ORIGINAL RESEARCH ARTICLE

Clinical impact of mindfulness meditation training combined with probiotics on postoperative gastrointestinal function, nutritional status, and psychological status in children with hypospadias

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Abstract

This study assessed the clinical impact of mindfulness meditation training combined with probiotics on children with hypospadias. A total of 126 children with hypospadias undergoing treatment in Capital Center For Children's Health, Capital Medical University from December 2021 to December 2023 were recruited as the study participants. They were randomly divided into a control group (CG) and a research group (RG) using a random number table method, with 63 in each group. Both groups received psychological nursing based on mindfulness meditation training and early enteral nutrition (EN) support. In contrast, the RG added Bifidobacterium tetravalent live bacteria capsules to enhance nutritional intervention for patients. The results showed that probiotics ameliorated intestinal microecology, enhanced intestinal mucosal barrier function, accelerated gastrointestinal function recovery, elevated nutritional status and mitigated anxiety level. We conclude that psychological nursing based on mindfulness meditation training combined with probiotics can improve gastrointestinal function recovery, strengthen nutritional status, and alleviate negative emotions in children with hypospadias. *(Afr J Reprod Health 2025; 29 [5s]: 89-96).*

Keywords: Hypospadias; children; mindfulness meditation training; probiotics; gastrointestinal function

Résumé

Cette étude a évalué l'impact clinique d'un entraînement à la méditation de pleine conscience associé à des probiotiques chez des enfants atteints d'hypospadias. Au total, 126 enfants atteints d'hypospadias, traités à l'Institut de pédiatrie de Centre de santé infantile de la capitale, Université médicale de la capitale entre décembre 2021 et décembre 2023, ont été recrutés comme participants à l'étude. Ils ont été répartis aléatoirement en un groupe témoin (GT) et un groupe de recherche (GR) selon la méthode des tables de nombres aléatoires, avec 63 personnes dans chaque groupe. Les deux groupes ont bénéficié d'un suivi psychologique basé sur un entraînement à la méditation de pleine conscience et un soutien à la nutrition entérale précoce (NE). En revanche, le GR a ajouté des capsules de bactéries vivantes tétravalentes Bifidobacterium afin d'améliorer l'intervention nutritionnelle des patients. Les résultats ont montré que les probiotiques amélioraient la microécologie intestinale, renforçaient la fonction de barrière muqueuse intestinale, accéléraient la récupération de la fonction gastro-intestinale, amélioraient l'état nutritionnel et atténuaient le niveau d'anxiété. Nous concluons que le suivi psychologique basé sur un entraînement à la méditation de pleine conscience associé à des probiotiques peut améliorer la récupération de la fonction gastro-intestinale, renforcer l'état nutritionnel et atténuer les émotions négatives chez les enfants atteints d'hypospadias. *(Afr J Reprod Health 2025; 29 [5s]: 89-96).*

Mots-clés: Hypospadias; enfants; entraînement à la méditation de pleine conscience ; probiotiques ; fonction gastro-intestinale

Introduction

Hypospadia is a common paediatric urological malformation, often occurring in male children. Hypospadias majorly is characterized by ectopic urethral opening, which can be accompanied by penile curvature and dorsal foreskin compression.[1,2] The incidence of hypospadias is reported differently both domestically and internationally, with most research reports concentrated between 1.5 ‰ and 7 ‰[3] and displaying an increasing yearly trends.[4] As hypospadias have adverse effects on the development of children's sexual organs and adult sexual function, it requires early treatment.[5]

Surgical treatment is a major treatment for hypospadias in clinical practice. Due to its unique location and the fact that multiple patients are discharged with catheters, the likelihood of

postoperative complications is high.[6,7] Research has shown that most children with hypospadias experience pain after urethroplasty.[8] In postoperative nursing process, nursing staff often focus on nursing for catheters and incision, ignoring pain and subjective feelings of the patients. Thus the affected children often cryand fail to cooperate with treatment, seriously affecting postoperative recovery and mental health.[9] It has been shown that psychological nursing based on mindfulness meditation training can alleviate pain level and improve the children's comfort.[10]

