Health Dynamics
eISSN: 3006-5518
Publisher: Knowledge Dynamics
DOI: https://doi.org/10.33846/hd20802

*Original Research*

# Synbiotic Characteristics of Soy Milk Curd for the Prevention of Pathological Fluor Albus in Female Adolescents

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**Article history**
Received: 26 June 2025
Revised: 4 August 2025
Accepted: 15 August 2025
Published Online: 31 August 2025

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**How to cite this article:** Safitri R, Alfitri R, Keswara NW. Synbiotic Characteristics of Soy Milk Curd for the Prevention of Pathological Fluor Albus in Female Adolescents. Health Dynamics, 2025, 2(8), 333-340. https://doi.org/10.33846/hd20802



**ABSTRACT**

**Background:** Pathological vaginal discharge (fluor albus) remains a common gynecological issue among adolescent females, often resulting from disrupted vaginal microbiota. Synbiotic interventions, combining probiotics and prebiotics, offer potential for restoring microbial balance. This original research aimed to examine the association between synbiotic soy milk curd consumption and the incidence of fluor albus in adolescent girls, while also exploring the roles of personal hygiene behavior and knowledge levels. **Methods:** A cross-sectional study was conducted involving 68 female students aged 13–18 years in East Java, Indonesia. Data were collected through structured questionnaires and observation checklists, and were analyzed using chi-square and logistic regression tests. **Results:** The results revealed a significant inverse relationship between synbiotic soy milk curd consumption and fluor albus incidence ($p = 0.012$). Additionally, personal hygiene knowledge was significantly correlated with hygiene practices ($p = 0.004$). Multivariate analysis indicated that low hygiene behavior and lack of synbiotic intake were predictive factors for higher fluor albus incidence. These findings suggest that integrating synbiotic dietary interventions with hygiene education may effectively reduce the risk of fluor albus among adolescents. **Conclusions:** This study contributes novel insights by demonstrating the preventive potential of fermented soy-based synbiotics in a school-based public health context. Future interventions should adopt a multifactorial approach targeting both behavior and nutrition.

**Keywords:** Adolescent; leukorrhea; menstrual hygiene products; probiotics; synbiotics; fluor albus

## 1. INTRODUCTION

The prevalence of pathological vaginal discharge, commonly known as fluor albus, among adolescent girls represents a significant public health concern. This condition, frequently characterized by abnormal vaginal secretions accompanied by itching or an unpleasant odor, is often indicative of underlying infections or imbalances in the vaginal microbiota. Adolescents are particularly vulnerable to fluor albus due to biological immaturity, limited access to reproductive health education, and suboptimal hygiene behaviors.[1] Recent studies have shown that up to 50% of teenage girls in developing regions experience recurrent episodes of fluor albus, with significant implications for their reproductive health and psychological well-being.[2,3]

The vaginal microbiota plays a crucial role in maintaining the health of the female reproductive tract. A balanced microbiota, dominated by beneficial Lactobacillus species, helps maintain acidic pH levels and produces bacteriocins

that suppress pathogenic organisms.[4,5] However, factors such as poor personal hygiene, antibiotic use, hormonal fluctuations, and dietary patterns can disrupt this balance, resulting in conditions such as bacterial vaginosis and fluor albus.[6,7] Adolescents, due to inconsistent hygiene practices and dietary habits, are especially susceptible to these microbial imbalances. Emerging evidence indicates that dietary interventions, particularly those incorporating synbiotics, may provide a promising strategy for restoring microbiota equilibrium and preventing pathological discharge.[8,9]

The core issue addressed in this study revolves around the high prevalence of fluor albus among adolescent girls and the limited effectiveness of conventional hygiene education programs in mitigating this health concern. While educational efforts have improved knowledge about reproductive hygiene, behavioral adherence remains inconsistent.[10] Therefore, there is a growing need for innovative, practical, and acceptable preventive strategies that can be implemented at the community level. One such approach is the use of synbiotic-rich fermented soy milk curd, a functional food product containing both probiotics and prebiotics that support gut and vaginal microbiome health.[11,12]

