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MINI REVIEW

Health Benefits of Water Kefir Consumption

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Abstract

Water kefir is a non-dairy fermented beverage produced by the fermentation of sugar-rich solutions by a symbiotic consortium of Lactic Acid Bacteria (LAB), Acetic Acid Bacteria (AAB), and yeasts embedded in a polysaccharide matrix. Unlike milk kefir, water kefir is suitable for individuals with lactose intolerance, milk protein allergies, and those following vegan diets. This mini review critically examines original research articles investigating the health-related properties of water kefir. Experimental evidence from *in vitro* assays and *in vivo* animal models demonstrates that water kefir exhibits antioxidant, anti-inflammatory, antibacterial, detoxifying, antidiabetic, and gut microbiota-modulating activities. Studies have shown protective effects in experimental models of colitis and type 2 diabetes, as well as mycotoxin detoxification and safety in subchronic toxicity assessments. The bioactive properties are attributed to both viable microorganisms and fermentation-derived postbiotics, including organic acids, Exopolysaccharides (EPS), and phenolic compounds. Despite these promising preclinical findings, well-designed human clinical trials remain scarce. This review synthesizes the current evidence, highlights consistencies and limitations across studies, and identifies directions for future research to establish water kefir as a functional beverage for human health.

Introduction

Water kefir, also known as tibicos or sugary kefir, is a traditional fermented beverage with origins traced to the Caucasus region and Mexico. Unlike its dairy counterpart, water kefir is produced by fermenting sugar-rich water — typically supplemented with dried or fresh fruits — with water kefir grains. These grains are not true grains but rather a symbiotic culture of bacteria and yeasts embedded in a dextran polysaccharide matrix [1,2].

The microbial composition of water kefir is highly diverse and

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includes Lactic Acid Bacteria (LAB) such as *Lactobacillus hilgardii*, *Lactobacillus harbinensis*, *Lactobacillus nagelii*, and *Liquorilactobacillus satsumensis*; Acetic Acid Bacteria (AAB) such as *Acetobacter fabarum* and *Acetobacter lovaniensis*; and yeasts including *Saccharomyces cerevisiae*, *Dekkera bruxellensis*, and *Zygotorulaspora florentina* [3-5]. This microbial consortium varies depending on geographical origin, fermentation substrates, and environmental conditions, contributing to significant heterogeneity in the final product's composition and bioactivity [6].

In recent years, water kefir has attracted growing scientific interest as a non-dairy potential probiotic beverage suitable for individuals with lactose intolerance, milk protein allergies, or those adhering to vegan diets. While the health benefits of milk kefir have been extensively characterized, research on water kefir's functional properties has expanded considerably over the past decade. Experimental studies have suggested that water kefir may exert antioxidant, anti-inflammatory, antibacterial, detoxifying, and antidiabetic effects, largely attributed to its diverse microbial community and the bioactive metabolites produced during fermentation [7].

This mini review aims to critically analyze the available original research evidence regarding the potential health benefits of water kefir, focusing on findings from *in vitro* and *in vivo* studies, while identifying methodological limitations and gaps that need to be addressed in future research.

Methodology

A targeted literature search was conducted using PubMed, Scopus, and Web of Science databases covering the period from 2011 to 2026 (last 15 years). The final database search was performed in June 2026. The search terms included combinations of "water kefir," "sugary kefir," "tibicos," "health," "probiotic," "antioxidant," "anti-inflammatory," "antidiabetic," "antimicrobial," and "gut microbiota." Inclusion criteria were: (i) original research articles (not reviews), (ii) studies specifically investigating water kefir (not milk kefir alone), (iii) articles reporting health-related outcomes *in vitro* , *ex vivo*, or *in vivo*, and (iv) studies published in peer-reviewed journals. Studies on milk kefir were included only when they provided direct comparative data with water kefir. No language restrictions were applied. A total of 18 original research articles and 4 reviews were identified through database searching. After screening for relevance and adherence to the objectives of this review, 14 articles were selected for detailed analysis and are discussed in this review. Of these, 9 original research articles on the health effects of water kefir are summarized in table 1.

