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Effect of returning versus discarding gastric residual volume on enteral feeding outcomes among critically ill children: A randomized control trial

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Abstract
Background and Aim: Enteral feeding is the recommended and preferred feeding method for critically ill children with a functional gastrointestinal system because of its lower cost and complication rates when compared with parenteral nutrition. The study was aimed to evaluate the effect of returning versus discarding gastric residual volume on enteral feeding outcomes among critically ill children.
Subjects and Method: randomized controlled trial comparison study was utilized to conduct the current study. A total sample of 100 critically ill children was recruited from pediatric intensive care unit of El-Monira Children Hospital-Cairo University and assigned randomly into the study and the control group. Data were collected by a structured interview questionnaire and Subjective Global Nutrition Assessment Form (SGNA).
Results: there were a statistical significant difference in the total mean score of children' respiration and pulse at the 2nd, 3rd and 4th day, sodium and potassium levels at 3rd and 4th day and a highly statistical significant difference between both groups regarding the SGNA at 1st, 3rd and 4th day but there was no statistical significant difference between both groups at 2nd day.
Conclusion: Better feeding outcomes were seen in children who their residual volume was discarded. However, a majority of children followed the discarding method had lower electrolyte levels than the returning group.

Keywords: Children, discarding, enteral feeding, returning, residual volume

Introduction
Enteral feeding (EF) is the recommended method of feeding for critically ill children with a functional gastrointestinal system since it is less expensive and has less complication than parenteral nutrition (PN) [1]. The American Society for Parenteral and Enteral Nutrition (ASPEN) provides a definition of it as a method of supplying food directly into the gastrointestinal system by a stoma, catheter, or tube, avoiding the nasal or mouth cavities [2].
Evidence based practices showed that early institution of EF for children that are critically ill are linked to beneficial consequences and has become more prevalent during critical illness [3]. Nonetheless, despite the proportional benefits, providing secure and efficient enteral feeding may still reveal challenges in terms of effort, expense, and technical expertise [4]. Subsequent maintenance of enteral nutrient delivery remains elusive and studies showed that EF In place of safe procedures that are supported by evidence, rituals and personal beliefs are used to implement practices, and critically ill children due to variations in practise, do not receive the required nutritional support [5].
Inappropriate delivery of EF is still a problem for critically ill children. Only 37% of children seeking intensive care received the recommended amount of calories, according to an international study [6] and many critically ill children do not achieve the goal of EF and are highly susceptible to problems include lung aspiration, feeding intolerance, and gastrointestinal retention [7]. In this population, It is frequently accompanied by significant gastric residual volumes, which could raise the risk of vomiting and regurgitation and delay the fulfillment of nutritional objectives [8]. To improve the outcomes of critically ill children, researchers must investigate ways to maximize the benefits and minimize the problems of feeding tubes for nutrition support. [3].

Gastric residual volume is the volume of liquid expelled from a stomach after receiving EF at a given point in time to determine whether the feedings are being tolerated and digested then utilized to manage the progression of feeding [9]; GI juice secretion and infused nutritional content make up the majority of this liquid. GRV is measured either by gravity drainage to a reservoir or aspiration using a syringe. GRV is the most preferred clinical marker for stomach emptying due to its ease of application**.** Frequent GRV measurements are required for GRV monitoring. With the help of GRV monitoring, healthcare professionals might be able to detect children who have delayed stomach emptying earlier and can use preventative measures to lessen the negative effects of FI. [10].

Gastric residual volume monitoring is standard policy and holds a significant position in the suggestions in Pediatric Intensive Care Units (PICUs), a crucial part of EF management and helps to avoid problems caused by EF. It is likely one of the most established and widely used nursing techniques in the intensive care unit as well. [11]. More than 97% of nurses, according to the American Society of Critical Care Nurses, reported measuring GRV. By monitoring GRV, the nurse could identify the child's delayed gastric emptying early and take appropriate action. Implementing GRV protocol improved the outcomes for critically ill children, yet unlike many other therapeutic practices, GRV management criteria are not supported by evidence. And little guidance provided about the technique [12].

There is a lot of disagreement in the nursing literature on whether the gastric aspirate should be returned to the child or discarded and the effects and safety of discarding or returning gastric aspirates remain uncertain. So, further studies are required in order to confirm this observation and establish its applicability when offering EF to the critically ill children [13].

Some nurses discard gastric contents while others return it to the child, either totally or partially, depending on their assessment. Individual beliefs, group custom, and professional opinion or nurse's experience guide the decision [8]. To return or discard GRV is a crucial query that demands careful confirmation. According to some authors, injecting stomach content after aspiration can help to maintain the electrolyte balance and gastric juices [12]. Others hypothesize that discarding is the most advantageous course of action to prevent tube contamination, infection risks, tube problems such blockage, aspiration pneumonia, and volume retention due to delayed gastric emptying. [14].

