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Original Article

The effect of a new preoperative fasting regime on the subjective perception, postoperative recovery, postoperative complications, and satisfaction in pediatric patients

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Abstract: Aim: This study aimed to evaluate the effect of a new fasting regime with a 6-hour fasting from solids and a 2-hour fasting from liquids before a pediatric operation. Methods: A total of 150 children who underwent surgical treatment in our hospital were recruited as the study cohort. They were randomly divided into the traditional group (n=74) and the new group (n=76). The traditional group adopted the conventional fasting regime, and the new group adopted the new fasting regime. The outcome indicators in both groups were compared. Results: There were no significant differences in the stomach content or the stomach pH in the new and traditional groups. The perioperative hunger, gastric discomfort, thirst, and rates of nausea in the new group were significantly lower than they were in the traditional group. The times to first postoperative exhaust and defecation as well as the hospitalization times in the new group were significantly lower than they were in the traditional group. The rate of postoperative complications (7.89%) in the new group was lower than it was in the conventional group (18.92%). The communication, physical activity, facial activity, soothing effect, and sleep quality scores in the new group were lower than they were in the traditional group. The satisfaction with the nursing as rated by the parents was 93.42% in the new group, which was higher than the satisfaction rate in the traditional group (82.43%). Conclusion: The fasting regime with a 6-hour fasting from solids and a 2-hour fasting from liquids before a pediatric operation can decrease the discomfort rate in patients, improve their perioperative comfort, reduce postoperative complications, and results in higher parental satisfaction rates.

Keywords: Pediatrics, surgery, fasting from solids, fasting from liquids, subjective perception, complications, satisfaction

Introduction

All pediatric surgery patients require gastrointestinal preparation before their surgery, in which preoperative fasting from solids and liquids plays an important part [1]. In pediatric surgery, the duration for conventional preoperative fasting is 8 hours with a 4-hour fast from liquids. However, children have faster metabolisms compared to adults, with greater requirements for food and water. Long-duration fasting from solids and liquids can significantly increase the i dehydration, hypoglycemia, hunger, thirst, and other discomfort incidence rates [2, 3].

Incorporating the findings of recent research, the durations of fasting from solids and liquids were adjusted in the relevant guidelines. In 2017, the American Society of Anesthesiologists (ASA) suggested the duration of preoperative fasting should be reduced to 6 hours in the updated guidelines. The guidelines also indicated that patients of all ages were allowed to consume moderate amounts of water, tea, juice and other beverages 2 hours before the surgery and moderate amounts of digestible foods such as milk, bread, and other easy-to-digest food 6 hours before the surgery [4]. A two-year study on 400 patients who underwent elective abdominal surgeries indicated that

the new fasting regime could significantly alleviate thirst and improve metabolism during the perioperative period as well as effectively improve the insulin resistance in diabetic patients. This proved that a fasting regime with 6 hours of fasting from solids and 2 hours of fasting from liquids is safe and feasible [5].

Previous studies on preoperative fasting were mostly focused on adults, with very few studies focused on children. Some studies focusing on children examined significantly different regimes for preoperative fasting. Currently, there is no standardized and unified guideline for preoperative fasting in pediatric patients [6-8]. In fact, the gastric emptying rate in children is faster than it is in adults. The gastric emptying of water and milk only takes 1-1.5 h and 3-4 h in children [9]. Therefore, it is of more practical significance to pay attention to the study of the preoperative fasting regime in children. A total of 150 children who underwent elective surgeries were recruited for this study. The differences between the practical values of traditional fasting and the new fasting regimes were compared in detail.

Materials and methods

Materials

A total of 150 patients who underwent elective surgeries in the Department of Pediatrics in our hospital from October 2018 to December 2019 were recruited as the study cohort. Inclusion criteria: confident diagnosis of the disease, patients who underwent elective surgeries, patients who met the indications for surgery, and patients with normal gastrointestinal function before the surgery. The parents of the children were fully aware of the research and voluntarily signed the informed consent. This study was approved by the ethics committee of the First Affiliated Hospital of Hainan Medical University. Exclusion criteria: patients requiring emergency surgery, patients from the outpatient clinic, patients with contraindications to surgery or anesthesia, patients with gastroparesis, patients > 12 years old, and patients with severe diseases that interfered with the operation.

Methods

Traditional group: 12 hours fasting from solids and 4 hours fasting from liquids were planned before the surgery, and 4-5 days of postoperative fasting from both solids and liquids were carried out.