Results

Antioxidant and anti-inflammatory properties

The antioxidant capacity of water kefir has been demonstrated through multiple experimental approaches. Masarudin, et al. [4] conducted a comprehensive analysis of water kefir fermented in Malaysia using UHPLC-TWINS-QTOF-MS and identified flavonoid and phenolic acid derivatives as the major bioactive compounds responsible for antioxidant activity. In a subchronic toxicity study on BALB/c mice, oral administration of water kefir significantly enhanced Superoxide Dismutase (SOD) and Ferric Reducing Antioxidant Power (FRAP) activities, while Reducing Nitric Oxide (NO) levels, particularly in brain and kidney tissues. Importantly, no toxicological signs, behavioral changes, or adverse effects were observed during the 28-day treatment period, confirming the safety of water kefir for consumption.

Lee, et al. [7] compared the antioxidant properties of water kefir fermented with

Table 1: Summary of original studies on the health benefits of water kefir included in this review.

Study	Study Design	Key Findings	Main Conclusions
[4]	In vivo (BALB/c mice) + in vitro chemical analysis	Enhanced SOD and FRAP activities; reduced NO levels in brain and kidney tissues; no toxicological signs in 28-day subchronic toxicity study; identified flavonoid and phenolic acid derivatives as major antioxidant compounds.	Water kefir is safe for consumption and exhibits antioxidant properties mediated by phenolic compounds and organic acids.
[7]	In vitro (chemical and enzymatic assays)	Deep ocean water (DOW)-fermented kefir showed highest antioxidant activity (DPPH, ABTS); highest organic acid content (gluconic, lactic, acetic); α-glucosidase inhibitory activity; superior antimicrobial efficacy against pathogens.	Water source significantly influences the biochemical and functional properties of water kefir; DOW enhances bioactive metabolite production.
[8]	In vivo (DSS-induced colitis mouse model)	Ameliorated disease severity: attenuated body weight loss, restored colon length, reduced DAI scores; restored tight junction proteins (occludin, ZO-1, claudin-1); modulated cytokine balance via TLR4-MyD88-NF-κB pathway inactivation.	Water kefir microbiota prevents intestinal inflammation through anti-inflammatory and microbiota-balancing mechanisms.
[9]	In vitro (microbial binding and degradation assays)	Water kefir grains effectively reduced aflatoxin B1 (AFB1) concentrations through microbial binding and metabolic degradation.	Water kefir grains have potential as a natural detoxifying agent for food safety applications.
[10]	In vivo (STZ-induced diabetic Wistar rats)	Significant reduction in fasting blood glucose; improved body weight; reduced total cholesterol, triglycerides, LDL, and VLDL; increased HDL levels after 5-week treatment.	Water kefir exhibits anti-hyperglycemic and anti-hyperlipidemic activities, potentially mediated by exopolysaccharides and microbial content.
[11]	In vivo (HFD/STZ-induced type 2 diabetes mouse model)	Improved insulin tolerance (reduced AUC); regulated hepatic genes related to glucose homeostasis and lipid metabolism after 14-week treatment.	Lactobacillus paracasei isolated from water kefir contributes to antidiabetic effects through insulin sensitivity improvement.
[12]	In vitro (SHIME model of human gut microbiota)	Both fresh and pasteurized water kefir increased SCFA production; reduced intestinal permeability; modulated cytokine production (decreased IL-1β, increased IL-10) in a donor-dependent manner.	Water kefir modulates gut microbiota and intestinal barrier function; postbiotic metabolites remain bioactive after pasteurization.

[13]	Human intervention study (exploratory single-arm trial, n=40, 14 days)	Significant shifts in β-diversity; increased relative abundance of Blautia and Roseburia; decreased Clostridium sensu stricto.	First human evidence supporting gut microbiota-modulating properties of water kefir in healthy adults.
[14]	In vitro (microbial characterization and probiotic assays)	Isolated 36 microbial strains with adhesion capacity, bile salt resistance, and bacteriocin/vitamin production; EPS from L. satsumensis showed prebiotic properties promoting Bifidobacterium and Lactobacillus growth.	Water kefir harbors diverse microorganisms with probiotic potential; EPS exhibit prebiotic activity.

Note: Studies are listed in the order discussed in the text.
EPS: Exopolysaccharides; **SCFA:** Short-Chain Fatty Acids; **SOD:** Superoxide Dismutase; **FRAP:** Ferric Reducing Antioxidant Power; **DAI:** Disease Activity Index; **STZ:** Streptozotocin; **HFD:** High-Fat Diet.

different water sources — deionized water (DW), deep ocean water (DOW), and natural mineral water (NMW). Water kefir fermented with DOW exhibited the highest antioxidant activity, as measured by DPPH and ABTS radical scavenging assays. This enhanced activity was correlated with higher concentrations of organic acids, including gluconic, lactic, and acetic acids, produced during fermentation. The authors attributed this effect to the rich mineral profile of DOW, which stimulates microbial metabolism and the production of antioxidant metabolites.