Therefore, more rigorous studies are required to confirm the effects of returning or discarding remaining stomach aspirates and to give reliable information and recommendations for clinical care [15]. After carefully evaluating the potential benefits and hazards of such therapy, the discarding or returning of remaining stomach aspirates should be highly customized and used effectively, taking specific short- and long-term goals into account as well as any prospective benefits and drawbacks [16].

Significance of the study

Critically ill children admitted to PICUs range from 75 to 166 per 100,000 children worldwide every year [17]. Although providing nutrition support to seriously ill children has been seen as a crucial component of treatment in PICUs worldwide and EF is fundamentally important for better child clinical evolution, The best method for enteral feeding is still up for dispute [18]. To confirm the function of discarding or returning GRV, more meticulously planned, multi-center, large-sample randomized controlled trials must be carried out. [16].

In Egypt there are no studies carried out to compare the effectiveness of returning versus discarding gastric residual volume on critically ill children' enteral feeding outcomes, so, it is essential to evaluate the effectiveness of these types of intervention. A better knowledge of effective enteral feeding interventions for critically ill children will guide the clinical practice and future research. Therefore, this study will be conducted to evaluate the effect of returning versus discarding gastric residual volume on enteral feeding outcomes among critically ill children. Hopefully the findings of current study can improve the outcomes of PICU children with EF and provide evidence based data that can develop the nursing practice.

Operational definition

1. Enteral feeding refers to feeding given via nasogastric tube.
2. Enteral feeding outcomes refer to:

a. Nutritional status (nutrition-focused medical history and physical examination)
b. Nutritional markers (Hb, albumin)
c. Biochemistry results refer to electrolyte levels, such as potassium, sodium, and blood glucose level.
d. Physiological status; vital signs (respiration, pulse & temperature) and oxygen saturation.

Aim of the study

The aim of the current study was to evaluate the effect of returning versus discarding gastric residual volume on enteral feeding outcomes among critically ill children.

Research Hypothesis

H_1: Critically ill children with returning gastric residual volume will have better enteral feeding outcomes than those in the discarding group.

H_2: Critically ill children with discarding gastric residual volume will have better enteral feeding outcomes than those in the returning group.

Subject and Methods

Research design: A randomized controlled trial comparison study was utilized to conduct the current study. It was single blinded; where the participants were blinded in both groups and investigators were aware of the group a participant was belonged to. Participants were randomized into two groups (A and B) using sealed envelopes [19].

Setting

The current study was conducted in pediatric intensive care unit (PICU) at El-Monira Children Hospital which is affiliated to Cairo University. It is the largest hospital for children in Egypt, and it provides its services free of charge. The unit has a feeding protocol every 3 hours with GRV measurement and withholding feeds if this volume exceeds 25% of previous feeding and return it. The unit is proactive in starting enteral feeding and supported by a dedicated dietician who revise daily children dietary intake.

Sample

A total sample of 100 critically ill children were recruited and assigned randomly into two main groups, the study group (i.e. critically ill children who received nasogastric feeding/ 3 hrs. and discard gastric residual of his/her previous feeding), and the control (i.e. critically ill children who received nasogastric feeding/ 3 hrs. and return gastric residual volume of his/ her previous feeding. The inclusion criteria was newly admitted critically ill children with invasive mechanical ventilator, aged 1-5 years, and taking enteral feeding within 24 hours of admission. Children with abdominal surgery, gastro intestinal bleeding, esophageal reflux, bowel obstruction, electrolyte disturbances and children who received post-pyloric feeding were excluded. A sample size calculation was made by equation based on the proposed intervention's effect size of 0.65, the standard normal deviation for $\alpha = Z\alpha = 1.96$, the standard normal deviation with power of 80.0 percent, the confidence interval of 95%, and the type I error probability on 0.05 level.

$$n = \frac{2(Z_{1-\alpha/2} + Z_{1-\beta})^2}{\Delta^2} + \frac{Z^2_{1-a/2}}{2}$$

$$n = \frac{2(1.96+1.28)^2}{0.65} + \frac{1.96^2}{2} = 50 \text{ for each group}$$

Data collection Tools

Two tools were used for data collection

1. A structured interview questionnaire

It was constructed by the researchers after reviewing recent literature, It includes three parts: Part1: personal data: such as age and gender. Part II: child present history such as medical diagnosis, disease onset, duration of hospitalization in PICU, time connected with mechanical ventilator, previous weight and level of consciousness as recorded from patient file. Part III: child nasogastric feeding such as type of feeding, amount, frequency, amount of residual volume, color. Part VI: Biochemistry results such as potassium, sodium, Hb, albumin and blood glucose level in serum blood**.**

2. Subjective Global Nutrition Assessment Form (SGNA)

It was adopted from [20] to assess child nutritional status, it includes two parts; part I: nutrition-focused medical history which assesses child linear growth, weight relative to length/height, changes in body weight, adequacy of dietary intake, persistent gastrointestinal (GI) symptoms, functional impairment and metabolic stress. Part II: nutrition-focused physical examination to assess loss of subcutaneous fat, muscle wasting and nutritional related edema. The overall SGNA rating is not based on a numerical scoring system and is instead subjective. These children might be ranked in all three categories. The normal/well-nourished category is given if the child exhibits little to no physical evidence of malnutrition, weight loss or growth failure, dietary problems, nutrition-related functional deficits, or persistent gastrointestinal symptoms that could indicate malnutrition. When a child's recent weight loss is equal to or greater than 10%, there has been no subsequent weight gain, there has been a reduction in dietary intake, and there has been little to no loss of subcutaneous fat or muscle, they are categorized as moderately malnourished; severely malnourished children have progressive malnutrition with a downward trend in most or all categories. Significant physical indicators of malnutrition include decreased intake, increased GI losses and/or acute metabolic stress, as well as loss of fat storage, muscle atrophy, and weight loss of more than 10%. Severe are rating in the majority of categories with little or no sign of improvement.

