attitude. Only 16.0% of the participants demonstrated a negative attitude towards probiotic foods. The findings indicate that the majority of participants had either a positive or moderately positive attitude towards probiotic foods, with relatively few showing a negative attitude.

TABLE III
Distribution Of Participants According To Attitude Towards Probiotic Foods

Attitude level	n=375		
	Score range	Frequency (n)	Percentage (%)
Positive attitude	≥75% (15–20 marks)	159	42.4
Neutral / moderately positive attitude	50–74% (10–14 marks)	156	41.6
Negative attitude	<50% (0–9 marks)	60	16.0
Total		375	100.0

D. Probiotic Food consumption Pattern of Participants

Table IV shows the consumption pattern of various probiotic foods among the participants. Idli and dosa had the highest daily consumption (81.1%), followed by curd, which was most commonly consumed on a weekly basis (45.3%). Buttermilk and fermented rice/koozh were consumed regularly by a proportion of participants, whereas yoghurt, cheese, and lassi were consumed mainly on a weekly or monthly basis. Commercial probiotic products had the lowest consumption, with more than half of the participants (55.5%) reporting that they never consumed them. Overall, traditional probiotic foods were consumed more frequently than commercial probiotic products.

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TABLE IV
Frequency Of Consumption Of Probiotic Foods Among The Study Participants Aged 10-13 Years

Probiotic Food	Daily (%)	Weekly (%)	Monthly (%)	Rarely (%)	Never (%)
Curd	21.1	45.3	15.7	10.9	6.9
Yoghurt	4.8	17.3	31.5	26.9	19.5
Cheese	4.8	22.4	38.7	26.9	7.2
Buttermilk	13.9	28.3	21.1	26.9	9.9
Fermented rice / Koozh	14.4	20.5	22.9	26.9	15.2
Lassi	7.5	24.5	34.7	18.7	14.7
Idli / Dosa	81.1	12.5	4.0	1.9	0.5
Commercial probiotics	2.7	4.8	12.3	24.8	55.5

E. Influencing Factors and Barriers Affecting Consumption of Probiotic Foods

Table V shows that the majority of participants (54.4%) had moderate facilitators for probiotic consumption, while 25.9% exhibited strong facilitators. In contrast, 19.7% of participants were categorized as having poor facilitators or barriers. Facilitators may include factors such as family encouragement, availability of probiotic foods, affordability, awareness of health benefits, and personal preference for these foods. Barriers may include limited awareness, lack of availability, higher cost, taste preferences, and inadequate family or social support. Overall, most participants experienced moderate to strong supportive factors for probiotic consumption, whereas a smaller proportion faced barriers.

TABLE V
Distribution Of Participants Based On Influence Level

Influence level	N=375		
	Score range	Frequency(n)	Percentage (%)
Strong facilitators present	≥75% (15–20 marks)	97	25.9
Moderate facilitators present	50–74% (10–14 marks)	204	54.4
Poor facilitators / presence of barriers	<50% (0–9 marks)	74	19.7
Total		375	100.0

F. Significant Associations and Correlations of the Study

From the tableVI**,** the correlations were statistically significant at $p < 0.01$, indicating meaningful relationships among the variables. Knowledge showed a moderate positive correlation with attitude ($r = 0.344$) and practice ($r = 0.334$), suggesting that higher knowledge is associated with more favourable attitudes and better consumption behaviours. It also had a weaker but significant correlation with influence ($r = 0.210$).

Attitude demonstrated a moderate positive correlation with practice ($r = 0.383$) and the strongest correlation with influence ($r = 0.442$), indicating that social and motivational factors are closely linked with attitudes.

Practice was also positively correlated with influence ($r = 0.307$), suggesting that stronger facilitating factors are associated with improved probiotic consumption behaviour.

TABLE VI
Correlation Between Knowledge, Attitude, Practice And Influence Scores

Variable	Knowledge	Attitude	Practice	Influence
Knowledge	1	0.344**	0.334**	0.210**
Attitude	0.344**	1	0.383**	0.442**
Practice	0.334**	0.383**	1	0.307**
Influence	0.210**	0.442**	0.307**	1

V. CONCLUSION

The present study indicates that probiotic foods play an important role in maintaining gut health; however, awareness and understanding of these foods among school children are not fully adequate. Although commonly consumed foods such as curd and buttermilk are included in the daily diet, their consumption is not always based on proper knowledge of their benefits and appropriate intake. The findings show that while awareness of probiotic foods exists, gaps remain in their practical application, particularly in terms of correct usage and regular consumption. Factors such as availability, affordability, and existing dietary habits influence the inclusion of probiotic foods in the diet.