Regarding anti-inflammatory effects, Ye, et al. [8] investigated the preventative effects of water kefir microbiota in a Dextran Sodium Sulfate (DSS)-induced colitis mouse model. Water kefir microbiota administration effectively ameliorated disease severity, as evidenced by attenuated body weight loss, restored colon length, reduced spleen index, and decreased Disease Activity Index (DAI) scores. Histological analysis confirmed reduced colonic tissue damage. At the molecular level, water kefir microbiota restored the expression of tight junction proteins (occludin, ZO-1, and claudin-1) and modulated the balance of pro-inflammatory cytokines (IL-1β, IL-6, TNF-α, COX-2, iNOS) and anti-inflammatory cytokine IL-10. Mechanistically, these effects were mediated through inactivation of the TLR4-MyD88-NF-κB signaling pathway.

Antibacterial and detoxifying properties

The antibacterial activity of water kefir has been attributed to the production of organic acids (lactic, acetic, and gluconic acids), bacteriocins, and other antimicrobial metabolites during fermentation. Lee, et al. [7] demonstrated that water kefir fermented with DOW exhibited superior antimicrobial efficacy against pathogenic bacteria compared to those fermented with DW or NMW, correlating with its higher organic acid content.

In the context of detoxification, Ouyang, et al. [9] investigated the application of water kefir grains for the detoxification of aflatoxin B1 (AFB1), a potent mycotoxin with hepatocarcinogenic properties. The study demonstrated that water kefir grains effectively reduced AFB1 concentrations through microbial binding and metabolic degradation, highlighting the potential of water kefir as a natural detoxifying agent in food safety applications.

Antidiabetic and antihyperlipidemic effects

The antidiabetic potential of water kefir has been explored in both *in vitro* and *in vivo*

models. Alsayadi, et al. [10] evaluated the anti-hyperglycemic and anti-hyperlipidemic activities of water kefir in Streptozotocin (STZ)-induced diabetic Wistar rats. Administration of water kefir at concentrations of 10%, 20%, and 30% in drinking water for five weeks significantly reduced fasting blood glucose levels compared to untreated diabetic controls. Additionally, water kefir treatment improved body weight and ameliorated dyslipidemia, with significant reductions in total cholesterol, triglycerides, LDL, and VLDL, and increased HDL levels. The authors suggested that these effects may be mediated by exopolysaccharides and the microbial content of water kefir.

More recently, Talib, et al. [11] investigated the anti-diabetic potential of *Lactobacillus paracasei* isolated from Malaysian water kefir grains in a high-fat diet/streptozotocin (HFD/STZ)-induced type 2 diabetes mouse model. After 14 weeks of treatment, the *L. paracasei* strain significantly improved insulin tolerance, reducing the area under the curve compared to untreated diabetic controls (2017.50 ± 347.09 *vs.* 3884.50 ± 39.36 mmol/L·min at the high dose). Gene expression analysis of the liver revealed that treatment regulated several genes related to glucose homeostasis and lipid metabolism. These findings indicate that specific probiotic strains isolated from water kefir contribute to its antidiabetic effects and provide mechanistic insights beyond those obtained with whole water kefir.

Complementing these findings, Lee, et al. [7] demonstrated that water kefir exhibited α-glucosidase inhibitory activity *in vitro* , with DOW-fermented kefir showing the highest inhibition. α-Glucosidase inhibitors delay carbohydrate digestion and glucose absorption, representing a therapeutic strategy for managing postprandial hyperglycemia in type 2 diabetes. The inhibitory activity was strongly correlated with acetic acid content, suggesting that organic acids are key contributors to the antidiabetic potential of water kefir.

Gut Microbiota modulation and probiotic potential

Using an *in vitro* approach, Calatayud, et al. [12] evaluated the effects of water kefir and derived pasteurized beverages on gut microbiota composition and intestinal barrier function using the Simulator of the Human Intestinal Microbial Ecosystem (SHIME) model. Both fresh and pasteurized water kefir modulated the metabolic activity of the gut microbiota, increasing short-chain fatty acid (SCFA) production. Notably, pasteurized water kefir retained some modulatory capacity, suggesting that fermentation-derived postbiotic metabolites contribute to gut microbiota modulation independently of viable microorganisms. Additionally, both formulations reduced intestinal permeability and modulated cytokine production, decreasing pro-inflammatory interleukin (IL)-1β while increasing anti-inflammatory IL-10 levels in a donor-dependent manner.