New group: A liquid diet was provided 6 hours before the surgery, and 5 ml/kg of maltodextrin and fructose drink (Approval number: TY20180010, Jinhua Zhongjia Shangpin Biotechnology Co., Ltd.) were provided 2 hours before the surgery. 5 ml warm water was given after the postoperative effects of the anesthesia faded. The patients were monitored for 10 minutes, which indicated no discomfort. 5 ml warm water was then given every 1 hour until the patients were asleep at night. On the second day, if no abdominal bloating, vomiting, or nausea were observed in the patients in the morning, 2 ml/kg maltodextrin and fructose drink was provided every one h until the patients were asleep at night. On the third day, 2 ml/kg of nutrient solutions were given, and the patients' diets were slowly transitioned to their regular, pre-surgery diets.

Assessment parameters

Stomach content and pH: We compared the stomach contents and the pH in the two groups under anesthesia. Method for measuring the stomach content: A gastric tube was inserted under general anesthesia. The gastric content was extracted using a 20 ml sterile syringe (Zhengzhou Kangjia Medical Equipment Co. Ltd.) and the volume was recorded. Stomach pH: the pH of the extracted stomach contents was measured using a pH meter (Hangzhou Mont Instruments Co., Ltd.).

Subjective perception: the incidence rates of thirst, hunger, nausea, and gastric discomfort were compared between the two groups.

Postoperative recovery: the times to first postoperative exhaust and defection as well as the hospitalization periods were compared between the two groups.

Postoperative complications: the incidence rates of postoperative wound infections, intestinal adhesions, aspirations or refluxes, and anastomotic leaks were compared between the two groups.

The comfort levels in the pediatric patients: Échelle Douleur Inconfort Nouveau-Né (EDIN) [10] was used to assess the degree of comfort.

Table 1. Comparison of the general information between the two groups ($\bar{x} \pm s$)/[n (%)]$\bar{x}$

Material		New group (n=76)	Traditional group (n=74)	t/X^2	*P*
Gender	Male	36 (47.37)	33 (44.59)	0.116	0.733
	Female	40 (52.63)	41 (55.41)		
Interval between admission and operation (d)		5.43±2.19	5.28±2.41	0.399	0.690
Age (years old)		2.01±0.67	2.05±0.65	0.371	0.711
Age group	1 year old	23 (30.26)	27 (36.49)	0.527	0.139
	2 years old	26 (34.21)	24 (32.43)		
	3 years old	27 (35.53)	23 (31.08)		
Preoperative infusion	Yes	41 (53.95)	38 (51.35)	0.101	0.750
	No	35 (46.05)	36 (48.65)		

The instrument includes five items: communication, physical activity, facial activity, soothing effect, and sleep quality, with each item scored from 0-3, for a total score of 0-15. The higher the score, the lower the level of comfort.

Parent satisfaction: the satisfaction survey was conducted based on 10 aspects including the nursing attitude, technical level, perceived quality, hospital environment, consultation, and feedback. Each item is scored by marking one of four levels that indicated 'dissatisfied', 'partly satisfied', 'satisfied', and 'very satisfied' respectively. The total score ranges between 0 and 30, in which 30 indicates 'very satisfied', 24-29 indicates 'satisfied', 18-23 indicates 'partly satisfied', and below 18 indicates 'dissatisfied'. Parent satisfaction = (the number of 'very satisfied' cases + the number of 'satisfied' cases)/total number of cases (150) * 100%.

Statistical analysis

The statistical analysis was performed using SPSS 23.0. The measurement data were expressed as ($\bar{x} \pm s$) and assessed using t tests. The count data were expressed as [n (%)] and assessed using Chi-square tests. The graphs were plotted using GraphPad Prism 8, and $P < 0.05$ indicated statistical significance.

Results

General information

There were no significant differences in the gender or age ratios or the proportions of patients who received preoperative infusions in the two groups ($P > 0.05$), nor were there any significant differences in the average intervals between admission and surgery in the two groups ($P > 0.05$) (**Table 1**; **Figure 1**).

Stomach content and pH

The stomach content of the children in the new group was (0.41±0.29) ml/kg and the stomach content in the traditional group was (0.43±0.31) ml/kg. The pH in the stomachs of the children in the new group was (2.10±0.69) and the pH in the stomachs of the children in the traditional group was (2.07±0.72). The stomach content showed no significant difference between the new group and the traditional group ($P > 0.05$). No significant difference was observed in the pH values of the stomachs in the new group and the traditional group ($P > 0.05$) (**Figure 2**).