Tools validity and reliability

Tool I was thoroughly reviewed by three experts to test content validity. Modifications of the tools were done according to the experts' judgment on clarity of sentences, appropriateness of content and sequence of items. The Cronbach's alpha value (internal consistency) of tool I was (0.901). Inter-observer agreement in assessment of SGNA in a previous study was good (90·2%). SGNA, The interrater reliability (k = 0.703) and test-retest reliability (k = 0.779) were good, the Cronbach's α coefficient of SGNA is 0.871 [20]. For the current study the Cronbach's alpha value (internal consistency) of the SGNA was (0.897).

Ethical consideration

An approval was obtained from the research ethics committee at Faculty of Nursing, in Cairo University. The purpose, methodology, advantages, and nature of the study were explained to all parents of participating children, and the researchers then received their official written agreement. The researchers made it clear that participation in the study was voluntary, that participants might decline to participate for any reason, and that the data collected would only be used for research purposes. The parents' right to withdraw from the study at any moment during the study, without having any bearing on the care given to their children, was guaranteed, and the anonymity and confidentiality of the information was upheld.

Procedure

An official permission was obtained from the directors of El-Monira Pediatric Hospital of Cairo University and from the head of PICU. A clear explanation was given for children's parents about the nature, importance and expected outcomes of the study**.** After the parent accepts to participate in the study the information were handled confidentially, and participants were listed by a number in the computerized database.

The allocation of concealment was addressed by the researchers. In order to ensure randomization, two steps selection process will be used. First: identifying the random sample, this step was achieved on admission to PICU. Children who met the eligibility criteria and who had an odd number on admission ticket or files were recruited in the study. After signing the written consent, the second drawing will be a random assignment of the sample into two groups; the control (returning) and the study (discarding). In separate opaque envelopes, numbers from one to one hundred and two was inserted, which was drawn in an ascending series**.** The ratio of the control versus the study group was one to one. Even numbers were allocated to the experimental group and odd numbers to the control group. who receive routine hospital's care. Single blindness will be achieved; all children were blinded in both groups.

Data about children for both control and study groups were obtained by the researchers by conducting a physical assessment of the child to assess loss of subcutaneous fat,

muscle wasting and nutritional related edema(tool II), and checking children's medical records on individual bases (tool I), it was take about 10-30 minutes. Firstly, the study was implemented by the researchers with the control group who was follow PICU feeding protocol; that is nasogastric feeding/ 3 hrs and return gastric residual volume of his/ her previous feeding (tool I part II, III, IV and tool II). Subjective global nutrition assessment form (SGNA) was used four times: the first time within 24 hours from nasogastric tube insertion then at the second, third, and fourth times for three constitutive days after nasogastric tube feeding for two times after the morning shift. It was take about 10-30 minutes**.** After finishing the control group, the study was implemented with the study group who received nasogastric feeding/ 3 hrs and discard gastric residual of his/her previous feeding). The gastric residual volume was checked for both groups before feeding. Subjective global nutrition assessment form (SGNA) was used four times as done with the control group.

Statistical analysis

All statistical analyses were conducted using SPSS for windows version 20.0 (SPSS, Chicago, IL). Continuous data were normally distributed and were reported as mean ± standard deviation (SD). Categorical data were expressed in number and percentage. Chi-square test (or fisher's exact test when applicable) was used for comparison of variables with categorical data. Correlation co-efficient test was used to test for correlations between two variables with continuous data. The reliability (internal consistency) test for the questionnaires used in the study was calculated. Statistical significance was set at $p<0.05$.

Results

Table 1: Percentage distribution of children' characteristics in the two groups (n=100)

Children' characteristics	Control group (Returning)		Study group (Discarding)		Chi – Square / Fisher's exact test	
	n	%	N	%	X^2	P
Gender						
Male	18	36.0	21	42.0	0.378	0.539
Female	32	64.0	29	58.0		
Age (Years)						
< 3	31	62.0	29	58.0	0.167	0.683
3 or More	19	38.0	21	42.0		
Mean ± SD	1.9±0.9		2.0±1.0			
The weight on admission (K.G.)						
≤ 10	19	38.0	16	32.0	0.396	0.529
> 10	31	62.0	34	68.0		
Mean ± SD	10.2±3.2		12.9±4.3			
The current weight (K.G.)						
≤ 10	27	54.0	21	42.0	1.442	0.230
>10	23	46.0	29	58.0		
Mean ± SD	9.5±3.3		10.5±2.9			