The gastrointestinal tract is one of the common secondarily damaged organs after surgery. The traumatic stress response of the body causes damage to gastrointestinal mucosa, leading to ischemia and necrosis, which can lead to damage to the gastrointestinal mucosa function barrier. This cannot only affect digestion and absorption of nutrients by the body, it can also lead to an imbalance in homeostasis of normal gut microbiota, resulting in various bacterial communities and endotoxins to shift.[11]

In recent years, probiotics have been shown to exert an effective regulatory impact on gut microbiota.[12] Probiotics refer to bacteria with beneficial physiological activities for the human body, such as bifidobacteria, lactobacilli, and yeast. The probiotic preparations applied in clinical practice include various dosage forms, including solid (capsules, tablets) or liquid (oral liquid, fermented milk), which can remarkably ameliorate gut microbiota and help enhance immunity of the body.[13] However, the effect of psychological nursing based on mindfulness meditation training combined with probiotics on children with hypospadias remains unclear.

This study applied a combination of psychological nursing based on mindfulness meditation training with probiotics to children with hypospadias to clarify its clinical impact on postoperative gastrointestinal function, nutritional status, and psychological status in children with hypospadias.

Methods

A total of 126 children with hypospadias undergoing treatment in Capital Center For Children's Health, Capital Medical University from December 2021 to December 2023 were recruited as the study participants. The inclusion criteria included: (1) meeting the diagnostic criteria for hypospadias;[14] and (2) age of ≤ 12 years old. The exclusion criteria were: (1) having other reproductive system diseases; (2) having severe heart disease; (3) child not cooperating; (4) children with mental and cognitive disorders.

The patients were randomly allocated into a control group (CG) and a research group (RG) using a random number table method. Each group comprised 63 cases. All family members of diseased children provided informed consents and signed an informed consent forms.

Nursing methods

Both groups received psychological nursing based on mindfulness meditation training.

The psychological nursing based on mindfulness meditation training was delivered in four stages.

1) Preliminary preparation: A psychological nursing team was established, consisting of a pediatric head nurse and five pediatric nurses. Nursing staff imparted knowledge related to mindfulness meditation training to children and their families, including specific methods and precautions. Nursing staff helped children to choose their preferred meditation objects and things and to inform parents who guided and supervised them daily.

2) Relax the body: Nursing staff guided the children to remove distractions and slowly close their eyes for mindfulness meditation training in a quiet environment. Nursing staff utilized their hands to gently touch the children's forehead, cheeks, chest, abdomen, and lower limbs from top to bottom. During the touch process, nursing staff slowly and gently made the children to feel comfortable. This entire stage lasted approximately 10 min.

3) Breath regulation: Nursing staff guided the children to take deep breaths according to instructions, maintain a moderate frequency, feel sensation of gas inhalation and exhalation, and guided the children to shift their attention to things they want to meditate on, after slow and steady breathing. This stage lasted 10 min.

4) Concentrate and engage in meditation: Children chose a painting, and nursing staff guided them to carefully observe scene in painting. The children closed their eyes, while the nursing staff guided them to imagine themselves and engage in associations. Furthermore, appropriate music was selected based on content of painting to make it

easier for children to engage in meditation. This entire stage lasted 15 min.
5) Different forms of mindfulness meditation training: After the children adapted and became accustomed to meditation, the nursing staff guided them to engage in various forms of mindfulness meditation training. When children experience negative emotions, nursing staff provided psychological counseling. The entire process lasted 20 min.
6) Consolidation stage: Nursing staff guided children to consolidate the above meditation training content and elevate meditation time, 25 min per session, 3 sessions per week.