Subjective perception

The incidence rate of hunger during the perioperative period in the new group was 7.89%, which was lower than the of 20.27% rate in the traditional group. The incidence rate of gastric discomfort in the new group was 10.53%, which was lower than the 22.97% rate in the traditional group. The incidence rate of thirst in the new group was 6.58%, which was lower than the rate of 17.57% in the traditional group. The incidence rate of nausea in the new group was 6.58%, which was lower than the rate of 20.27% in the traditional group ($P < 0.05$) (**Table 2**).

Postoperative recovery

The time to first postoperative exhaust was (15.35±5.13) hours in the new group and (19.83±6.34) hours in the traditional group.

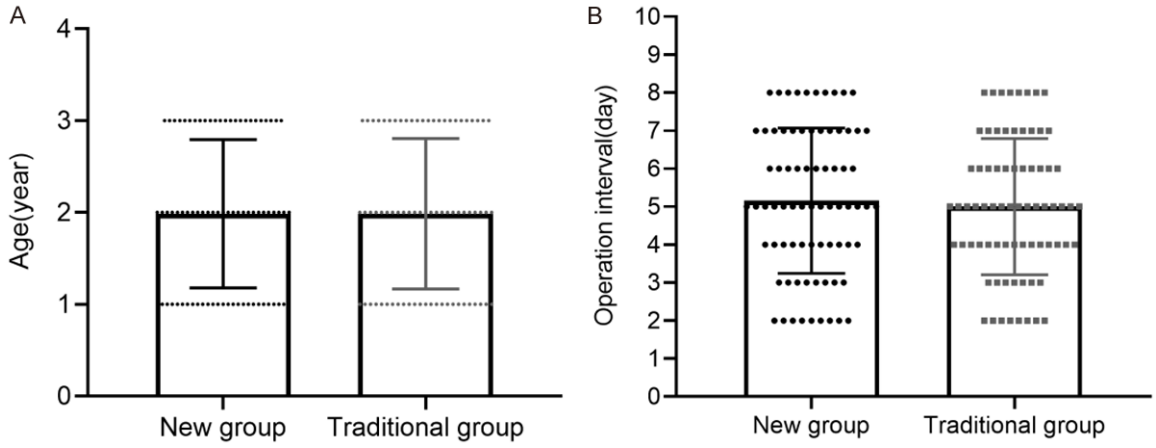

Figure 1. Age and interval between admission and surgery. The differences in age (A) and the intervals between admission and surgery (B) were not statistically significant in the two groups ($P > 0.05$).

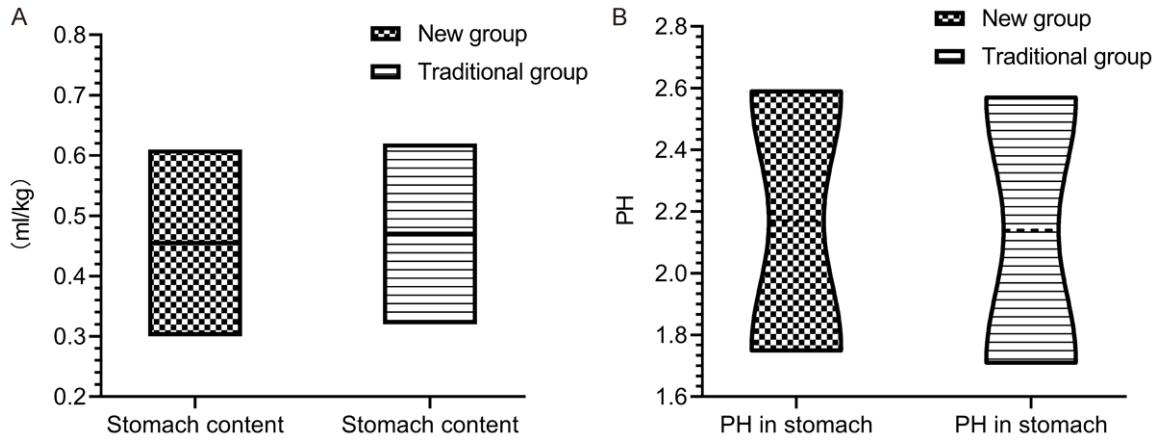

Figure 2. Stomach content, stomach pH levels. The differences in the stomach content (A) and the stomach pH levels (B) in the two groups were not statistically significant ($P > 0.05$).