Table (1) reveals that 64.0% of children in the returning and 58.0% in the discarding groups were females and the mean age ± SD of children was 1.9±0.9 and 2.0±1.0 years respectively. Regarding their weight on admission more than half of (62.0%) in returning and about two third (68.0%) in the discarding groups were more than ten Kg with mean 10.2±3.2±931.384 and 12.9±4.3 respectively. More than half (54.0%) of children' current weight in the returning group was less than ten Kg while more than half (58.0%) of them in the discarding group was more than ten Kg with mean 9.5±3.3 and 10.5±2.9 respectively. The table also shows no statistical significant differences between children in the two groups related to their gender, age and weight.

Table 2: Percentage distribution of children' medical data in the two groups (n=100)

Children' medical data	Control group (Returning)		Study group (Discarding)		Chi – Square / Fisher's exact test	
	n	%	n	%	X^2	P
The onset of the disease (Days)						
< 5	30	60.0	27	54.0	0.749	0.688
5 – 10	14	28.0	18	36.0		
> 10	6	12.0	5	10.0		
Mean ± SD	10.0±4.4		10.7±4.1			
The duration of intensive care unit stay (Days)						
< 5	11	22.0	11	22.0	0.106	0.948
5 – 10	33	66.0	34	68.0		
> 10	6	12.0	5	10.0		
Mean ± SD	11.5±4.0		11.1±3.9			
The duration of connecting to the ventilator (Days)						
< 5	4	8.0	3	6.0	0.302	0.860
5 – 10	41	82.0	43	86.0		
> 10	5	10.0	4	8.0		
Mean ± SD	7.3±3.3		7.1±2.8			
Conscious level						
Conscious	25	50.0	26	52.0	0.100	0.951

Semi-conscious	23	46.0	21	42.0		
Comatose	2	4.0	3	6.0		
Diagnosis						
Pneumonia	13	26.0	18	36.0	1.500	0.827
Respiratory distress	25	50.0	23	46.0		
Gallien barre syndrome	7	14.0	6	12.0		
Branchial Asthma	3	6.0	2	4.0		
Myocarditis	2	4.0	1	2.0		

Table (2) shows that 60.0% of children in the returning group and 54.0% of them in the discarding group had onset of disease less than five days with Mean ± SD of 10.0±4.4 and 10.7±4.1 respectively in two groups. Regarding duration of intensive care unit stay about two third of them in both groups (66.0% & 68.0% respectively) was ranged from five to ten days with means ± SD 11.5±4.0 and 11.1±3.9 respectively and their mean duration of connecting to the ventilator in both groups were 7.3±3.3 and 7.1±2.8. Half of children (50%) in returning group and more half of them (52.0%) in discarding group were conscious. Fifty percent (50.0%) in returning group and 46.0% in discarding group were diagnosed as respiratory distress. No statistically significant differences between children in the two groups related to medical data.

Table 3: Comparison between the two groups in relation to children' nutritional data (n = 100)

Children' nutritional data	Control group (Returning)		Study group (Discarding)		Chi – Square / Fisher's exact test	
	n	%	n	%	X^2	P
Type of feeding						
Milled foods	31	62.0	26	52.0	1.980	0.159
Fluids	19	38.0	24	48S.0		
The amount of prescribed feeding/ time (cm)						
< 100	26	52.0	20	40.0	1.464	0.481
100 – 150	14	28.0	18	36.0		
> 150	10	20.0	12	24.0		
Mean ± SD	116.9±53.8		129.2±57.5			
Presence of residual volume						
Yes	38	76.0	36	72.0	0.208	0.648
No	12	24.0	14	28.0		
The number of times of previous residual volume						
≤3 times	40	80.0	40	80.0	0.052	0.975
> 3 times	10	20.0	10	20.0		
Mean ± SD	2.9±0.8		2.8±0.8			
The amount of residual volume/ time						
≤ 25%	31	62.0	32	64.0	0.292	0.864
>25%	19	38.0	18	36.0		
Mean ± SD	25.3±12.1		24.4±11.6			
Color of residual volume						
Yellowish white	26	52.0	29	58.0	0.644	0.422
Yellow	24	48.0	21	42.0		
The child uses intravenous solutions						
Yes	13	26.0	11	22.0	0.219	0.640
No	37	74.0	39	78.0		

Table (3) shows that (62.0% & 52.0%) respectively of children in returning and discarding groups received milled foods as type of feeding with mean amount of prescribed feeding 116.9±53.8 and 129.2±57.5 of both groups respectively. Also this table shows that in returning and discarding groups (76.0% & 72.0% respectively) had presence of residual volume and the mean number of times was 2.9±0.8 and 2.8±0.8 respectively in both groups. The amount of residual volume shows that (62.0% & 64.0% respectively) of children in returning and discarding groups was ≤ 25% and its color was yellowish white in (52.0% & 58.0%) respectively in both groups and the highest percent in the returning and the discarding groups didn't use intravenous fluids (74.0% & 78.0%) respectively. This table also shows that there was no statistical significant difference between both groups in relation to nutritional data.