Treatment methods

Both groups received early enteral nutrition (EN) support. After surgery, basic energy requirements of the children were calculated based on their weight, and nutrients were infused into the children's body through a nutrition pump within 48 h.

The RG added Bifidobacterium tetravalent live bacteria capsules on the basis of early enteral nutrition support to enhance nutritional intervention for patients. Nursing staff grinded the capsules and diluted them with appropriate amount of warm water before injecting them into the nutrition pump, three times a day. The treatment course for both groups lasted 14 days.

Outcome indicators

(1) Gastrointestinal function recovery: The postoperative exhaust time, defecating time, dietary recovery time, and out of bed activity time between both groups were recorded and compared.
(2) Intestinal microecology: The 0.5 g of fresh feces were added to sterile sodium chloride solution and tested. The instrument applied was the ATB semi-automatic microbial identification system (BioMerie, France). The result was expressed as logarithmic value of number of colony forming units per gram of wet fecal weight in lgCFU/g. The strains included Bifidobacterium, Enterobacterium, Lactobacillus, and Enterococcus.
(3) Intestinal mucosal barrier function: The serum intestinal fatty acid binding protein (I-FABP), diamine oxidase (DAO), and D-lactate levels between both groups was compared. Blood was drawn on the day of admission of children and 14 days after treatment. The I-FABP, DAO, and D-lactate levels were detected with an enzymatic spectrophotometer method.
(4) Nutrition related proteins: The changes in nutrition related protein levels between both groups before and 14 days after treatment were compared. Three 3 ml of venous blood were obtained from the patients, and were centrifugated at 2500 r/min for 8 min, and the serum was collected. The serum albumin (ALB) and prealbumin (PA) levels were measured using a fully automated biochemical analyzer.
(5) Anxiety level: The anxiety level between both groups before and 14 days after treatment were scored with the Screen for Child Anxiety Related Emotional Disorders (SCARED) scale.[15] This scale includes 5 dimensions and a total of 41 questions. Each question was selected based on its level and a 3-level scoring method was adopted. The higher the total scores, the higher the anxiety level.

Statistical analysis

Statistical analysis was carried out using SPSS 27.0 software. Quantitative data following a normal distribution were represented by ($x \pm s$), followed by independent sample t-tests for intergroup comparisons, and paired t-tests for intragroup comparisons. Counting data was expressed as percentage (%), followed by a chi square test for intergroup comparisons. The difference was statistically significant at $P < 0.05$.

Ethical clearance

This study was consistent with the ethical standards of the 1964 Declaration of Helsinki and its later amendments, and was approved by the Ethics Committee of Capital Center For Children's Health, Capital Medical University on May 11, 2021, and the ethical approval number was SHERLL2021038.

Results

Socio-demographic characteristics t between CG and RG

The comparison of socio-demographic characteristics between both groups demonstrated no statistical significance ($P > 0.05$; Table 1), indicating comparability.

Table 1: General data in both groups

Groups	N	Age (years)	Hypospadias types [n (%)] Coronal sulcus type	Penile scrotal type
CG	63	8.03±1.36	48 (76.19)	15 (23.81)
RG	63	7.92±1.32	45 (71.43)	18 (28.57)
χ^2/t		0.668	0.37	
P		0.505	0.543	

