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Effectiveness of dragon fruit ice cream with Yakult in relieving constipation among preschool children

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ABSTRACT

Children aged 3-6 years, also known as preschoolers, are at a stage when independence begins to develop, including in eating. Children in the preschool age group experience a decrease in appetite or become more selective in their food choices. They prefer playing and interacting with their environment over eating. A common health issue during this age is constipation. Parents play a crucial role in providing proper nutrition to prevent constipation in their children. Objective: To determine the effectiveness of dragon fruit ice cream, Yakult, and dragon fruit ice cream on constipation in preschool children. Method: This study is a quasi-experimental study with two treatment groups. The first treatment group received a combination of dragon fruit ice cream and Yakult, while the second received dragon fruit ice cream alone. The sample consisted of 60 preschool-aged children from a preschool and a community health centre in Kedung Badak Village, Tanah Sareal District, Bogor City, selected purposively. Results: There was effectiveness of the intervention after the administration of dragon fruit ice cream and Yakult ($p < 0.000$) and after the administration of dragon fruit ice cream alone ($p < 0.003$). This study indicates that dragon fruit ice cream is more effective than Yakult in treating constipation in preschool-aged children ($p < 0.000$). Conclusion: Dragon fruit ice cream and Yakult are more effective than dragon fruit ice cream alone in treating constipation in preschool-aged children.

Keywords: dragon fruit, ice cream, constipation, preschool children, Yakult

INTRODUCTION

Children aged 3-6 years, also known as preschoolers, are at a stage when their independence begins to develop, including in eating **[1]**, and **[2]**. Preschoolers tend to have a decreased appetite or become more selective in their food choices. They prefer playing and interacting with their environment over eating **[3]**, and **[4]**. One of the most common health issues is constipation. Constipation is becoming increasingly prevalent. Many children experience constipation due to insufficient Fiber intake. The role of parents is extremely important in instilling a love and an appetite for healthy food in children from an early age. Parents often choose to use laxatives to address their children's constipation without changing their children's dietary patterns to include sufficient Fiber. According to Basic Health Research of Indonesia **[5]**, another picture: when assessed against the WHO minimum target (≥5 servings/day), the proportion of the population that does not achieve the recommended intake of fruits and vegetables is very high — e.g. 96.3% of adults reported having inadequate intake of fruits and vegetables **[6]**. The average vegetable consumption is 70.0 grams per person per day, and fruit consumption is 38.8 grams per person per day. The total vegetable and fruit consumption of the population is 108.8 grams per person per day. Compared with the recommended intake according to balanced nutrition guidelines, this consumption of vegetables and fruits is still low. According to a survey of 10 preschool-aged children, 70% experienced constipation **[7]**.

The majority of preschool-aged children in Indonesia consume insufficient amounts of fruits and vegetables. For example, one study found that more than 50% of 5-6-year-old children had low fiber intake, consumed

fewer than 7 types of vegetables, and ate less than 250 g of vegetables and 150 g of fruit per day **[8]**. Another study reported average consumption among pre-schoolers of only 65.9 g of vegetables/day and 73.6 g of fruit/day, far below national recommendations of 150-200 g of vegetables and 300 g of fruit **[9]**. Systematic review evidence also confirms that Indonesian children under five frequently consume fruit and vegetables in low frequency and volume, insufficient to meet dietary guidelines **[10]**. Functional constipation is common in children and poses a global burden due to its increasing prevalence. Prevalence ranges from 0.7-29.6%, with a female-to-male ratio of 1:1. Constipation score is similar in both genders by age 13, with a peak during toilet training (around 2-3 years). The most common cause of constipation in children is functional, accounting for approximately 95%, while only 5% is due to organic causes. Constipation is a disorder of the digestive system characterized by hard stools, leading to infrequent, difficult, and painful bowel movements. This is caused by hard, compacted stools that can cause changes due to anal fissures. Constipation can be caused by various factors, including insufficient Fiber intake, inadequate fluid intake, stress, reluctance to use the bathroom for bowel movements, and the effects of certain medications. Therefore, a high-Fiber diet is highly recommended for children with constipation. Parents play a crucial role in ensuring their children receive adequate nutrition to prevent constipation. Ice cream is highly favoured by children due to its taste, which appeals to their preferences, its ease of consumption, its soft texture, and its nutritional value. Ice cream can serve as an alternative to fruit for children and help prevent constipation. Ice cream is a dairy-based product enjoyed by people of all ages, from children to the elderly. It has a delicious taste, attractive colours, and a soft texture. Ice cream is a nutrient-rich food containing protein, fat, carbohydrates, vitamins, and minerals. The fat content of ice cream is three to four times that of milk, and half of its total solids are sugar. Ice cream production can vary depending on the types of fruit added, including red dragon fruit. Red dragon fruit has small, black, very soft, tender seeds **[11]**. Dragon fruit contains bioactive compounds beneficial to the body, including antioxidants (in the form of ascorbic acid, beta-carotene, and anthocyanins), as well as dietary Fiber in the form of pectin. Additionally, dragon fruit contains several minerals, including calcium, phosphorus, and iron. The vitamins found in dragon fruit include vitamin B1, vitamin B2, vitamin B3, and vitamin C **[12]**, **[13]**. The weight of a red dragon fruit can reach 500 grams per fruit, and it has a sweetness level of 13-15 Brix **[14]**. Dragon fruit is one of the fruit plants with a unique appeal, thanks to its distinctive fruit shape and vibrant colour. Beyond its sweet, refreshing taste, dragon fruit offers numerous benefits. This fruit can lower cholesterol and balance blood sugar levels. Dragon fruit also contains vitamin C, beta-carotene, calcium, and is high in fibre, which acts as a binding agent for carcinogenic substances that cause cancer and aids in digestion.