Table 4: Comparison of mean children' Physiological status in both groups at 1st, 2nd, 3rd and 4th day

Children' Physiological status	Control group (Returning)	Study group (Discarding)	Student's T – Test	
	Mean ± SD	Mean ± SD	T	P
Day 1				
Respiration	43.1±15.0	41.3±11.6	0.684	0.496
Pulse	129.3±25.0	127.5±21.3	0.392	0.696
Temperature	37.2±0.7	38.5±8.9	1.061	0.291
Blood pressure	103.7±17.4	104.6±17.8	0.245	0.807
Oxygen saturation	70.6±16.6	66.6±15.1	1.242	0.217

Day 2				
Respiration	45.2±18.7	39.2±9.5	2.022	0.045*
Pulse	133.9±35.1	120.1±33.1	2.023	0.045*
Temperature	37.2±0.8	37.3±0.5	0.690	0.492
Blood pressure	97.1±19.5	98.3±14.6	0.354	0.724
Oxygen saturation	67.6±19.3	62.1±14.7	1.585	0.116
Day 3				
Respiration	44.6±16.5	39.0±9.2	2.096	0.038*
Pulse	133.1±28.8	121.8±24.4	2.116	0.036*
Temperature	37.5±0.7	37.4±0.6	1.404	0.163
Blood pressure	100.1±19.0	99.7±12.3	0.131	0.896
Oxygen saturation	68.3±19.6	63.0±15.8	1.499	0.137
Day 4				
Respiration	43.9±14.1	37.8±15.2	2.058	0.042*
Pulse	135.9±45.8	120.1±29.8	2.063	0.041*
Temperature	37.4±0.7	38.5±8.3	0.935	0.352
Blood pressure	98.8±18.6	98.3±16.2	0.152	0.880
Oxygen saturation	67.0±19.2	63.9±17.7	0.838	0.404

*Statistically significant difference

Table (4) reveals that at the 1st day of intervention, there was no statistical significant difference was detected in the total mean scores of children' respiration, pulse, temperature, blood pressure and oxygen saturation of both groups (p = 0.496, .0696, 0.291, 0.307 & 0.217 respectively). This table also represents that in the 2nd, 3rd and 4th day there was a statistical significant difference in the total mean score of children' respiration (p= 0.045, 0.033 & 0.042 respectively) and pulse (p= 0.045, 0.036 & 0.041 respectively) of both groups, otherwise there were no statistical significant differences at 2nd, 3rd and 4th day regarding temperature (p= 0.492, 0.163 & 0.352 respectively), blood pressure (p= 0.724, 0.896 & 0.880 respectively) and oxygen saturation (p= 0.116, 0.137 & 0.404 respectively).

Table 5: Comparison between the laboratory findings between both groups at 1st, 2nd, 3rd and 4th day

Laboratory findings	**Control group (Returning)**	**Study group (Discarding)**	**Student's T – Test**	
	Mean ± SD	**Mean ± SD**	**T**	**P**
Day 1				
Sodium	136.2±7.4	136.5±9.7	0.162	0.871
Potassium	4.5±1.0	4.4±1.1	0.557	0.579
Hemoglobin	9.2±1.6	9.6±1.9	1.248	0.215
Albumin	3.3±1.4	3.6±2.4	0.983	0.328
Glucose	117.3±56.9	119.5±52.2	0.201	0.841
Day 2				
Sodium	137.6±6.7	137.6±8.8	0.051	0.959
Potassium	4.4±0.9	4.3±1.1	0.614	0.541
Hemoglobin	9.8±1.7	9.8±1.9	0.033	0.974
Albumin	3.2±1.2	3.2±1.0	0.432	0.667
Glucose	120.3±47.9	120.6±50.3	0.037	0.971
Day 3				
Sodium	137.1±5.6	131.7±8.9	3.631	<0.001**
Potassium	4.5±1.1	3.8±1.0	3.329	<0.001**
Hemoglobin	10.0±1.6	10.2±2.1	0.636	0.526
Albumin	3.2±1.5	3.3±1.2	0.350	0.727
Glucose	112.1±24.1	110.5±30.7	0.304	0.762
Day 4				
Sodium	137.2±5.1	130.4±8.4	4.821	<0.001**
Potassium	4.5±1.1	4.3±1.3	3.449	<0.001**
Hemoglobin	9.9±1.4	10.1±2.0	0.637	0.525
Albumin	5.5±1.5	5.3±1.9	0.584	0.560
Glucose	108.0±23.0	108.5±24.6	0.093	0.926

*Statistically significant difference

Table (5) reveals that there was no statistical significant difference in the total means scores in 1st and 2nd day regarding sodium, potassium, hemoglobin, albumin and glucose levels between the two groups (p= 0.871, 0.579, 0.215, 0.328 & 0.841 respectively) and (p= 0.959, 0.541, 0.974, 0.667 & 0.971 respectively). This table also shows that at 3rd and 4th day there was a statistical significant difference in the total mean scores of sodium (p= 0.001& 0.001 respectively) and potassium (p = 0.001& 0.001 respectively) levels of both groups but there was no statistical significant difference regarding levels of hemoglobin (p= 0.526 & 0.525 respectively), albumin (p= 0.727 & 0.560 respectively) and glucose (p= 0.762 & 0.926 respectively).