Table 2. Comparison of the patients' subjective perceptions in the two groups [(n (%)]

Categories	Hunger	Gastric discomfort	Thirst	Nausea
New group (n=76)	6 (7.89)	8 (10.53)	5 (6.58)	5 (6.58)
Traditional group (n=74)	15 (20.27)	17 (22.97)	13 (17.57)	15 (20.27)
X^2	4.769	4.182	4.287	6.082
P	0.029	0.041	0.038	0.014

The time to first postoperative defecation was (22.42±4.72) hours in the new group and (27.68±5.19) hours in the traditional group. The hospitalization period was (6.28±1.75) days in the new group and (8.95±1.82) days in the traditional group. The time to first exhaust, the time to first defecation, and hospitalization period in the new group were all lower than they were in the traditional group ($P < 0.05$) (**Figure 3**).

Postoperative complications

There were 3 wound infection cases, 2 intestinal adhesion cases, 1 anastomotic leak case, and no aspiration or reflux cases in the new group, for a postoperative complications incidence rate of 7.89%. There were 6 wound infection cases, 5 intestinal adhesion cases, 2 anastomotic leak cases, and 1 aspiration or reflux case in the traditional group, for a postoperative complications incidence rate of 18.92%. The postoperative complications incidence rate in the new group was significantly lower than it

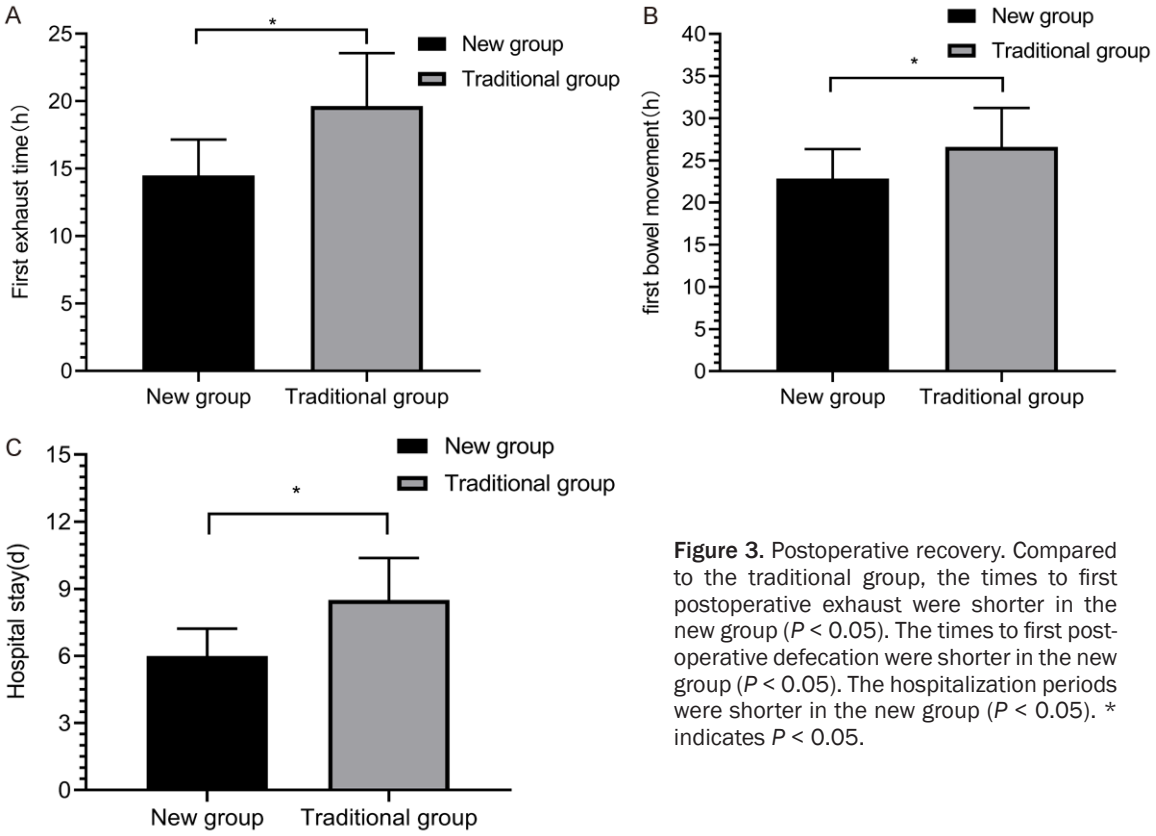

Figure 3. Postoperative recovery. Compared to the traditional group, the times to first postoperative exhaust were shorter in the new group ($P < 0.05$). The times to first postoperative defecation were shorter in the new group ($P < 0.05$). The hospitalization periods were shorter in the new group ($P < 0.05$). * indicates $P < 0.05$.