In this regard, scientific research aims to determine the effectiveness of dragon fruit ice cream with Yakult, and dragon fruit ice cream on constipation in preschool children.

Scientific Hypothesis

A high-Fiber diet is highly recommended for children with constipation. Ice cream can serve as an alternative for children to eat fruit and help prevent constipation. Ice cream is a nutrient-rich food containing protein, fat, carbohydrates, vitamins, and minerals. The fat content of ice cream is three to four times that of milk, and half of its total solids are sugar. Dragon fruit contains bioactive compounds beneficial to the body, including antioxidants (in the form of ascorbic acid, beta-carotene, and anthocyanins), as well as dietary fiber in the form of pectin. Additionally, dragon fruit contains several minerals, including calcium, phosphorus, and iron. The vitamins found in dragon fruit include vitamin B1, vitamin B2, vitamin B3, and vitamin C. This fruit can lower cholesterol and balance blood sugar levels. Dragon fruit also contains vitamin C, beta-carotene, and calcium, and is high in fiber, which acts as a binding agent for carcinogenic substances that cause cancer and aids in digestion. This concern has prompted our study, where we explored two hypotheses:

There is a difference in effectiveness between administering dragon fruit ice cream with Yakult and administering dragon fruit ice cream alone in alleviating constipation among preschool-aged children.

Objectives

This study aimed to determine the effectiveness of dragon fruit ice cream with and without Yakult in reducing constipation among preschool-aged children.

MATERIAL AND METHODS

Preliminary research is initial research conducted before the main research and serves as a reference when conducting the main research. Preliminary research is carried out in several steps, namely determining food ingredients that are rich in fiber, determining the ice cream formula by modifying recipes found in journals, and comparing them with SNI ice cream quality requirements, and then conducting preliminary tests on the formula obtained.

Samples

Samples description: Dragon fruit ice cream is a frozen processed product made from the flesh of fresh dragon fruit combined with basic ice cream ingredients such as milk and emulsifiers. This ice cream has a natural reddish-purple color (from red dragon fruit), without the need for added artificial coloring

Samples collection: Fresh red dragon fruits were collected from trusted local suppliers in Bogor to ensure quality and freshness. Fruits were selected based on ripeness, absence of defects, and uniform color. All dairy ingredients, including sweetened condensed milk, whipping cream, and full cream milk, were purchased from certified food-grade suppliers to guarantee safety and consistency. Yakult was obtained directly from commercial retail outlets to ensure authenticity and probiotic viability.

Samples preparation: The preparation process involved several steps. First, frozen dragon fruit cubes were blended together with condensed milk and a small amount of milk until smooth. Whipping cream was then beaten with a mixer until soft peaks formed. The dragon fruit puree was gently folded into the whipped cream using a spatula. For Group II, one bottle of Yakult was added to the mixture. The mixture was poured into a closed container and frozen for at least six hours, with stirring every two hours to maintain a smooth texture. Finally, the ice cream was scooped into cups and stored at -18 °C until consumption.

Number of samples analysed: 4 experimental samples (2 treatment combinations, 2 repetitions each). The combination of samples is one with Yakult and the other one without Yakult.