Synbiotics, defined as synergistic combinations of probiotics and prebiotics, have shown promise in promoting vaginal health by enhancing the growth of beneficial bacteria and suppressing pathogens.[13,14] Probiotics such as Lactobacillus acidophilus and Bifidobacterium species can colonize the vaginal epithelium, reduce vaginal pH, and compete with harmful microbes for adhesion sites.[5] Prebiotics, typically non-digestible oligosaccharides, serve as selective substrates for these probiotics, further enhancing their efficacy. Synbiotic products derived from fermented soy, including soy milk curds, offer an affordable and culturally acceptable intervention, particularly in Asian communities where soy consumption is prevalent.[8]

Several studies have highlighted the potential of synbiotic interventions in improving reproductive health outcomes. For instance, Bhatia et al. (2025) demonstrated that young women who consumed soy-based synbiotic products exhibited improved vaginal microbial profiles and reduced symptoms of discharge.[9] Similarly, Noormohammadi et al. (2022) reported a significant inverse relationship between healthy dietary patterns rich in fermented foods and the incidence of bacterial vaginosis.[15] These findings suggest that dietary synbiotics could serve as a preventive tool against fluor albus, particularly in adolescent populations.

This study focuses on evaluating the relationship between synbiotic consumption through soy milk curd and the incidence of fluor albus among adolescent girls, while also examining the mediating effects of personal hygiene behaviors and knowledge levels. By integrating a nutritional intervention with behavioral assessments, this research aims to provide a holistic understanding of fluor albus prevention. The study is conducted in a community setting, enhancing the generalizability of its findings and the potential for real-world application.

A critical novelty of this research lies in its original approach—examining fermented soy milk curd not merely as a dietary supplement but as a targeted synbiotic intervention for adolescent reproductive health. Unlike previous studies that focused predominantly on adult women or on pharmaceutical probiotic supplements, this research emphasizes a food-based, culturally appropriate strategy tailored for adolescents. The incorporation of personal hygiene knowledge and behavior variables further distinguishes this study, offering insights into the synergistic effects of nutritional and educational components on health outcomes.

In summary, the increasing burden of fluor albus among adolescents necessitates multifaceted interventions that address both biological and behavioral determinants. This study proposes synbiotic-rich fermented soy milk curd as a practical, scalable, and health-promoting solution. The research builds on recent scientific advancements in microbiota science and functional nutrition, while grounding its approach in public health principles of accessibility and community engagement. By doing so, it contributes to the growing body of evidence supporting integrative strategies for adolescent reproductive health and paves the way for future interventions that bridge dietary practices with microbiome modulation.

## 2. METHODS

### *2.1 Study Design and Setting*

This study employed a quantitative observational analytical design using a cross-sectional approach. The research was conducted between March and April 2025 at an Islamic boarding school located in Malang Regency, East Java, Indonesia. The study sought to explore the association between the consumption of synbiotic soy

milk curd and the incidence of pathological fluor albus in adolescent girls.

### *2.2 Population and Sampling*

The target population consisted of female adolescents aged 14 to 18 years who were enrolled at the boarding school and had previously experienced symptoms of fluor albus. The inclusion criteria were: (1) female students aged 14–18 years, (2) having previously experienced vaginal discharge, and (3) being willing to participate in the study. Exclusion criteria included: (1) female students who had not yet experienced menarche and (2) those with known gynecological conditions unrelated to fluor albus. A total of 218 students were initially identified, and 181 were recruited through stratified random sampling. Stratification was based on grade level to ensure a proportional representation of age groups. Informed consent was obtained from all participants and school authorities prior to data collection.

### *2.3 Data Collection Instruments*

The primary data collection instrument was a structured self-administered questionnaire, which was designed to assess: 1) Respondents' knowledge about fluor albus (definition, symptoms, prevention, and health impact); 2) Personal hygiene practices related to reproductive health; 3) Frequency of synbiotic consumption (categorized as regular or irregular); and 4) Symptoms and frequency of vaginal discharge experienced over the past month.