Table 6: Comparison between the SGNA data between returning and discarding group at 1st, 2nd, 3rd and 4th day.

SGNA	Control group (Returning)				Study group (Discarding)				Chi – Square / Fisher's exact test	
	Well-nourished		Moderately malnourished		Well-nourished		Moderately malnourished			
	N	%	n	%	N	%	N	%	X^2	P
Day 1	50	100.0	0	0.0	25	50.0	25	50.0	33.333	<0.001**
Day 2	30	60.0	20	40.0	25	50.0	25	50.0	1.010	0.315
Day 3	10	20.0	40	80.0	27	54.0	23	46.0	12.398	<0.001**
Day 4	5	10.0	45	90.0	28	56.0	22	44.0	23.926	<0.001**

*Statistically significant difference

Table (6) illustrates that there was a highly statistical significant difference between both groups regarding the SGNA at 1st, 3rd and 4th day (p = 0.001) but there was no statistical significant difference between both groups at 2nd day (p= 0.315). This table also indicates that all children (100.0%) in returning group were well nourished at 1st day compared to 50% of them in discarding group and in the 4th day only 10% of children in returning were well nourished compared to 56.0% of them in discarding group.

Table 7: Correlation between selected children data with respiration, pulse, sodium and potassium findings in both groups at day 4

Selected children data	Respiration				Pulse				Sodium				Potassium			
	Control (Returning)		Study (Discarding)		Control (Returning)		Study (Discarding)		Control (Returning)		Study (Discarding)		Control (Returning)		Study (Discarding)	
	r	p	R	P	r	p	r	P	r	p	r	p	r	p	r	p
Child's age	0.166	0.250	0.004	0.980	0.111	0.442	0.228	0.111	0.022	0.877	0.009	0.949	0.022	0.877	0.127	0.380
The onset of the disease	0.024	0.867	0.008	0.956	0.112	0.440	0.097	0.503	0.026	0.859	0.133	0.357	0.110	0.449	0.059	0.682
The duration of intensive care unit stay	0.029	0.840	0.118	0.414	0.017	0.908	0.147	0.308	0.051	0.727	0.205	0.154	0.026	0.857	0.165	0.252
The duration of connecting to the ventilator	0.362	0.010*	0.286	0.044*	0.206	0.152	0.015	0.917	0.393	0.005*	0.209	0.144	0.112	0.437	0.127	0.380
The current weight	0.159	0.271	0.303	0.033*	0.127	0.380	0.015	0.919	0.253	0.077	0.071	0.623	0.026	0.858	0.048	0.739
The number of feeding through the nasogastric tube	0.065	0.654	0.086	0.554	0.096	0.506	0.102	0.480	0.055	0.707	0.024	0.869	0.138	0.341	0.028	0.850
The amount of prescribed feeding	0.230	0.108	0.149	0.301	0.001	0.997	0.030	0.839	0.102	0.480	0.101	0.484	0.039	0.788	0.095	0.510
The amount of residual volume	0.273	0.055	0.134	0.353	0.140	0.332	0.043	0.767	0.191	0.185	0.071	0.626	0.174	0.226	0.064	0.661

*Statistically significant difference

Table (7) proves that there was a statistical significant correlation in returning group between children' respiration and sodium with the duration of connecting to the ventilator (p= 0.010 & 0.005 respectively). This table also detects that there was a statistical significant correlation in discarding group between children' respiration with the duration of connecting to the ventilator and their current weight (p= 0.044 & 0.033 respectively). Otherwise there were no statistical significant correlations between selected children medical data with respiration, pulse, sodium and potassium findings.

Table 8: Correlation between selected children data with SGNA Score in both groups at day 4

Selected children medical data	Control group (Returning)		Study group (Discarding)	
	r	p	r	p
Child's age	0.021	0.886	0.133	0.357
The onset of the disease	0.028	0.847	0.213	0.138
The duration of intensive care unit stay	0.106	0.462	0.257	0.072
The duration of connecting to the ventilator	0.496	<0.001**	0.667	<0.001**
The current weight	0.514	<0.001**	0.682	<0.001**
The number of feeding through the nasogastric tube	0.525	<0.001**	0.609	<0.001**
The amount of prescribed feeding	0.598	<0.001**	0.452	<0.001**
The amount of residual volume	0.571	<0.001**	0.785	<0.001**

*Statistically significant difference

Table (8) proves that there was a statistical significant correlation in returning and discarding groups between children' SGNA Score at day 4 with the duration of connecting to the ventilator, current weight, number of feeding through the nasogastric tube, The amount of prescribed feeding and The amount of residual volume (p= 0.001) but there were no statistical significant correlations between selected children SGNA Score at day 4 with child's age, onset of disease and the duration of intensive care unit stay in returning (p= 0.886, 0.847 & 0.462 respectively) and discarding (p= 0.357, 0.138 & 0.072 respectively) groups.