Chemicals

Chemicals used in the analysis included analytical-grade organic solvents (n-hexane, petroleum ether, ethanol), strong acids and bases (H_2SO_4, HCl, NaOH), enzymatic reagents (α-amylase, protease, amyloglucosidase), titration reagents (boric acid, sodium thiosulfate), Luff-Schoorl reagents, certified indicators, and distilled water..

Animals, Plants and Biological Materials

Red dragon fruit (Hylocereus costaricensis) has red flesh weighing approximately 400-500 grams and a sweet taste reaching 13-15 Brix.

Bacteria (probiotics) such as Lactobacilli and Bifidobacteria in the intestines.

Laboratory Methods

The analytical methods used in the production of “dragon fruit ice cream made from red dragon fruit, milk, and Yakult” were organoleptic tests conducted at Saraswanti Indo Genetech (SIG) in Bogor City. The product quality requirements are based on SNI 01-2891-1992.

Description of the Experiment

Study flow:

1. Prepare the ice cream maker according to the user manual.
2. Place the fruit of the dragon fruits into a blender with other ingredients and puree until smooth. Make 2 dough, one with Yakult and the other one without Yakult.
3. Pour into a prepared ice cream maker and run until the mixture is frozen.
4. Pour into a freezer-safe container and freezer for several hours or until firm.
5. Remove from freezer for 10 minutes to soften before serving.

Quality Assurance

The dragon fruit ice cream was produced under strict quality assurance procedures to ensure safety, consistency, and nutritional value. Fresh dragon fruit was carefully selected from trusted sources and checked to be free from defects or spoilage. All milk and cream used in the formulation were pasteurized to prevent microbial contamination, and Yakult was added as a probiotic source containing Lactobacillus casei Shirota.

During production, hygiene and sanitation standards were strictly maintained. The fruit was thoroughly washed, and all equipment was sterilized to avoid cross-contamination. Processing was carried out at low temperatures to preserve the natural nutrients and the dragon fruit's bright red-purple color.

The ice cream was packaged in clean, sealed cups. Each package was labeled with the production date, expiration date, ingredient list, and storage instructions, specifying that the product must be kept at -18 °C. Storage was consistently maintained at -18 °C to preserve texture, flavor, and microbiological safety. Distribution was conducted using refrigerated vehicles to ensure the cold chain was not broken.

Quality testing was performed before the product was given to children. Organoleptic tests assessed color, taste, aroma, and texture. Microbiological tests confirmed that the ice cream was free from pathogens. Nutritional analysis verified that fiber, sugar, and other nutrients matched the intended formulation.

All production followed Indonesian National Standards (SNI) for processed food, including safety standards for children’s products. Regular monitoring was carried out to guarantee that each batch of ice cream met the same quality and safety requirements.

Number of repeated analyses: Performed in duplicate (two times) for each sample to ensure the consistency and reliability of the analytical results.

Number of experiment replication: The experiment was conducted three times, consisting of two preliminary (pilot) experiments and one final experiment.

Reference materials: – For antioxidant calibration, a certified gallic acid standard (Sigma-Aldrich, ≥98%) was used to construct the standard curve for total phenolic content determination, ensuring analytical accuracy.

– For vitamin B analysis, certified reference solutions of thiamine and riboflavin (ChromaDex, USA) were employed to guarantee traceability and result validity.

– All microbiological media were quality-checked against manufacturer batch certificates prior to use to ensure media performance and reliability.

– All analytical instruments were verified using internal calibration standards before analysis to maintain measurement precision.

Calibration: All analytical instruments were calibrated prior to each measurement session in accordance with manufacturer-recommended procedures and standard solutions.

The spectrophotometer (Shimadzu UV-1800) was calibrated using a gallic acid standard curve ranging from 0 to 250 μg/mL to ensure accuracy in antioxidant measurements.

The analytical balance (RADWAG AS 220.R2) was calibrated using certified calibration weights to ensure weighing precision.

pH meters were calibrated before each use with standard buffer solutions at pH 4.00 and pH 7.00 to ensure measurement accuracy..

Laboratory accreditation: All experimental work was conducted at the laboratories of JSC Almaty Technological University, with analytical procedures performed at the accredited Food Safety Research Institute Laboratory. This laboratory operates in compliance with ISO/IEC 17025 standards, ensuring internationally recognized quality management and technical competence..

Data Access

Data supporting the findings of this study are available from the corresponding author upon reasonable request, in accordance with institutional data management and confidentiality policies.

The raw datasets include tabulated analytical measurements, experimental formulations, and processed statistical outputs to support data transparency and reproducibility.