In conclusion, the study highlights the need to improve knowledge and awareness regarding probiotic foods to ensure their effective utilization. Addressing these gaps can help promote better dietary practices and support overall health among school children.

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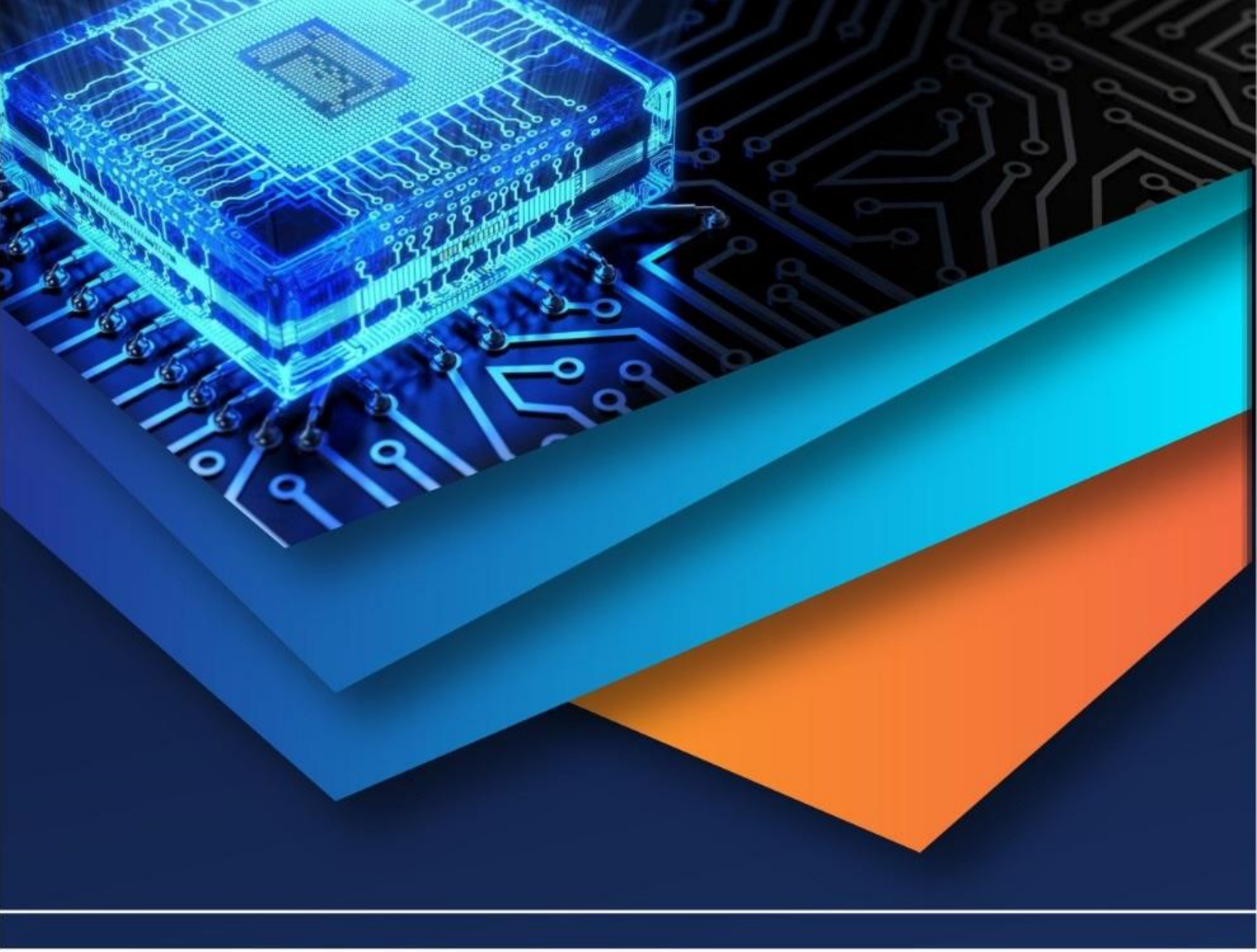
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