Table 3. Comparison of the postoperative complications in the two groups [n (%)]

Categories	Wound infection	Intestinal adhesion	Aspiration or reflux	Anastomotic leak	Total incidence rates
New group (n=76)	3 (3.95)	2 (2.63)	0 (0.00)	1 (1.32)	6 (7.89)
Traditional group (n=74)	6 (8.11)	5 (6.76)	1 (1.35)	2 (2.70)	14 (18.92)
X^2					3.943
P					0.047

was in the traditional group ($P < 0.05$) (**Table 3**).

The comfort levels in the children

The EDIN scores indicated that the communication scores were (0.86±0.35) in the new group and (1.72±0.51) in the traditional group. The physical activity scores were (0.82±0.39) in the new group and (1.96±0.40) in the traditional group. The facial activity scores were (0.68±0.42) in the new group and (1.76±0.43) in the traditional group. The soothing effect scores were (0.75±0.48) in the new group and (1.84±0.52) in the traditional group. The sleep quality scores were (0.62±0.52) in the new group and (1.75±0.59) in the traditional group. All the EDIN scores in the new group were significantly lower than they were in the traditional group ($P < 0.05$) (**Figure 4**).

Parent satisfaction

There were 30 responses indicating 'very satisfied' with the quality of nursing care in the new group and 23 in the traditional group. There were 41 responses indicating 'satisfied' in the new group and 38 in the traditional group. There were 5 responses indicating 'partly satisfied' in the new group and 12 in the traditional group. There were no responses indicating 'dissatisfied' in the new group and 1 in the traditional group. The parental satisfaction rate for the nursing care was 93.42% in the new group

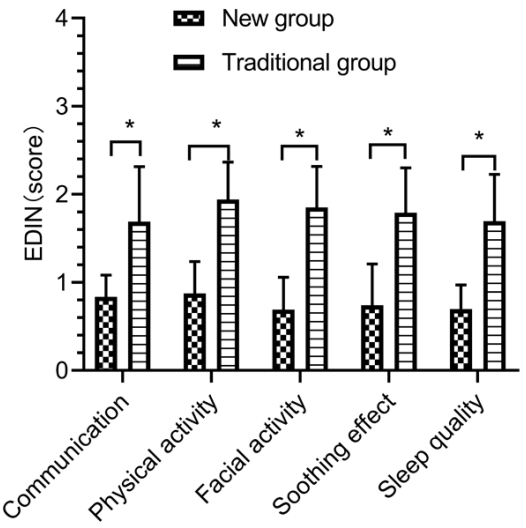

Figure 4. The children's comfort levels. Compared to the traditional group, the EDIN communication scores were lower in the new group ($P < 0.05$). The EDIN physical activity scores were lower in the new group ($P < 0.05$). The EDIN facial activity scores were lower in the new group ($P < 0.05$). The EDIN soothing effect scores were lower in the new group ($P < 0.05$). The EDIN sleep quality scores were lower in the new group ($P < 0.05$). * indicates $P < 0.05$.

and 82.43% in the traditional group, and the difference was statistically significant ($P < 0.05$) (**Table 4**).

Discussion

Fasting does not lead to an increase in the pH value in the stomach. Moreover, drinking a moderate amount of water can dilute gastric acid, decrease the acidity of the gastric acid, and stimulate gastric emptying [11]. A previous study indicated that when the stomach content reaches 0.4 ml/kg, the pH of the stomach can reach 2.5, significantly increasing the risk of aspiration pneumonia [12]. The traditional regime required a 12-hour preoperative fasting from solids and 4-hour preoperative fasting from liquids to minimize the risk of aspiration and reflux during the perioperative period [13]. However, due to the physical differences between children and adults, long-term fasting would result in greater energy expenditure, a delayed wound healing process, slower rates of tissue repair, a compromised immune system, and an increased risk of postoperative infection [14]. This study indicated that the incidence rates of wound infection in the new group with a shortened fasting period were significantly lower than the incidence rates of wound infection in the traditional group. However, the difference was not statistically significant, which could be due to the small sample size. In addition, the differences in stomach content and pH values between the two groups were not statistically significant, indicating that the adjustment of the fasting plan would not significantly affect the stomach content or pH. Physiological studies indicate that the gastric content affects the process of gastric emptying, in which the emptying of liquids increased, while the emptying of solids involves conversion into liquids and results in a significantly longer duration [15]. Hence, liquid meals provided during a certain period of time before the surgery do not have a significant effect on gastric emptying.