Statistical Analysis

An independent t-test was used to compare the mean post-intervention constipation scores between the dragon fruit ice cream group and the dragon fruit ice cream with Yakult group to determine whether a statistically significant difference existed between the two interventions. A paired t-test was used to compare the mean constipation scores before and after the intervention within each group to assess the effect of the treatment.

Reporting and transparency statement

This was a quasi-experimental study; randomization and blinding were not applied. The sample size was determined based on feasibility and reference to similar previous studies. Each laboratory analysis was performed in duplicate (technical replicates) to ensure reliability. The intervention was conducted in three stages (two preliminary experiments and one final experiment). No data or samples were excluded from the analysis, and all collected data were included in the final evaluation.

RESULTS AND DISCUSSION

This section will describe the data obtained from interventions involving dragon fruit ice cream and dragon fruit ice cream with Yakult on constipation in preschool-aged children. Analysis was conducted to evaluate the effectiveness of each treatment and compare their impact on bowel frequency and stool consistency.

Figure 1 Examples of dragon fruit ice cream and dragon fruit ice cream products.

Table 1 presents the results of laboratory analyses of dragon fruit ice cream samples conducted at PT Saraswanti Indo Genetech (SIG). The analyses were performed to determine the proximate composition, energy value, sugar content, dietary fiber, and sensory characteristics of the product using standardized Indonesian National Standard (SNI) methods and validated internal laboratory procedures. Measurements were carried out in duplicate (simplo and duplo) to ensure analytical reliability and data accuracy.

Table 1 Results of laboratory tests on dragon fruit ice cream samples at PT SIG (Saraswanti Indo Genetech).

No	Parameter	Unit	Simplo	Duplo	Method
1	Ash Content	%	0.59	0.60	SNI 01-2891-1992 item 6.1
2	Energy From Lipids	Kcal/100g	22.50	21.78	Calculation
3	Total Lipid Content	%	2.50	2.42	18-8-5/MU/SMM-SIG point 3.2.2 (Gravimetry)
4	Water Content	%	83.62	83.48	SNI 01-2891-1992 item 5.1
5	Total Energy	Kcal/100 g	75.66	75.78	Calculation
6	Carbohydrates (By Difference)	%	11.48	11.62	18-8-9/MU/SMM-SIG (calculation)
7	Protein Content	%	1.81	1.88	18-8-31/MU/SMM-SIG (Titrimetric)
8	Total Sugar (Luff Schrool)	%	7.29	7.47	18-8-8/MU/SMM-SIG (Luff Schrool)
9	Odor	-	Normal	Normal	SNI 01-2891-1992 item 1.2
10	Taste	-	Slightly sweet	Slightly sweet	SNI 01-2891-1992 item
11	Dietary Fiber	%	1.76	1.73	18-8-6-2/MU/SMM-SIG (Enzymatic Gravimetry)

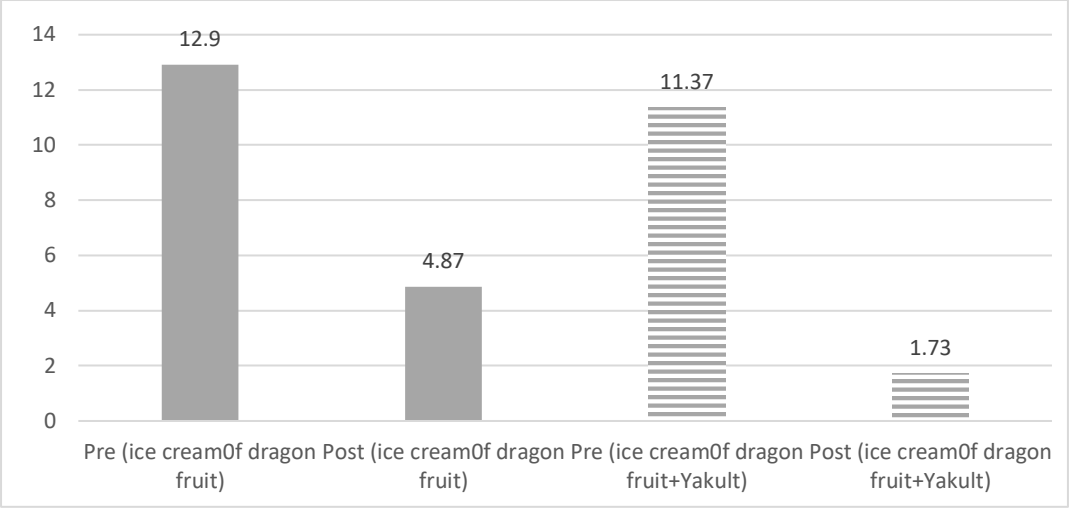

Figure 2 Comparison of Constipation Scores Before and After Dietary Interventions.