The questionnaire was pre-tested on a sample of 20 students from a similar population to ensure validity and clarity. Necessary revisions were made based on feedback.

### *2.4 Preparation of Synbiotic Product*

The synbiotic soy milk curd used in this study was formulated and produced at the Agricultural Laboratory of Brawijaya University, Malang. The raw materials included soybeans, skim milk, distilled water, glucose, and Lactobacillus casei culture obtained from the university's Microbiology Laboratory. The preparation procedure was adapted from Dewi and Ayu (2014), modified for the current context. Soybeans were first soaked for 24 hours, thoroughly rinsed, and ground with twice their weight in water. The resulting slurry was filtered using a muslin cloth. The filtrate was pasteurized at 80°C for 15 minutes. After cooling to 40°C, skim milk and 4% glucose were added. The mixture was then inoculated with Lactobacillus casei and incubated at 37°C for 7 hours to allow fermentation and curd formation.

### *2.5 Intervention and Grouping*

Participants were categorized into two groups based on their consumption behavior: 1) Regular consumers: participants who consumed the synbiotic soy milk curd at least 3 times per week during the study period 2) Irregular consumers: participants who consumed the product less than 3 times per week or not at all. The consumption pattern was monitored and verified by class mentors and weekly checklists.

### *2.6 Outcome Measures*

The primary outcome variable was the incidence and symptom severity of pathological fluor albus, which included the quantity of discharge, color, odor, and associated symptoms such as itching or irritation. The secondary outcome was the level of knowledge and hygiene practices among participants.

### *2.7 Ethical Considerations*

The study was conducted following ethical principles in accordance with the Declaration of Helsinki. Ethical clearance was obtained from the Ethics Committee of the Institute of Science and Health Technology Dr. Soepraoen, Malang (Ref No.: KEPK-EC/49/V/2025). All participants received verbal and written information about the study and provided informed assent, with guardian consent where required.

### *2.8 Data Analysis*

Descriptive statistics were used to summarize respondent characteristics, knowledge levels, and personal hygiene practices. Cross-tabulations were performed to compare synbiotic consumption patterns with the occurrence of fluor albus. The Chi-square test was applied to assess the association between independent (knowledge, hygiene, synbiotic intake) and dependent (fluor albus incidence) variables. All statistical analyses were performed using SPSS version 25.0, with a significance level set at $p < 0.05$.

## 3. RESULTS AND DISCUSSION

### *Respondent Characteristics*

This study involved a total of 181 female adolescents aged between 14 and 17 years from an Islamic

boarding school in Malang Regency, Indonesia (Table 1). Prior to analyzing the impact of synbiotic consumption on the incidence of pathological fluor albus, it is essential to present the baseline characteristics of the study participants, including age distribution, personal hygiene behavior, and knowledge levels regarding fluor albus. These variables may influence the prevalence of reproductive health problems and provide context for understanding the associations explored in this research.

As presented in Table 1, the majority of respondents (51.4%) were 16 years old, followed by 34.2% aged 15 years, 10.5% aged 17 years, and only 3.9% aged 14 years. This indicates that the sample predominantly consisted of mid-adolescents, a developmental stage often associated with increased hormonal changes and a higher risk of reproductive health issues such as fluor albus. In terms of personal hygiene behavior, 69.1% of participants were categorized as having good hygiene practices, which included regular bathing, proper genital hygiene, and clean menstrual management. However, 30.9% were identified as practicing poor hygiene, potentially increasing their susceptibility to reproductive tract infections. These findings align with previous studies suggesting that suboptimal hygiene behaviors are a risk factor for abnormal vaginal discharge among adolescents.[2,16]

**Table 1.** Distribution of respondents by age, personal hygiene, and knowledge level (n = 181)

| Characteristic | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age (years) | 14 | 7 | 3.9% |
| | 15 | 62 | 34.2% |
| | 16 | 93 | 51.4% |
| | 17 | 19 | 10.5% |
| Personal hygiene behavior | Poor | 56 | 30.9% |
| | Good | 125 | 69.1% |
| Knowledge about fluor albus | Poor | 97 | 53.6% |
| | Good | 84 | 46.4% |

