

Effect of Field Massage on Bilirubin Level and Stool Passage Frequency among Neonates with Hyperbilirubinemia under Phototherapy

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Abstract

Background: Neonatal jaundice is one of the most common problems in neonatal period and the main causes for admissions at neonatal intensive care units and effects on neonates during the first two weeks of life. **Aim** of this study was to determine the effect of field massage on bilirubin level and stool passage frequency among neonates with hyperbilirubinemia under phototherapy. **Research design:** quasi-experimental research design was utilized in this study. **Setting:** Neonatal Intensive Care Unit in Assiut University Children Hospital. **Subjects:** purposive sampling included 60 neonates with hyperbilirubinemia divided randomly into study and control groups. **Tool: Neonatal Assessment sheet** included age, gender, birth weight, onset of hyperbilirubinemia, daily total serum bilirubin level, hospital stay and stool frequency. **Results** indicated that five days of field massage has exceeded number of defecation in the study group and high statistical significant reduction in the level of serum bilirubin in the study group than control group ($p < 0.001$). **Conclusion:** Field massage with phototherapy in neonates with hyperbilirubinemia was effective in increasing number of stool frequency and reducing total serum bilirubin level. **Recommendations:** Educational training program should be provided for nurses about field massage as non-pharmacological intervention to reduce serum bilirubin level and increase stool passage frequency.

Key words: Field Massage, Bilirubin level, Stool Passage Frequency, Neonates, Hyperbilirubinemia and Phototherapy.

Introduction

Neonatal hyperbilirubinemia refers to an additional of more than 5 mg/dl bilirubin above the normal level. Icterus (jaundice) seems as a result of the deposition of bilirubin in the skin and mucosa (Eghbalian et al., 2017). Neonatal jaundice is one of the greatest common problems in neonatal period, and nearly 60% of term neonates and 80% of premature neonates suffer from this issue. Various factors such as the blood

group and Rh \pm mother play a role (Boskabadi et al., 2011). The importance of neonatal jaundice is not due to its prevalence, but because of the risky side effects of bilirubin deposition in the brain which if left untreated can lead to severe complications such as kernicterus, that is often followed by life-long disability (Fouladinejad et al., 2014 & Rahani et al., 2017).

There are different management methods ranging from phototherapy to

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neonatal blood transfusion to prevent the effects of hyperbilirubinemia. Every method has positive effects and drawbacks. Watery diarrhea, increased insensitve water loss, skin rashes, blue baby syndrome, and temporary skin tanning are some of the effects of phototherapy. It is too a matter of consideration whether phototherapy can reason melanoma in treating neonatal jaundice. Complications associated with blood transfusion contain allergic reactions and potential infections. Also, farewell of the baby from the mother throughout phototherapy emotionally affects both the mother and the baby. Therefore, it seems essential to simultaneously sustain the normal range of circulating bilirubin and control possible side effects (**Robert et al., 2015**).

Massage is one kind of therapy to motivate the organ system to function more optimally. Field massage method is a massage on neonates or neonates with main focus to give stimulation on the chest and abdomen area, and it's can also improve the activity of digestion organs and the ingestion process in neonates, thus, it can increase the metabolism system of the body, so that the toxin in the body can be easily disassembled and removed through feces and urine (**Field, 2010**).

Massage is a non-invasive therapeutic technique. It does not requisite any special technology or equipment; can easily be carried out together with classical medicine and can result in a lowering of treatment costs, shortening of the length of the disease and its side-effect, also lead to a better emotional relationship – which could have been disturbed by hospitalization between mother and neonate. Field massage has been associated to several benefits, including stimulation of the vagus nerve, increasing gastric fluids, aiding digestion, increasing appetite, increasing blood flow and stimulating of the lymphatic system, it helps in the collection, elimination of waste

products from the body, and early defecation stimulation (**Click et al., 2013**).