The Figrure 2 changes in constipation scores before and after two different interventions: dragon fruit ice cream alone, and dragon fruit ice cream combined with Yakult. In the dragon fruit ice cream group, the mean constipation score decreased markedly from 12.9 before the intervention to 4.87 after the intervention. This indicates a substantial improvement in constipation symptoms after consuming dragon fruit ice cream.

A similar but more pronounced pattern is observed in the group receiving dragon fruit ice cream with Yakult. The mean constipation score declined from 11.37 at baseline to 1.73 after the intervention, suggesting an even greater reduction in constipation severity. Overall, the graph suggests that both interventions were effective in reducing constipation scores, with the combination of dragon fruit ice cream and Yakult showing a stronger improvement compared to dragon fruit ice cream alone. To complete the data about the figure 1 wil more explain at Table 2.

Table 2 The score of constipation in preschool children before and after consuming dragon fruit ice cream and dragon fruit ice cream with Yakult (n = 60).

	Variable	Mean	Min-Maks	95%CI
Children with constipation	Before consuming dragon fruit ice cream	12.9	10 - 18	11.91 -13.89
	After consuming dragon fruit ice cream	4.87	1 - 13	4 – 5.74
Children with constipation	Before consuming dragon fruit ice cream with Yakult	11.37	9 - 19	10.56 -12.17
	After consuming dragon fruit ice cream with Yakult	1.73	1 - 8	1.18 – 2.29

As shown in Table 2, the average Score of constipation before eating dragon fruit ice cream was 12.9, with a minimum value of 10 and a maximum value of 18 (95% CI 11.91-13.89). The average Score after eating dragon fruit ice cream was 4.87, with a minimum value of 1 and a maximum value of 13 (95% CI 4-5.74). The average Score of constipation before eating dragon fruit ice cream plus Yakult was 11.37, with a minimum value of 9 and a maximum value of 19 (95% CI 10.56-12.17). The average Score of constipation after consuming dragon fruit ice cream plus Yakult was 1.73, with a minimum value of 1 and a maximum value of 8 (95% CI 1.18-2.29).

Table 3 The effect of dragon fruit ice cream and dragon fruit ice cream with Yakult on preschool children before and after consuming dragon fruit ice cream and dragon fruit ice cream with Yakult (n = 60).

Variabel	Kelompok.	Mean	SD	SE	p-Value	n
Constipation	1.dragon fruit ice cream	4.87	2.3	0.4	0.000 *	30
	2.dragon fruit ice cream with Yakult	1.73	1.5	0.3		30

*Note: * - Independent t-test*

Table 3 shows that the average Score of constipation after eating dragon fruit ice cream is 4.87, and the average Score of constipation after eating dragon fruit ice cream plus Yakult is 1.73. The statistical test results yielded a p-value of 0.000, indicating that, at the 5% significance level, there is a significant difference in the average Score for constipation between eating dragon fruit ice cream and eating dragon fruit ice cream plus Yakult.

Preschool children are children aged 3-6. The preschool period is called the golden period, window of opportunity, and critical period because it is highly sensitive to environmental influences, lasts for a very short time, and is not repeatable. One of the health issues that is often experienced during this period is constipation **[7]**. The subjects in this study were preschool children, with approximately equal numbers.

Defecation patterns are considered an indicator of good health. Constipation is a symptom and not a disease. The findings of Jennings et al. **[7]**, reported that 20% of children had a bowel movement frequency of less than 3 times per week. Wu et al. **[15]** also reported similar findings in their survey in Taiwan, where 27.7% of children had bowel movement frequency of ≥4 days or <3 times per week. Bowel movements (BMs) fewer than 3 times per week indicate constipation.

The Mann-Whitney test results showed no significant difference in bowel movement frequency between male and female subjects ($p > 0.05$). The results of Ambarita et al. **[16]** showed that the average fibre and water intake of the subjects remained insufficient, and there was a significant relationship between fibre intake and bowel movement frequency and stool consistency ($p = 0.05$). Fiber is abundant in vegetables and fruits, one of which is dragon fruit.

The benefits of dragon fruit stem from its rich nutritional content, which supports numerous health benefits. Some of the benefits of consuming dragon fruit include: preventing and treating constipation, as dragon fruit is high in fiber and prebiotics, which are good for digestive health. Dragon fruit can be used to make various dishes that appeal to children, such as dragon fruit ice cream, which is not only tasty but also visually appealing. These nutrients are known to facilitate bowel movements, thereby preventing and relieving constipation. Ice cream is a frozen dessert that is high in nutrients and widely enjoyed by people of all ages. These days, ice cream consumers are no longer limited to children but have expanded to teenagers, adults, and the elderly.