In order to ensure the safety and effectiveness of the shortened fasting plan, multiple studies were conducted around the world. The researchers abroad showed a preoperative 2-hour fasting from liquids in women during childbirth resulted in no occurrence of aspiration [16]. A study indicated that the moderate intake of carbohydrates 2 hours before the surgery is feasible and will not affect the surgical procedure or its safety [17]. Researchers in China proposed a new fasting regime based on the characteristics of the Chinese population. The regime involved a 6-hour preoperative fasting from solids and an intake of 500 ml syrup 2 hours before the surgery. The results indicated that the shortened fasting plan led to better subjective perception and reduced thirst with no increase in the risk of intubation or aspiration during the anesthesia [18]. In this study, the new group was given a liquid diet 6 hours before the surgery, 5 ml/kg maltodextrin and fructose drink 2 hours before the surgery, warm water after the postoperative effects of anesthesia wore off, and an increasing amount of water after no discomfort was observed after the surgery. The results showed no significant differences in the stomach contents or pH in the new group and the traditional group ($P > 0.05$). Significantly lower incidence rates of hunger, gastric discomfort, thirst and nausea during the perioperative period as well as shorter times to first postoperative exhaust and defecation, reduced hospitalization durations, decreased rates of postoperative complications, and better patient comfort levels were

Table 4. Comparison of the parent satisfaction with the nursing care in the two groups [n (%)]

Categories	More than satisfied	Satisfied	Partly satisfied	Dissatisfied	Total satisfaction
New group (n=76)	30 (39.47)	41 (53.95)	5 (6.58)	0 (0.00)	71 (93.42)
Traditional group (n=74)	23 (31.08)	38 (51.35)	12 (16.22)	1 (1.35)	61 (82.43)
X^2					4.287
P					0.038

seen in the new group ($P < 0.05$). This indicates that the new fasting regime for pediatric patients undergoing elective surgeries results in reduced rates of discomfort and a faster recovery of gastrointestinal functions with no effect on the stomach content or gastric pH. The reasons could be that the new group was given warm water at the early stages of postoperative period with an increasing amount given based on patient tolerance, which stimulated an early operation of the gastrointestinal tract and thus a faster recovery of gastrointestinal function after the surgery [19, 20]. Studies indicate that a prolonged fasting period before the surgery would induce a more significant stress response as well as a higher risk of insulin resistance or more severe conditions in the patients who already have insulin resistance during the perioperative period [21]. The function of insulin is closely related to the function of the immune system and the wound healing process after surgery. It is important to maintain normal insulin function before the surgery in order to reduce postoperative infections [22, 23]. Some guidelines did not recommend the long-term suspension of oral feeding after the surgery. Instead, the timing of oral feeding should be based on patient tolerance and the types of surgeries, and most of the patients were introduced to oral feeding within hours after the operation [24]. The traditional fasting regime required 4-5 days of fasting from solids and liquids, which would significantly hinder the postoperative recovery. This study showed that the parental satisfaction with the nursing care was 93.42% in the new group, significantly higher than the rate of 82.43% in the traditional group ($P < 0.05$). The reason could be that the new fasting regime involved the early providing of water after the surgery, which could alleviate postoperative fatigue and negative emotions and encourage early ambulation that further accelerates the recovery of gastrointestinal functions, protects the function of the gastrointestinal mucosa, and avoids dysbiosis [25]. The patients' faster recovery and discharge resulted in a smaller medical burden and increased relief among the parents who then expressed higher levels of satisfaction with the nursing care.

In conclusion, the fasting regime with 6 hours of fasting from solids and 2 hours of fasting from liquids before pediatric operations can decrease the discomfort rate in patients, improve the comfort levels during the perioperative period, reduce the postoperative complications, resulting in higher satisfaction among the parents. However, this study had a relatively small sample size which resulted in bias and a lack of comprehensiveness in the results. Further studies should be conducted with a larger sample size and a focus on multiple aspects. Prospective studies should also be carried out to obtain more scientific and representative conclusions.

Disclosure of conflict of interest

None.

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