The effects of water kefir on gut microbiota composition have been investigated in the context of intestinal inflammation. Ye et, al. [8] reported that water kefir microbiota administration in DSS-induced colitis mice significantly improved the composition and metabolic function of intestinal microbiota, counteracting the dysbiosis induced by DSS treatment. This microbiota-modulating effect was associated with the restoration of beneficial bacterial populations and suppression of pro-inflammatory microbial taxa.

More recently, de Mel, et al. [13] conducted the first human intervention study investigating the effects of water kefir consumption on gut microbiota composition in healthy adults. In a 14-day exploratory single-arm trial with 40 participants (aged 18-65 years), daily consumption of water kefir led to significant shifts in β-diversity, indicating changes in overall microbial community structure. Specific

taxonomic shifts included an increase in the relative abundance of *Blautia* and *Roseburia*, genera associated with beneficial metabolic functions and SCFA production, as well as a decrease in the relative abundance of *Clostridium sensu stricto*. Although the study was exploratory in nature, with no formal power calculation and no assessment of functional or metabolic outcomes, these findings provide the first human evidence supporting the microbiota-modulating properties of water kefir previously observed in preclinical models.

The probiotic potential of microorganisms isolated from water kefir has also been characterized. Luang-In, et al. [14] isolated 36 microbial strains from Thai water kefir and evaluated their probiotic-related traits, including adhesion capacity, bile salt resistance, and production of bacteriocins and vitamins. Several strains exhibited promising probiotic characteristics. Furthermore, exopolysaccharides (EPS) produced by *Liquorilactobacillus satsumensis* strains isolated from water kefir demonstrated prebiotic properties, selectively promoting the growth of beneficial bacteria such as *Bifidobacterium* and *Lactobacillus* species, along with increased short-chain fatty acid (SCFA) production.

Safety assessment

The safety of water kefir consumption has been validated in animal models. Masarudin, et al. [4] conducted a 28-day subchronic toxicity study in BALB/c mice and found no toxicological signs, behavioral changes, or adverse histopathological effects in the liver, kidney, spleen, or brain at both low and high doses. These findings support the traditional use of water kefir as a safe beverage for human consumption.

Discussion

The collective evidence from original research articles indicates that water kefir possesses multiple health-promoting properties, including antioxidant, anti-inflammatory, antibacterial, antidiabetic, and gut microbiota-modulating activities. These findings are broadly consistent across different experimental models and independent research groups, lending credibility to the functional potential of water kefir.

The inclusion of recent *in vitro* mechanistic studies has further strengthened the evidence base. Calatayud, et al. [12] demonstrated that water kefir, even in pasteurized form, can modulate gut microbiota activity and reduce intestinal permeability in a simulated human intestinal environment, suggesting that both viable microorganisms and postbiotic metabolites contribute to its bioactivity. This finding aligns with the multi-omics observations of functional redundancy reported by Moreira, et al. [5] and supports the concept that metabolic output — rather than specific viable taxa — may drive key health effects.

A notable strength of the current evidence base is the convergence of findings from multiple methodological approaches. The antioxidant properties have been confirmed through both chemical assays (DPPH, ABTS, FRAP) and biological markers (SOD, NO levels) in animal models [4,7]. The anti-inflammatory effects observed in the DSS-induced colitis model [8] are supported by mechanistic evidence at the molecular level, including modulation of the TLR4-MyD88-NF-κB pathway and restoration of intestinal barrier integrity. The antidiabetic effects have been demonstrated through both *in vivo* glycemic control (Alsayadi, et al. [10]) and *in vitro* enzyme inhibition assays [7].

However, several limitations must be acknowledged. First, the available evidence remains predominantly preclinical, derived from *in vitro* assays and animal models. While the recent human trial by de Mel, et al. [13] represents an important step forward, it was an

exploratory single-arm study with a relatively small sample size (n = 40), short duration (14 days), and no control group, limiting the strength of its conclusions. Well-designed randomized controlled trials are critically needed to validate these preliminary findings in human populations. Second, the substantial variability in water kefir microbial composition — influenced by grain origin, fermentation substrates, mineral content, and environmental conditions — poses a significant challenge for reproducibility and standardization. As demonstrated by Cufaoglu & Erdinc [3] and Moreira, et al. [5], different water kefir inocula can yield distinct microbial communities and metabolic profiles, complicating direct comparisons across studies. Third, the dosage and administration protocols vary widely across studies, from 10-30% water kefir in drinking water [10] to specific microbial fractions [8,11], making it difficult to establish standardized consumption recommendations.