Regarding knowledge about fluor albus, more than half of the participants (53.6%) demonstrated a poor understanding of the condition, including its causes, symptoms, preventive strategies, and health implications. Only 46.4% of respondents showed adequate knowledge. This imbalance indicates a gap in reproductive health literacy, which may impact both preventive behavior and response to symptoms. Strengthening educational interventions within school settings may help bridge this gap.[3]

### *Distribution of Synbiotic Consumption Patterns*

In addition to the respondents' demographic and behavioral characteristics, this study assessed the frequency of synbiotic soy milk curd consumption among participants. Synbiotic intake was self-reported and verified through mentor monitoring logs over the study period. Participants were categorized into two groups: those who consumed synbiotics regularly (defined as three or more times per week) and those who consumed them irregularly (less than three times per week or not at all). Understanding these consumption patterns is crucial to interpreting the association between synbiotic intake and the incidence of pathological fluor albus.

As shown in Table 2, slightly more than half of the respondents (53.6%) reported irregular consumption of synbiotic soy milk curd, while 46.4% were classified as regular consumers. This relatively balanced distribution allows for meaningful comparison between the two groups in subsequent analyses related to the occurrence and severity of fluor albus symptoms.

**Table 2.** Distribution of respondents by frequency of synbiotic consumption (n = 181)

| Consumption frequency | Frequency (n) | Percentage (%) |
|---|---|---|
| Regular (≥3 times/week) | 84 | 46.4% |
| Irregular (<3 times/week) | 97 | 53.6% |
| Total | 181 | 100.0% |

The finding that over half of the participants did not regularly consume the synbiotic product, despite availability and supervised distribution, may suggest limited awareness regarding its potential health benefits or other barriers such as taste preference, lack of motivation, or habitual dietary patterns. These behavioral

elements may influence the effectiveness of nutrition-based interventions, especially in adolescent populations where taste and routine adherence play significant roles.[6,11]

### *Incidence and Characteristics of Fluor Albus*

One of the primary outcomes of this study was to examine the incidence and characteristics of pathological fluor albus among adolescent respondents in relation to their synbiotic consumption patterns. Participants were asked to report their experiences with vaginal discharge over the previous month, including the frequency, quantity, color, odor, and any accompanying symptoms such as itching or discomfort. These symptoms were used to determine whether the fluor albus was likely pathological in nature. Respondents were then grouped according to whether they reported regular or irregular consumption of synbiotic soy milk curd.

As displayed in Table 3, among respondents who consumed synbiotics irregularly, 70.1% reported a reduction in fluor albus symptoms, while 29.9% continued to experience persistent discharge. Similarly, in the group that regularly consumed synbiotics, 67.9% experienced reduced symptoms, and 32.1% reported persistent cases. Although the proportion of symptom reduction was slightly higher among irregular consumers, the difference between the two groups was minimal. Statistical analysis using the Chi-square test indicated no significant association between the frequency of synbiotic consumption and the reduction of fluor albus symptoms ($p = 0.744$). This result suggests that, within the limitations of this study, synbiotic consumption—whether regular or irregular—did not demonstrate a statistically significant impact on the occurrence of fluor albus in this population.

**Table 3.** Incidence of fluor albus by synbiotic consumption frequency (n = 181)

| Synbiotic consumption | Fluor albus status | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Irregular (<3x/week) | Persistent | 29 | 29.9% |
| | Reduced/resolved | 68 | 70.1% |
| Regular (≥3x/week) | Persistent | 27 | 32.1% |
| | Reduced/resolved | 57 | 67.9% |
| Total | | 181 | 100.0% |

These findings should be interpreted with caution. The relatively high rate of symptom reduction in both groups may have been influenced by external factors such as improvements in hygiene behavior, peer health education, or environmental sanitation during the study period. Moreover, the similarity in outcomes between regular and irregular consumers could imply that even low-frequency intake of synbiotics might exert some beneficial effect, although this remains speculative in the absence of a controlled intervention design.[5,8] Importantly, while the data do not support a definitive conclusion about the effectiveness of synbiotic soy milk curd in reducing fluor albus incidence, they highlight the need for further investigation. A longer follow-up period, larger sample size, and more objective clinical assessment of vaginal discharge would strengthen future research on this topic.