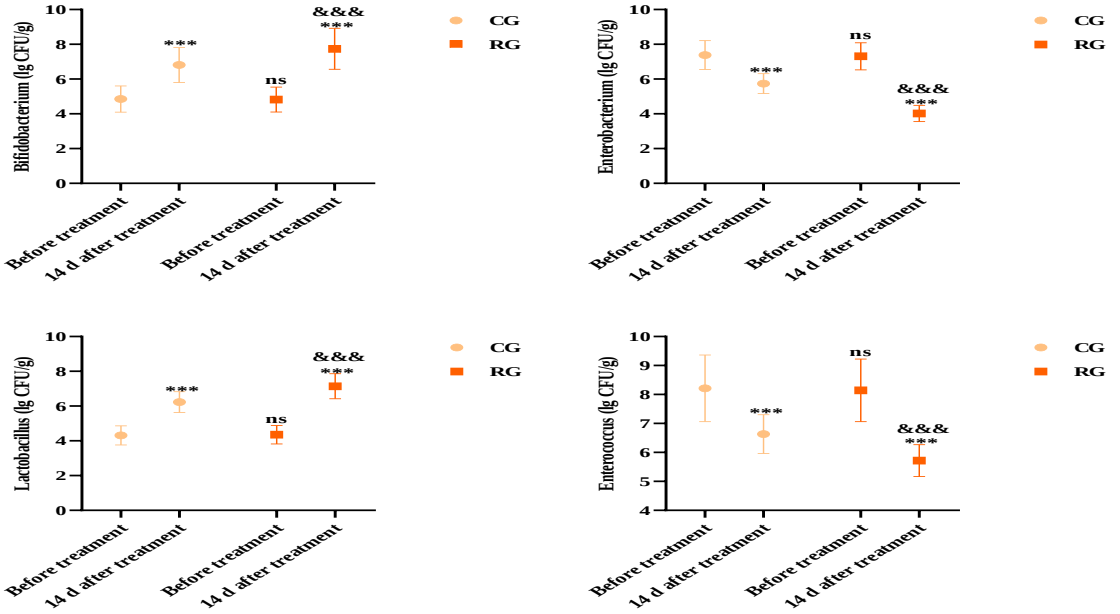

Figure 1: Intestinal microflora in both groups. Note: Versus before treatment, $^{***}P < 0.001$; versus CG, ns = no significance, $^{\&\&\&}P < 0.001$

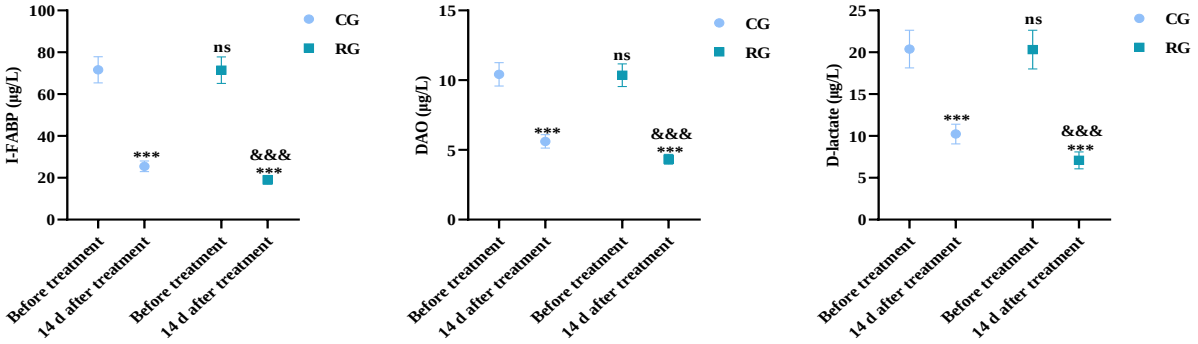

Figure 2: Intestinal mucosal barrier function indicators in both groups. Note: Versus before treatment, $^{***}P < 0.001$; versus CG, ns = no significance, $^{\&\&\&}P < 0.001$

Probiotics ameliorates intestinal microecology in RG

Before treatment, no statistical significance was shown between both groups in terms of Bifidobacterium, Enterobacterium, Lactobacillus, and Enterococcus levels (P > 0.05). After treatment, Bifidobacterium and Lactobacillus levels in both groups were elevated comparedwith those before treatment while Enterobacterium and Enterococcus levels in both groups were significantly less in comparison with those before treatment (P < 0.05);