The multi-omics approach employed by Moreira, et al. [5] revealed functional redundancies in water kefir fermentations despite taxonomic differences, suggesting that the metabolic output — rather than specific microbial taxa — may be the key determinant of health effects. This finding underscores the importance of fermentation-derived postbiotics, including organic acids, EPS, and phenolic compounds, which may contribute to bioactivity independently of viable cells.

Practical limitations

Despite the promising health-related properties demonstrated in preclinical models, several practical limitations must be acknowledged when considering water kefir as a functional beverage. First, batch-to-batch variability represents a major challenge for reproducibility. Even when using the same kefir grain inoculum, factors such as fermentation temperature, duration, carbohydrate source, fruit supplementation, and water mineral composition can significantly alter the final microbial composition and metabolite profile [5,7]. This inherent variability makes it difficult to ensure consistent bioactivity across different production batches. Second, there is a lack of standardized production protocols. Unlike many industrialized food products, no universally accepted parameters exist — such as minimum fermentation time, minimum viable microbial counts, or specific organic acid profiles — for a product to be labeled as "water kefir." This regulatory gap means that commercially available water kefir products may differ substantially in their composition and functional properties. Third, these challenges have direct implications for scalability, limiting the transition of water kefir from an artisanal homemade beverage to a commercially viable functional food product with consistent quality. Finally, from a consumer perspective, the absence of standardization means that products marketed as water kefir may vary widely in their health effects, potentially undermining consumer trust and hindering the translation of preclinical findings into real-world health benefits.

Conclusion

This mini review synthesized the current original research evidence on the health benefits of water kefir consumption. Experimental studies have demonstrated that water kefir exhibits antioxidant, anti-inflammatory, antibacterial, detoxifying, antidiabetic, and gut microbiota-modulating properties in preclinical models. The safety of water kefir has been confirmed in animal toxicity studies, supporting its traditional use as a fermented beverage. Preliminary human evidence, although still limited, has begun to emerge, with the first intervention study reporting shifts in gut microbiota composition following water kefir consumption in healthy adults.

Table 2: List of Abbreviations.

Abbreviation	Full Form
AAB	Acetic Acid Bacteria
ABTS	2,2'-Azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)
AFB1	Aflatoxin B1
AUC	Area Under the Curve
COX-2	Cyclooxygenase-2
DAI	Disease Activity Index
DOW	Deep Ocean Water
DPPH	2,2-Diphenyl-1-picrylhydrazyl
DSS	Dextran Sodium Sulfate
DW	Deionized Water
EPS	Exopolysaccharides
FRAP	Ferric Reducing Antioxidant Power
HDL	High-Density Lipoprotein
HFD	High-Fat Diet
IL	Interleukin
iNOS	Inducible Nitric Oxide Synthase
LAB	Lactic Acid Bacteria
LDL	Low-Density Lipoprotein
MyD88	Myeloid Differentiation Primary Response 88
NF-κB	Nuclear Factor kappa B
NMW	Natural Mineral Water
NO	Nitric Oxide
SCFA	Short-Chain Fatty Acids
SHIME	Simulator of the Human Intestinal Microbial Ecosystem
SOD	Superoxide Dismutase
STZ	Streptozotocin
TLR4	Toll-Like Receptor 4
TNF-α	Tumor Necrosis Factor alpha
VLDL	Very Low-Density Lipoprotein
ZO-1	Zonula Occludens-1

Note: Abbreviations are listed in alphabetical order.

Despite these encouraging findings, significant gaps remain. The translation of preclinical results to human health outcomes requires well-designed randomized controlled trials using standardized water kefir formulations with clearly defined microbial composition and dosage regimens. Future research should also prioritize: (i) the identification and characterization of specific bioactive postbiotics responsible for health effects; (ii) investigation of the synergistic interactions between water kefir microorganisms and the host gut microbiota; (iii) long-term safety assessments in human populations; and (iv) development of scalable production protocols that maintain functional bioactivity while ensuring product consistency.

In conclusion, water kefir represents a promising functional beverage with demonstrated health potential in preclinical studies and initial translational evidence from human research. Addressing the current limitations through rigorous clinical research will be essential to establish its role in human nutrition and disease prevention (Table 2).