Table 9: Association between children' gender and diagnosis with respiration, pulse, sodium, potassium and SGNA Score in both groups at day 4

	Respiration		Pulse		Sodium		Potassium		SGNA	
	Returning	Discarding	Returning	Discarding	Returning	Discarding	Returning	Discarding	Returning	Discarding
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Gender										
Male	44.4±14.3	34.3±16.0	148.9±57.8	124.5±37.8	136.3±5.7	131.3±10.6	5.4±1.5	4.1±1.4	23.2±8.2	16.4±7.7
Female	43.8±14.9	31.9±15.4	129.9±52.6	126.0±34.1	136.3±6.0	126.0±10.2	4.5±1.2	4.4±2.1	24.7±4.3	17.7±7.7
Student's T – Test	T=0.153 P=0.879	T=0.535 P=0.595	T=1.184 P=0.242	T=0.152 P=0.879	T=0.002 P=0.998	T=1.811 P=0.076	T=2.310 P=0.025*	T=0.589 P=0.558	T=0.816 P=0.419	T=0.558 P=0.589
Diagnosis										
Pneumonia	48.0±13.5	34.5±16.9	138.1±55.8	135.8±34.1	137.2±5.7	127.4±10.8	5.1±1.5	4.4±1.6	25.4±5.0	16.7±7.3
RDS	41.8±14.1	31.4±15.1	140.3±52.7	117.3±35.4	136.0±6.1	129.1±11.4	5.0±1.3	4.3±1.9	23.3±6.8	17.3±8.6
GBS	43.3±16.2	35.3±12.8	137.7±65.3	120.7±37.3	137.6±7.1	123.3±4.3	4.1±0.9	4.5±2.2	23.6±5.9	15.8±7.1
Bronchial Asthma	39.0±19.0	27.3±7.6	81.3±30.4	138.7±34.5	133.3±3.8	135.3±11.7	4.3±2.1	4.0±1.6	27.3±4.0	17.0±8.2
Myocarditis	56.5±19.1	37.7±16.7	163.0±66.5	131.3±45.0	134.0±1.4	128.3±12.5	5.0±2.4	3.7±1.5	24.0±1.4	22.7±8.0
One way ANOVA	F=0.849 P=0.502	F=0.308 P=0.871	F=0.906 P=0.469	F=0.766 P=0.553	F=0.420 P=0.793	F=0.702 P=0.595	F=0.809 P=0.525	F=0.131 P=0.970	F=0.485 P=0.747	F=0.447 P=0.774

*Statistically significant difference

Table (9) shows that in returning group there was a statistical significant association between children' gender and potassium level (p= 0.025) but there was no statistical significant association with respiration, pulse, sodium and SGNA score (p= 0.879, 0.242, 0.998 & 0.419 respectively) as well as there was no statistical significant association between children' diagnosis with respiration, pulse, sodium, potassium and SGNA score (p= 0.502, 0.469, 0.793, 0.525 & 0.747 respectively). On the other hand; in discarding group there was no statistical significant difference between children' gender and diagnosis with respiration, pulse, sodium, potassium and SGNA score (p= 0.595, 0.879, 0.076, 0.558 & 0.589 respectively) and (p= 0.871, 0.553, 0.595, 0.970 & 0.774 respectively).

Discussion

A critical decision that requires discrete verification is whether to return or discard the gastric residual volume. The risk of infection and tube blockage may increase as a result of gastric residues, but children's risk of fluid and electrolyte imbalance may increase if stomach remnants are discarded. The present study evaluated the effect of returning versus discarding gastric residual volume on enteral feeding outcomes among critically ill children. The findings of the present study found that the children in the return and discard groups were similar in gender, age and weight similarly, a study conducted by [3] who mentioned that There was no difference among the two groups in terms of gender, age, weight, study period, or amount of formula given.

As revealed in this study that the duration of intensive care unit stay about two third of children both groups was ranged from five to ten days with means ± SD 11.5±4.0 and 11.1±3.9 respectively and their mean duration of connecting to the ventilator were 7.3±3.3 and 7.1±2.8. In the same context, a study conducted by [21] who emphasized that the study group's ICU stay and duration of mechanical ventilation were much shorter than those of the control group.

Findings noted that there were no statistically significant variations in the medical information as diagnosis (respiratory distress) and conscious level between the children in the two groups. This finding is consistent with [2] who detected a significant percentage of the study's participants and the control group developed respiratory problems. As regards, the duration of nasogastric tube feeding, the majority of children in both groups received nasogastric tube feeding for more than five days and more than three times per day. According to empirical data and previously acknowledged scholarly papers, parenteral feeding was to be helpful in the majority of situations, particularly in the PICU to address the nutritional needs of the critically ill child [22].