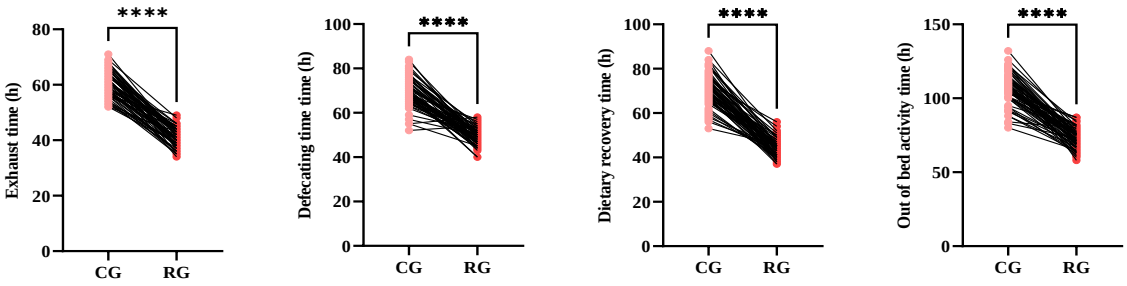

Figure 3: Gastrointestinal function recovery indicators in both groups. Note: Versus before treatment, $^{***}P < 0.001$; versus CG, ns = no significance, $^{\&\&\&}P < 0.001$

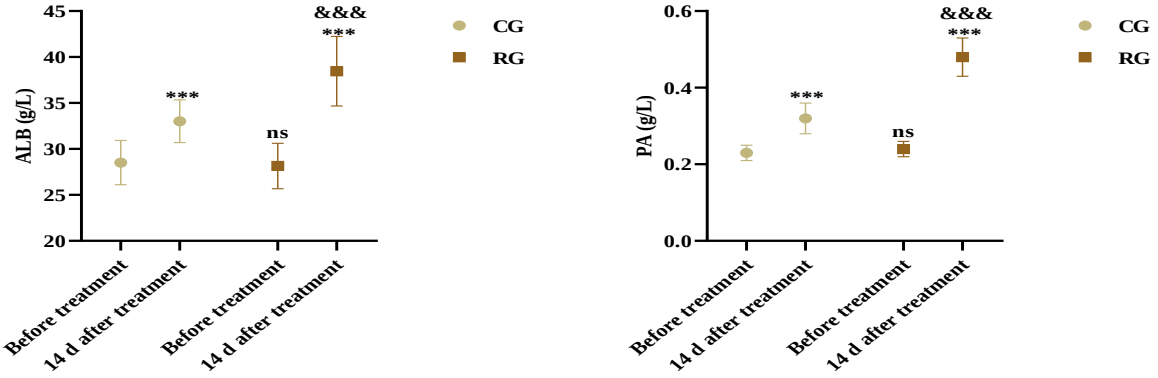

Figure 4: Nutritional indicators in both groups. Note: Versus before treatment, $^{***}P < 0.001$; versus CG, ns = no significance, $^{\&\&\&}P < 0.001$

Bifidobacterium and Lactobacillus levels in RG increased in comparison with those in the CG while Enterobacterium and Enterococcus levels were less in comparison with those in CG during the same period, implying statistical significance ($P < 0.05$; Figure 1).

Probiotics enhances intestinal mucosal barrier function in RG

Before treatment, no statistical significance was shown between both groups in terms of intestinal fatty acid binding protein (I-FABP), diamine oxidase (DAO), and D-lactate levels ($P > 0.05$). After treatment, I-FABP, DAO, and D-lactate levels in both groups demonstrated attenuation in comparison with those before treatment, and I-FABP, DAO, and D-lactate levels in RG were less in comparison with those in CG during the same period, implying statistical significance ($P < 0.05$; Figure 2).

Probiotics accelerates gastrointestinal function recovery in RG

The exhaust time, defecating time, dietary recovery time, and out of bed activity time in RG were significantly less in comparison with those in CG, ($P < 0.05$; Figure 3).