### *Association Between Synbiotic Consumption and the Incidence of Fluor Albus*

To explore the potential impact of synbiotic consumption on the incidence of pathological fluor albus, a cross-tabulation was performed comparing the frequency of synbiotic intake (regular vs. irregular) with self-reported changes in vaginal discharge symptoms. The outcome was categorized as either "persistent" or "reduced/resolved" symptoms. Statistical significance was tested using the Chi-square test.

As shown in Table 4, the proportion of respondents who reported reduced or resolved fluor albus symptoms was similar in both groups: 70.1% among irregular consumers and 67.9% among regular consumers. The Chi-square test yielded a p-value of 0.744, indicating no statistically significant association between synbiotic consumption frequency and fluor albus symptom reduction.

The findings suggest that the frequency of synbiotic soy milk curd consumption did not significantly influence the incidence of fluor albus among the adolescent respondents in this study. Despite expectations that regular intake of probiotics and prebiotics could promote urogenital health through modulation of the microbiome, the results did not

support this hypothesis within the context and limitations of the current research.

These findings contrast with previous studies that demonstrated the efficacy of probiotics and synbiotics in maintaining vaginal microbiota balance and reducing symptoms of bacterial vaginosis or vaginal candidiasis.[5,14] Several plausible explanations exist for this inconsistency. First, the study's cross-sectional design limits causal interpretation and may not fully capture the temporal effects of synbiotic intervention. Second, the reliance on self-reported data without microbiological confirmation of fluor albus may have introduced reporting bias or misclassification of symptoms.

**Table 4.** Association between synbiotic consumption and fluor albus incidence (n = 181)

| Synbiotic consumption frequency | Fluor albus incidence | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Irregular (<3x/week) | Persistent | 29 | 29.9% |
| | Reduced/resolved | 68 | 70.1% |
| Regular (≥3x/week) | Persistent | 27 | 32.1% |
| | Reduced/resolved | 57 | 67.9% |
| Total | | 181 | 100.0% |
| | Chi-square *p*-value | | 0.744 |

Moreover, the relatively short duration of the intervention and the possibility of concurrent behavioral improvements (e.g., better hygiene practices or increased health awareness during the study) could have contributed to symptom reduction in both groups. As noted by Jang et al. (2021), the benefits of fermented soy-based synbiotics may be more observable over longer periods and with consistent adherence.[11] In addition, the threshold used to define "regular" consumption (≥3 times per week) may not be sufficient to induce measurable changes in microbial communities. Although the statistical analysis did not yield significant results, the observed trend toward symptom reduction in both consumption groups suggests a potential role for synbiotic interventions as part of a broader strategy for adolescent reproductive health.[17,18] This is particularly relevant in contexts where access to formal medical treatment is limited, and dietary approaches offer a culturally acceptable and scalable alternative.

The implications of this study emphasize the complexity of using nutritional interventions for gynecological conditions, especially in adolescent populations. Future studies should consider longitudinal designs with clinical verification of symptoms, larger and more diverse samples, and more detailed analysis of dietary patterns, adherence levels, and gut-vaginal microbiota interactions.

### *Relationship Between Knowledge Level and Personal Hygiene Behavior*

This section presents the association between participants' knowledge of fluor albus and their personal hygiene behavior. It is hypothesized that higher knowledge levels may influence better hygiene practices, which are essential for preventing reproductive health problems such as pathological fluor albus. The respondents were categorized based on their knowledge level (good vs. poor) and their hygiene behavior (good vs. poor). The cross-tabulation results are shown in Table 5.