The Score rate of constipation in preschool-aged children before and after consuming dragon fruit ice cream and dragon fruit ice cream with Yakult in Bogor City

The average Score of constipation before consuming dragon fruit ice cream was 12.9, with a minimum value of 10 and a maximum value of 18 (95% CI 11.91-13.89). The average Score after consuming dragon fruit ice cream was 4.87, with a minimum value of 1 and a maximum value of 13 (95% CI 4-5.74). The average Score of constipation before consuming dragon fruit ice cream plus Yakult was 11.37, with a minimum value of 9 and a maximum value of 19 (95% CI 10.56-12.17). The average Score after eating dragon fruit ice cream plus Yakult was 1.73, with a minimum value of 1 and a maximum value of 8 (95% CI 1.18-2.29).

Constipation is a common digestive disorder in both adults and children; recent systematic reviews and consensus guidelines estimate a pooled prevalence in children of about 9.5%–14.4%, although prevalence varies widely by setting and diagnostic criteria. Prevalence varies widely across studies and settings, with some local/clinical samples also reporting rates of ~30% **[17]**, **[18]**, and **[19]**. Some experts emphasise that constipation may be defined by a single cardinal symptom — difficulty passing stool — rather than a complex symptom cluster. The Score of functional constipation is similar between boys and girls by early adolescence, and its peak occurrence commonly coincides with the toilet-training period (around 2-3 years of age) **[19]**, and **[20]**. Thus, good parental involvement ensures adequate fiber intake in children, preventing constipation, while insufficient parental involvement in meeting fiber intake needs leads to constipation.

In this context, parental involvement is crucial for meeting children's basic needs, including adequate fiber intake. This aligns with the findings of Ambarita et al. **[16]**. There is a significant relationship between fiber intake and bowel movement frequency and stool consistency ($p < 0.05$). Because dragon fruit ice cream with added Yakult has a higher fiber content, which is 1.76 per 100 grams of dragon fruit ice cream.

According to Claudina **[21]**, vegetables and fruits are dietary fiber-rich foods that are readily available. Based on the 2018 Riskesdas **[5]** survey, the national prevalence of insufficient fruit and vegetable consumption among individuals aged 5 years and older was 95.5%. In Central Java, 89.7% of individuals aged 5 years or older consumed insufficient amounts of fruits and vegetables. The average fiber intake among the Indonesian population is 10.5 grams per day, while the recommended daily fiber intake is 25-30 grams. This indicates that the Indonesian population's fiber intake is only one-third of the recommended level.

Dietary fiber can bind water in the colon, increasing stool volume and stimulating nerves in the rectum, thereby triggering the urge to defecate. Some benefits of consuming red dragon fruit include: Preventing and alleviating constipation, as dragon fruit is high in fiber and prebiotics, which are good for digestive health. The fiber content in dragon fruit helps alleviate constipation or bowel irregularities **[22]**, **[23]**, and **[24]**.

The effect of dragon fruit ice cream and dragon fruit ice cream with Yakult on preschool children before and after consuming dragon fruit ice cream and dragon fruit ice cream with Yakult in Bogor City

There is an effect of consuming dragon fruit ice cream before eating on the occurrence of constipation ($p = 0.000$, $\alpha = 0.05$), with an average difference before and after consuming dragon fruit ice cream of 8.138. From the statistical test results, a p-value of 0.000 with $\alpha = 0.05$ was obtained, indicating a significant difference in constipation scores before and after eating dragon fruit ice cream. There is an effect of consuming dragon fruit ice cream plus Yakult before eating on the occurrence of constipation ($p = 0.000$, $\alpha = 0.05$), with an average difference before and after consuming dragon fruit ice cream plus Yakult of 9.586.