Probiotics elevates nutritional status in RG

Before treatment, no statistical significance was shown between both groups in terms of albumin (ALB) and prealbumin (PA)levels ($P > 0.05$). After treatment, ALB and PA levels in both groups were higher in comparison with those before treatment, and ALB and PA levels in RG were significantly higher in comparison with those in CG during the same period. ($P < 0.05$; Figure 4).

Probiotics mitigates anxiety level in RG

Before treatment, no statistical significance was shown between both groups in terms of Screen for

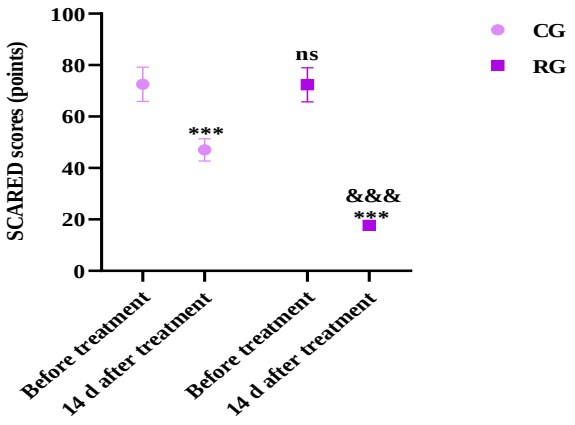

Figure 5: SCARED scores in both groups. Note: Versus before treatment, ***P < 0.001; versus CG, ns = no significance, P < 0.001

Child Anxiety Related Emotional Disorders (SCARED) scores (P > 0.05). After treatment, SCARED scores in both groups were lower in comparison with those before treatment, and SCARED scores in RG were significantly less in comparison with those in CG during the same period (P < 0.05; Figure 5).

Discussion

Hypospadias is a congenital anomaly in male children due to a combination of genetical and environmental elements.[16] With the continuous improvement of surgical techniques, the treatment effect of hypospadias is remarkable. Nevertheless, postoperative gastrointestinal complications and negative emotions remain a major challenge for medical treatment and nursing. In previous correlation analysis research, nutritional risk scores had positive correlation with anxiety and depression scores, while BMI had negative correlation with anxiety and depression scores, indicating that the higher the nutritional risk and the lower the BMI, the more evident the negative emotions of patients.[17,18] Thus, the combination of psychological nursing and nutritional intervention has crucial clinical significance for postoperative recovery of children with hypospadias.

Mindfulness meditation training is a simple and effective psychological nursing intervention method,[19] which originated from Eastern Buddhist culture with a history of thousands of years. Through mindfulness meditation training, patients can effectively regulate themselves, eliminate negative emotions, and convert them into positive emotions, thereby effectively improving their compliance and facilitating postoperative recovery.[20]

Probiotics can regulate bile acid metabolism via regulating gut microbiota, producing antibacterial substances, and interfering with intestinal mucosal adhesion, facilitating intestinal mucus secretion and synthesis of key proteins in intestinal epithelial cell junction structures, enhancing epithelial cell integrity, reducing low-grade inflammation and pathogen count, improving intestinal environment, maintaining intestinal barrier function, and regulating innate and adaptive immune systems. Research has depicted that addition of Bifidobacterium tetravalent live bacteria capsules in EN therapy exerts a promoting impact on recovery of phase movement pattern of gastrointestinal electromyographic mobility complex waves, which can effectively facilitate peristalsis rate of small intestine, thereby facilitating its absorption and emptying of nutrients; moreover, it exerts a competitive inhibitory influence on proliferation of intestinal microbiota, thereby reducing translocation of intestinal microbiota and facilitating restoration of intestinal microbiota balance.[21]