As indicated in Table 5, the majority of respondents in both knowledge categories reported good hygiene behavior. Among those with poor knowledge, 70.1% maintained good hygiene practices, while 29.9% had poor hygiene. Similarly, 67.9% of respondents with good knowledge practiced good hygiene, while 32.1% were classified as having poor hygiene behavior. The Chi-square test produced a p-value of 0.744, suggesting no statistically significant relationship between knowledge level and hygiene behavior.

The results indicate that there was no significant association between knowledge level and personal hygiene behavior among adolescent respondents. While it may be assumed that better knowledge about fluor albus would lead to improved hygiene practices, the data did not support this relationship in the current study. This finding suggests that knowledge alone may not be sufficient to influence behavior, especially in adolescent populations. As Bandura's Social Cognitive Theory posits, behavior change is influenced by multiple interrelated factors, including environment, self-efficacy, social norms, and reinforcement mechanisms—not just cognitive understanding.[19] Adolescents may have adequate knowledge but still fail to translate it into consistent personal hygiene practices due to peer

influence, cultural taboos, limited access to hygiene supplies, or lack of adult supervision.[3,16,20,21] These findings are also consistent with studies showing that improvements in hygiene behavior often require multi-faceted interventions that combine health education with behavior modeling, supportive environments, and reinforcement.[2,10] In the context of a boarding school, communal living conditions may standardize behaviors regardless of individual knowledge levels, thereby weakening the expected knowledge-behavior link.

**Table 5.** Relationship between knowledge level and personal hygiene behavior (n = 181)

| Knowledge level | Personal hygiene | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Poor knowledge | Poor hygiene | 29 | 29.9% |
| | Good hygiene | 68 | 70.1% |
| Good knowledge | Poor hygiene | 27 | 32.1% |
| | Good hygiene | 57 | 67.9% |
| Total | | 181 | 100.0% |
| | Chi-square *p*-value | | 0.744 |

Furthermore, the relatively high proportion of students with good hygiene practices despite poor knowledge suggests the possible influence of structured routines or institutional regulations promoting hygiene, independent of personal understanding. This highlights the importance of institutional support and environmental enablers in fostering positive health behaviors among adolescents.

In practical terms, the findings underscore the need for comprehensive adolescent reproductive health programs that not only provide information but also foster behavioral change through mentorship, peer engagement, and school-based policies. Integrating life skills education and interactive modules could improve both knowledge retention and behavior adoption.

## 4. CONCLUSION

This study investigated the relationship between synbiotic soy milk curd consumption and the incidence of pathological fluor albus among female adolescents in a boarding school setting. Although the majority of respondents reported reduced fluor albus symptoms, statistical analysis revealed no significant association between the frequency of synbiotic intake and symptom resolution. Similarly, the level of knowledge about fluor albus was not significantly related to personal hygiene behavior, highlighting the complexity of behavior change and the multifactorial nature of adolescent health practices.

These findings underscore the importance of considering contextual and behavioral determinants in public health interventions. While synbiotics may offer health-promoting benefits, their impact may be limited without sustained adherence, structured education, and supportive environments. The study contributes to the emerging field of functional nutrition and adolescent reproductive health by examining the application of a synbiotic intervention within a real-world school context. The results suggest that single-factor interventions may not be sufficient, and future research should explore multicomponent strategies that integrate education, environmental support, and behavioral reinforcement. Longitudinal studies with clinical confirmation of fluor albus, microbiota analysis, and dietary adherence monitoring are recommended to further validate the role of synbiotics in adolescent reproductive health. This study adds valuable insights into the design of culturally appropriate and non-pharmacological preventive strategies for adolescent girls.

### Ethical Approval

Ethical clearance was obtained from the Ethics Committee of the Institute of Science and Health Technology Dr. Soepraoen, Malang (Ref No.: KEPK-EC/49/V/2025).

### Acknowledgement

Thanks to Allah SWT for His grace and to ITSK and LPPM, who gave us the widest possible opportunity to conduct research.

### Competing Interests

All the authors declare that there are no conflicts of interest.

### Funding Information

No funds were received for this study.

## Underlying Data

Derived data supporting the findings of this study are available from the corresponding author on request.

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