Pediatric neonatal nurses are significant members of medical health groups and have vital role in pediatric neonatology care; quality of the care could be enhanced through improving their performances and skills. So there are need to develop educational tools for training nursing students and families on the use of field massage technique (**Hughers et al., 2008**).

Significance of the study

Bilirubin is one indicator of the health examined from the function of organs, especially the liver function of neonates. Increased bilirubin physiologically occurs in neonates aged 3-10 days in which the level is less than 10 mg/dl. If the bilirubin level is uncontrolled, it can lead to the dysfunction of the central nervous system as well as fatality (**Naufal and Widodo, 2016**).

As regard to the effect of massage on neonatal jaundice, and the high incidence of neonatal hospitalization due to jaundice, and taking into account the role of nurses in the provision of non-invasive care services, the researchers have investigate the effect of field massage on bilirubin level and stool passage frequency among neonates with hyperbilirubinemia under phototherapy.

Aim of the study

This study aimed to determine the effect of field massage on bilirubin level and stool passage frequency among neonates with hyperbilirubinemia under phototherapy

Research Hypotheses:

- Implementing field massage with phototherapy to neonates with hyperbilirubinemia will increase number

of stool frequency than those who receiving phototherapy only.

- Neonates with hyperbilirubinemia who receiving field massage with phototherapy will decrease serum bilirubin level than who those receiving phototherapy only.

Subjects and Method

Research Design:

A quasi-experimental research design was utilized for this study.

Setting:

This study was conducted at Neonatal Intensive Care Unit (NICU) in Assiut University Children Hospital.

Subjects:

A purposive sample composed of sixty full-term neonates with hyperbilirubinemia divided randomly into two groups (30 neonates for study group and 30 neonates for control group), the following criteria were considered:

1. Full term neonates (38–42weeks) with unconjugated hyperbilirubinemia.
2. Bilirubin levels $12 \leq 20$ mg/dL but not exceed 20 mg/dL
3. Neonates under phototherapy and not requiring exchange transfusion
4. Neonates who had birth weight ≥ 2 .500 kg.
5. No congenital anomalies, neonatal surgery and absence from any disease otherwise hyperbilirubinemia.

Two groups were distributed as follows:

Group I: Control group that involve full-term neonates who were caring with phototherapy alone.

Group II: Study group that involve

full-term neonates who were applying field massage technique with phototherapy.

The total sample was randomly divided into two groups (each group contain 30 neonates) using simple random sample, the researchers' write the name of neonates in table (the first one was selected for study group (group 1) and the second was selected for control group (group 2) and so on.

Tool and Data Collection

Neonatal Assessment sheet was developed by the researchers to collect the required information and it includes two parts:

Part one: personal data of studied neonates (such as age, gender, birth weight, mode of delivery).

Part two: Clinical data of the studied neonates (such as onset of hyperbilirubinemia, total serum bilirubin level (TSB), hospital stay, stool passage frequency and daily weight).

Methods for data collection:

- The official permissions were attained from the director of the pediatric hospital and the head of neonatology unit, based on a letters from the faculty of nursing, Assiut University.

Pilot study

A pilot study was done on 10% of the sample size (6 neonates). No modification was done so neonates who shared in the pilot were included in the study.

Validity

The validity of tool was tested by measuring its contents validity index by 5 experts in both pediatric nursing and medicine neonatologist field and it equaled 93%.

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Reliability

The reliability of the tool was calculated statistically by alpha crumbach test ($r=0.84$).

- Initially, the phototherapy lamps were checked and adjusted at a height of 15-20 cm above the neonates who were kept in the cots with eyes closed and reproductive organs protected.