This research applied a combination of psychological nursing based on mindfulness meditation training and Bifidobacterium tetravalent live bacteria capsules. The results depicted that after treatment, Bifidobacterium and Lactobacillus levels in both groups demonstrated elevation in comparison with those before treatment while Enterobacterium and Enterococcus levels in both groups demonstrated attenuation in comparison with those before treatment; Bifidobacterium and Lactobacillus levels in RG demonstrated elevation in comparison with those in CG while Enterobacterium and Enterococcus levels demonstrated attenuation in comparison with those in CG during the same period. This indicates that probiotics can effectively improve gut microbiota status in patients. This is because supplementing probiotics can enhance intestinal barrier function of the body, help intestinal mucosa compete to block various pathogenic bacteria, and can also produce acetic acid and lactic acid in intestine, thereby enhancing immune regulatory function and reducing inflammatory responses, thereby ameliorating intestinal microbiota balance. Additionally, after treatment, I-FABP, DAO, and D-lactate levels in

both groups demonstrated attenuation in comparison with those before treatment, and I-FABP, DAO, and D-lactate levels in RG demonstrated attenuation in comparison with those in CG during the same period. This indicates that probiotics help facilitate repair of gastrointestinal mucosal barrier function in patients. Herein, exhaust time, defecating time, dietary recovery time, and out of bed activity time in RG demonstrated attenuation in comparison with those in CG. This indicates that probiotics accelerate recovery of gastrointestinal function in children. This is because addition of probiotics on the basis of EN can further restore normal intestinal permeability, reduce occurrence of enterogenous infections, elevate patient's immune system, avoid intestinal failure, and correct metabolic disorders.

Due to the fact that surgery itself can exert a partial impact on stress response of the body, postoperative diet and nutritional intake of patients are suppressed, making them prone to complications such as malnutrition.[22] ALB can maintain normal colloid osmotic pressure and pH value in blood, as well as transport and modulate physical function, immune function, and nutritional effects of metabolites, which can be applied to distinguish and diagnose diseases, as well as a vital indicator for monitoring nutritional status of the body; ALB level decreases, indicating poor nutrition or liver function damage in the body.[23] PA, a transthyroxine protein, receives synthesis by liver cells and displaying before ALB during electrophoresis separation; PA half-life is less than 48 h, and its level can be detected for liver function and protein nutritional status.[24] Herein, after treatment, ALB and PA levels in both groups demonstrated elevation in comparison with those before treatment, and ALB and PA levels in RG demonstrated elevation in comparison with those in CG during the same period. This indicates that addition of probiotics to EN exerts a marked improvement effect on nutritional status of children with hypospadias. This is because probiotics can synthesize digestive enzymes, which, together with digestive enzymes in the body, participate in nutrient digestion, stimulate secretion of digestive enzymes, elevate surface area of small intestine, and facilitate nutrient absorption. Probiotics themselves contain components such as peptidoglycan and lipoteichoic acid, which can exert immune activation effects, stimulate immune system of the body, enhance immunity, and maintain a healthy state of the body.[25] Furthermore, after treatment, SCARED scores in both groups demonstrated attenuation in comparison with those before treatment, and SCARED scores in RG demonstrated attenuation in comparison with those in CG during the same period. This indicates that probiotics can reduce negative emotions such as anxiety and maintain their mental health through ameliorating nutritional status of children.

Strengths and limitations

This was a well-designed, placebo-controlled trial. The primary limitation was limited sample size and duration of nursing.

Conclusion

The psychological nursing based on mindfulness meditation training combined with probiotics can improve intestinal microbiota status of children with hypospadias, improve intestinal mucosal barrier function, accelerate gastrointestinal function recovery, strengthen nutritional status, and alleviate negative emotions in children with hypospadias, which is worthy of clinical promotion and application.

Competing interests

The authors report no actual or potential conflicts of interest.

Authors contribution

An M and Wang L: conceived and designed the study, collected and analysed the data, as well as prepared the manuscript. All authors mentioned in the article approved the manuscript.

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