The statistical test yielded a p-value of 0.000 with $\alpha = 0.05$, indicating a significant difference in constipation scores before and after consuming dragon fruit ice cream. According to the study conducted by Lim and Ling **[25]**, there is an effect of red dragon fruit on young adults. Dragon fruit contains both soluble and insoluble fiber in its flesh. Insoluble fibers increase the bulk (volume) of stool, while soluble fibers (e.g., pectin-like polysaccharides) form a gel that enhances the stool's ability to hold water, resulting in a softer consistency and facilitating ejection. Therefore, the consumption of fiber-rich foods like dragon fruit is directly associated with increased defecation frequency and a decrease in constipation score across various populations **[26]**. DFO (*dragon fruit oligosaccharides*) are substrates that are not digested in the small intestine and are degraded by the colon microbiota. Randomized clinical trials in adults reported that DFO consumption increased the group of beneficial bacteria (e.g., Bifidobacterium) and altered fecal metabolites (including increased SCFAs). SCFAs (specifically butyrate and acetate) can: 1) lower the pH of the colon, 2) provide energy to colonocyte cells, and 3) modulate intestinal motility—all contributing to increased transit and frequency of bowel movements **[27]**.

The fiber intake requirement for preschool-aged children (3-6 years) is 20-30 g/day, according to the recommended daily fiber intake **[28]**. According to the official website of the Ministry of Health (Kemenkes.go.id), red dragon fruit is a fruit with a high-water content and dietary fiber. These two nutrients are excellent for alleviating constipation in children. Increasing fiber (and fluid) intake helps soften stools, increases stool volume/frequency, and is the main non-pharmacological strategy in managing functional constipation in children **[29]**.

The effectiveness of dragon fruit ice cream with dragon fruit ice cream plus Yakult on constipation Score in preschool children in Bogor City

The average Score of constipation after eating dragon fruit ice cream was 4.87, and the average Score of constipation after eating dragon fruit ice cream plus Yakult was 1.73. The statistical test results showed a p-value of 0.000, indicating that at a 5% alpha level, there is a significant difference in the average Score of constipation between eating dragon fruit ice cream and eating dragon fruit ice cream with Yakult. This aligns with the study by Yang et al. in 2012, which stated that fiber intake clearly increases bowel movement frequency but is unclear in reducing pain during bowel movements or constipation. This means that the more fiber intake there is, the softer, more voluminous, and easier to pass the stool becomes, and vice versa. Hillemeier's **[30]** study showed the same results, indicating that fiber intake softens stool consistency and increases volume, thereby reducing stool transit time in the large intestine. A study also showed that subjects with constipation had higher average water intake than healthy controls. Dragon fruit ice cream can help hydrate children's bodies and soften stools **[31]**.

Dragon fruit is rich in fiber, which helps improve digestion and reduce constipation. The antioxidants and vitamin C in dragon fruit can reduce inflammation in the digestive tract. The sweet, delicious taste of dragon fruit ice cream can increase children's appetite. Vitamin C in dragon fruit can help reduce stress and anxiety often experienced by children with constipation, and enzymes in dragon fruit can help break down food and improve digestion. This is because dragon fruit is rich in fiber and oligosaccharides, which act as prebiotics that support the growth of beneficial bacteria (probiotics) such as Lactobacilli and Bifidobacteria in the intestines **[32]**, and **[33]**. These two bacteria are beneficial for killing viruses and disease-causing bacteria **[34]**, and **[35]**. Thus, consuming dragon fruit can maintain the balance of good and bad bacteria in the intestines. A common digestive disorder experienced by adults and children is constipation.

Globally, constipation affects nearly 30% of children worldwide. To date, there is no global consensus on the definition of constipation in children. Some experts prefer to use a single symptom, namely, difficulty passing stool. The Score of constipation tends to be similar in both genders by the age of 13; and the peak Score occurs during toilet training (around 2-3 years). Prevalence is higher in Asia and the Americas. In the United States, approximately 10% of children and adolescents suffer from chronic constipation. In Taiwan, nearly one-third of elementary school children suffer from constipation, while in Hong Kong and South Korea, prevalence ranges from 12-28%, and in Sri Lanka, 7-15% of school-aged children suffer from constipation.

Various factors, such as diet, psychological, socio-cultural, and political factors, can increase the risk of children experiencing constipation. Thus, it can be said that the better the role of parents, the less likely children are to experience constipation, and conversely, the less the role of parents, the more likely children are to experience constipation. Therefore, good parental roles ensure adequate fiber intake for children, preventing constipation, while inadequate parental roles in meeting fiber intake needs can lead to constipation. In this case, the role of parents is very important in meeting children's basic needs, such as food intake, including fiber intake. In Taillie's 2019 study **[36]**, a relationship was observed between parents' roles as facilitators of food intake. To meet fiber intake, parents must instill a liking and taste for healthy foods in children from an early age, especially fiber, so that children do not easily experience constipation. The study by Ambarita et al. **[16]** also showed a significant relationship between fiber intake and stool consistency, and, similarly, according to Nissa et al. **[37]**, constipation in children is associated with parental involvement and insufficient fiber intake.