Regarding feeding method, milled foods made up (62.0% & 52.0%) of the returning and discarding groups, respectively, with the mean amount of prescribed feeding being (116.9±53.8 and 129.2±57.5) for both groups. The researchers revealed that participants primarily used a nasogastric tube to feed the critically ill children using formula feeds, breast milk, fluids, and other refined feeds [21]. A burgeoning literature has also demonstrated that unless there is a serious issue with stomach motility, conventional formulae should be begun at a pace of 20–40ml/hr. [23].

Additionally, this finding showed that both the control and study groups had higher percentages of children who had residual volume than usual, with the mean number of times being 2.9±0.8 and 2.8±0.8, respectively among both groups. On the same line with [23] who Showed comparison of gastric residual volume between the two groups there was no significant difference with between the two groups but as revealed in study conducted by [6] there was a significant decrease in times of gastric residual of the study groups than control groups (1.48±0.80) versus (2.80±1.18) respectively.

More than half of the children in the control (returning) and study (discarding) groups made up less than 25% of the residual volume, which was yellowish white. The study results were in contrast to a study by [25] who noted that the study group's overall stomach residual volume was much lower than control groups.

According to the study's findings, there was no significant difference between the two groups' overall mean scores for children's respiration, pulse, temperature, blood pressure, and oxygen saturation on the first day of the intervention. This indicated that there was significant increase in the overall mean score of children's respiration and pulse in

control (returning) group on the second, third, and fourth days. This finding is consistent with study implemented by [15] who revealed that in regard to comfort outcomes evaluated by vital signs and oxygen saturation, According to the study's findings, there was a statistically significant difference between the control group's pulse and respiration on the first and seventh days. On the other hand, related to comfort outcomes, there was no statistically significant difference in the study group, proving that returning gastric aspirate may not cause the child any discomfort.

The current study results illustrated that there was no statistical significant difference in the total means scores in 1st and 2nd day regarding sodium, potassium, hemoglobin, albumin and glucose levels between the two groups. Also it showed that at 3rd and 4th day there was a significant decrease in the total mean scores of sodium and potassium levels in study (discarding group). These findings support current evidence that It is thought that discarding stomach aspirate could cause electrolyte loss, but An emerging evidence from recent study by [26] because there was no statistically significant difference in electrolyte levels between the study and control groups in this study, (potassium & sodium) and glucose in the 1st& 7th days.

The present findings indicated that all children in control group (returning) were well nourished at 1st day compared to half of them in study group (discarding) and in the 4th day highest percent of children were moderately malnourished in control group compared with less than half in the study group. The current study results were in accordance with [27] who found that malnutrition was present in 86.0% of cases, compared to 20% in the control group.

According to the study's findings, there is a statistically significant correlation in control group (returning) between children' respiration and sodium with the duration of connecting to the ventilator. Also described that there was a statistical significant correlation in study group between children' respiration with the duration of connecting to the ventilator and their current weight. In the same context, a study conducted by [10] who revealed that there was a significant association of electrolyte imbalance (Na+ and K+), respiratory rate, duration of connecting to mechanical ventilator. Compared to the reintroduction group, it was more frequently noticed in the discard group.

It is noticed also that that there was a statistical significant correlation in control and study groups between children' SGNA Score at day 4 with the duration of connecting to the mechanical ventilator, current weight, number of feeding through the nasogastric tube, The amount of prescribed feeding and the amount of residual volume. This finding is contradicted with [27] who discussed that there was no relationship between common diagnoses, mechanical duration ventilator and nutrition status or growth variables. These results are contrary to the majority of the literature [28].

It is apparent from current findings that there were no statistical significant correlations between selected children SGNA Score at day 4 with child's age, onset of disease and the duration of intensive care unit stay in control and study groups. This finding disagree with [11] who showed that lower growth potential and older age at remedial intervention as predictors of malnutrition in children with respiratory problems, whereas factors like diagnosis, dietary intake and socioeconomic scale had no significant impact on nutritional status. Moreover, The current study findings highlighted that in control (returning) group there was a significant association between children' gender and potassium level but there was no significant association with respiration, pulse, sodium and SGNA score as well as there was no significant association between children' diagnosis with respiration, pulse, sodium, potassium and SGNA score. On the other side; in study (discarding) group there was no significant difference between children' gender and diagnosis with respiration, pulse, sodium, potassium and SGNA score. This finding is supported by [29] who highlighted that no independent association between clinical outcomes, including vital signs, sodium, potassium and nutritional assessment score.

Conclusion

On conclusion, most critically ill children who returned gastric residual volume had higher rate of their respiration and pulse. Better well-nourished feeding outcomes were seen in children who their residual volume was discarded. However, a majority of children followed the discarding method had lower electrolyte levels than the returning group.

Recommendation

Based on the current findings the following recommendations are

1. Nutritional status for critically ill children undergoing nasogastric tube feeding should be regularly assessed.
2. Design a management strategy for gastric residual volume in critically ill children.
3. Further studies should be carried out to evaluate the benefits of discarding or returning residual gastric aspirates in pediatric intensive care

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