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Conflicts of Interest

The authors declare no conflicts of interest.

References

1. Lynch KM, Wilkinson S, Daenen L, Arendt EK. An update on water kefir: microbiology, composition and production. Int J Food Microbiol. 2021;345:109128. doi:10.1016/j.ijfoodmicro.2021.109128.
2. Wichello SP, Chaves KF, Vimercati WC, Saraiva SH, Teixeira LJQ. Development, characterization, and

stability of flavored water kefir: impact of fermentation and storage. Fermentation (Basel). 2025;11(9):513. doi:10.3390/fermentation11090513.

3. Cufaoglu G, Erdinc AN. Comparative analyses of milk and water kefir: fermentation temperature, physicochemical properties, sensory qualities, and metagenomic composition. Food Biosci. 2023;55:103079. doi:10.1016/j.fbio.2023.103079.
4. Masarudin MJ, Alitheen NB, et al. Metagenomic and phytochemical analyses of kefir water and its subchronic toxicity study in BALB/c mice. BMC Complement Med Ther. 2021;21:193. doi:10.1186/s12906-021-03358-3.
5. Moreira LPD, Porcellato D, Yin X, Brennan L, et al. Water kefir multi-omics reveals functional redundancies despite taxonomic differences and the underappreciated contribution of yeast. npj Sci Food. 2025;9:6. doi:10.1038/s41538-025-00624-3.
6. De Almeida KV, Zanetti VC, Camelo-Silva C, Alexandre LA, da Silva AC, Verruck S, Teixeira LJQ. Powdered water kefir: effect of spray drying and lyophilization on physical, physicochemical, and microbiological properties. Food Chem Adv. 2024;5:100759. doi:10.1016/j.focha.2024.100759.
7. Lee JY, Kim H, Yang TH, Oh S, Kim GJ, Park S, Lee S, Mok IK, Kang DH, Kim D. Enhancing the biochemical and functional properties of water kefir: comparative effects of different water sources with emphasis on deep ocean water. J Funct Foods. 2025;132:106965. doi:10.1016/j.jff.2025.106965.
8. Ye Z, Yang X, Deng B, Liao Z, Fang X, Wang J. Prevention of DSS-induced colitis in mice with water kefir microbiota via anti-inflammatory and microbiota-balancing activity. Food Funct. 2023;14:6813-27. doi:10.1039/D3FO00354J.
9. Ouyang W, Liao Z, Yang X, Zhang X, Zhu X, Zhong Q. Microbial composition of water kefir grains and their application for the detoxification of aflatoxin B1. Toxins (Basel). 2024;16(3):107. doi:10.3390/toxins16030107.
10. Alsayadi M, Al Jawfi Y, Belarbi M, Soualem-Mami Z, Merzouk H, Sari DC, Sabri F, Ghalim M. Evaluation of anti-hyperglycemic and anti-hyperlipidemic activities of water kefir as probiotic on streptozotocin-induced diabetic Wistar rats. J Diabetes Mellit. 2014;4(2):85-95. doi:10.4236/jdm.2014.42015.
11. Talib N, Mohamad NE, Yeap SK, Ho CL, Masarudin MJ, Abd-Aziz S, Izham MNM, Kumar MR, Hussin Y, Alitheen NB. Anti-diabetic effect of *Lactobacillus paracasei* isolated from Malaysian water kefir grains. Probiotics Antimicrob Proteins. 2024;16(6):2161-80. doi:10.1007/s12602-023-10159-2.
12. Calatayud M, Borner RA, Ghyselinck J, Verstrepen L, De Medts J, Van den Abbeele P. Water kefir and derived pasteurized beverages modulate gut microbiota, intestinal permeability and cytokine production in vitro. Nutrients. 2021;13(11):3897. doi:10.3390/nu13113897.
13. de Mel R, Al Khafaji AH, Muthusamy S, Xu J, Håkansson Å. Changes in gut microbiota composition following water kefir consumption in healthy adults. Sci Rep. 2026;16:16006. doi:10.1038/s41598-026-53645-7.
14. Luang-In V, Saengha W, Yotchaisarn M, Halaslova M, Udomwong P, Deeseenthum S. Microbial strains and bioactive exopolysaccharide producers from Thai water kefir. Microbiol Biotechnol Lett. 2018;46(4):403-15. doi:10.4014/mbl.1804.04019.