Red dragon fruit is one of the fruits that has been extensively studied for its benefits. According to Ariffin et al. **[38]**, and **[39]** dragon fruit is a fruit rich in nutrients **[40]**. Each component of dragon fruit has benefits for the body. Dragon fruit can help alleviate constipation in children and serves as an alternative fruit for preschool-aged children. This is because dragon fruit is high in fiber and appealing to children.

Ice cream is highly favoured by children due to its taste, which aligns with their preferences, its ease of consumption, its soft texture, and its nutrient-rich nature. This ice cream serves as an alternative for children to consume fruits to prevent constipation. Ice cream is a dairy product loved by people of all ages, from young to old. It has a delicious taste, attractive colours, and a smooth texture. Ice cream is a nutrient-rich food, containing protein, fat, carbohydrates, vitamins, and minerals. The fat content of ice cream is three to four times that of milk, and half of its total solids are sugar. Ice cream production can vary by adding various types of fruit, including red dragon fruit. Ice cream is a frozen food made from milk products, combined with flavourings and sweeteners.

According to SNI 01-3973-1995, ice cream is a semi-solid food made by freezing a mixture of milk, animal or plant fats, sugar, and other permitted food ingredients, with or without other permitted food ingredients. Red dragon fruit (*Hylocereus costaricensis*) has red flesh weighing approximately 400-500 grams and a sweet taste with a Brix reading of 1315. Dragon fruit also contains high levels of antioxidants such as vitamin C and anthocyanins. Red dragon fruit contains protein that can boost metabolism and maintain heart health, fiber that helps prevent colon cancer, diabetes **[41]** carotene for eye health and improved brain function, and calcium for stronger bones **[42]**. Dragon fruit or dragon fruit contains bioactive compounds beneficial to the body, including antioxidants (in the form of ascorbic acid, beta-carotene, and anthocyanins), as well as dietary fiber in the form of pectin **[43]**.

Limitations: The sample size was relatively small (n = 60) and was drawn from a single geographic area (Tanah Sareal, Bogor), limiting the generalizability of the findings to broader preschool populations with different socio-demographic and dietary backgrounds. Participants were selected using purposive sampling rather than probability-based methods, increasing the risk of selection bias and reducing representativeness. The intervention period was short (2 weeks), so long-term effectiveness, sustainability of benefits, and recurrence of constipation could not be evaluated. Outcome assessment relied largely on parent-reported daily records and the Bristol Stool Form Scale, which are subject to reporting bias and subjectivity..

CONCLUSION

This study demonstrates that both dragon fruit ice cream and dragon fruit ice cream enriched with Yakult are effective non-pharmacological interventions for reducing constipation symptoms in preschool-aged children. Quantitatively, consumption of dragon fruit ice cream alone for two weeks resulted in a marked reduction in constipation scores, with mean values decreasing from 12.9 before intervention to 4.87 after intervention, indicating a clinically meaningful improvement in stool consistency and bowel movement frequency. However, the magnitude of improvement was substantially greater when Yakult was added to the dragon fruit ice cream.

Children who consumed dragon fruit ice cream with Yakult showed a more pronounced reduction in constipation scores, from a baseline mean of 11.37 to 1.73 after the intervention. The between-group comparison revealed a statistically significant difference in post-intervention constipation scores ($p = 0.000$), confirming that the addition of Yakult significantly enhanced the intervention's effectiveness compared with dragon fruit ice cream alone. The average reduction in constipation score was also higher in the combination group (mean difference = 9.586) than in the dragon fruit ice cream group (mean difference = 8.138), supporting a synergistic effect between dietary fiber from dragon fruit and probiotic bacteria from Yakult.

The findings demonstrate that dragon fruit ice cream enriched with Yakult represents a more effective, child-friendly, and nutritionally beneficial alternative to dragon fruit ice cream alone for alleviating functional constipation in preschool-aged children. This functional food approach may serve as a practical strategy to

increase fiber and probiotic intake in young children who are typically reluctant to consume fruits and vegetables, and it has strong potential for application in community-based nutrition and child health programs.

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Competing Interests:

We declare no conflict of interest,

Ethical Statement:

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted following the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Health research (Project identification code: 05/KEPK/EC/VIII/2023, Date of approval: August 06, Name of the Ethics Committee: Health Research Committee of Health Polytechnic Bandung, Health Ministry, Indonesia).

AI Statement:

We use CHATGPT 4.0 tools for apart such as to find limitation of this study. We analyze, check and change it to suit the actual situation.

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