- Massage Technique:

Implementing massage techniques and procedures based on the method of massage therapy **Field et al., (2010)**. Each neonate in study group received massage as follows:

- **Face:** using both thumbs rubbed on the area under the eyes and cheeks gently and done these seven repetitions.
- **Neck:** Front massage on neck was done by using three fingers under the chin on the neonate (seven repetitions), this stimulation is aimed to improve the ability to swallow.
- **Chest:** Using hands rub on the neonate's chest. Movement is done from the outside towards the inside of the body, or towards the heart (seven repetitions), aims to provide stimulation towards the back flow of blood toward the heart.
- **Belly:** Implementing semicircle gentle massage on the stomach, clockwise direction (seven repetitions), aims to stimulate the intestines and digestive organs.
- **Leg:** Using hands pushed from distal to proximal or from the bottom up in the legs, done these seven repetitions.

- Massage intervention was carried out beside phototherapy and routine hospital care without interruption for all neonates in the study group every day for 5 days.

- To account the number of neonates' stool passage frequency for twenty four hours: The researchers asks the nurses about the

number of neonates' stool passage frequency every day for 5 days and documented from nursing report for each neonates.

- The researchers measuring serum bilirubin level twice/ day, in the morning shift and afternoon every day for 5 days.

- After that the relations between the numbers of stool passage frequency for 5 days and serum bilirubin level were calculated.

- The neonates in the control group were given phototherapy and routine hospital care only.

Field work

This study was carried out through a period of six months from the beginning of June 2018 to the end of November 2018. The neonates in the study group were received field massage technique by the researchers for 15- 20 minutes twice/ day, 1- 2 hours in the morning shift (10.00 am – 11.00 am) and midday feed (1.00 – 2.00 pm) every day for 5 days.

Ethical Consideration

Acceptance from ethical committee, faculty of nursing, Assiut University was gained. The confidentiality of information was ascertained. A formal written consent was obtained from the parents of the neonates who were admitted to the unit and fulfilling the inclusion criteria after explaining the goal and nature of the study. The parents had the right to withdraw from the study at any time during the study without any effect on the care provided that for their neonates.

Statistical analysis

The data were tested for normalcy through the Anderson-Darling test and for

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homogeneity variances prior to further statistical analysis. Categorical variables were designated by number and percent, where continuous variables described by means and standard deviation. Chi-square test and fisher exact test used to compare between categorical variables

where compare between continuous variables by t-test. Person correlation was used to appear the association between stool frequency and serum bilirubin. A two-tailed $p < 0.05$ was considered statistically significant. All analyses were achieved with the IBMSPSS 20.0 software.

Result:

Table (1): Percentage distribution of the full-term neonates according to their characteristics in the study and control groups (n=60).

| Item | Study group (n=30) | | Control group(n=30) | | χ^2 | P. value |
|--|--------------------|------|---------------------|------|-----------|----------|
| | No | % | No | % | | |
| Gestational age / weeks | | | | | | |
| 38 - < 40 | 12 | 40.0 | 17 | 56.7 | 1.068 | 0.301 |
| 40 ≤ 42 | 18 | 60.0 | 13 | 43.3 | | |
| $\bar{x} \pm SD$ | 39.70± 1.36 | | 39.36± 1.32 | | t=0.958 | 0.329 |
| Age per day | | | | | | |
| <3 | 8 | 26.7 | 6 | 20.0 | 0.0932 | 0.670 |
| >3 | 22 | 73.3 | 24 | 80.0 | | |
| $\bar{x} \pm SD$ | 5.2±1.42 | | 4.7±0.75 | | t=1.702 | 0.094 |
| Gender | | | | | | |
| Male | 18 | 60.0 | 16 | 53.3 | 0.164 | 0.196 |
| Female | 12 | 40.0 | 14 | 46.7 | | |
| Birth weight / kg | | | | | | |
| 2.500- < 3.000 | 24 | 80.0 | 23 | 76.7 | 0.098 | 0.754 |
| 3.000- ≥ 3.500 | 6 | 20.0 | 7 | 23.3 | | |
| $\bar{x} \pm SD$ | 2.52±0.44 | | 2.53±0.6 | | t= -0.124 | 0.902 |
| Mode of delivery | | | | | | |
| Vaginal delivery | 19 | 63.3 | 14 | 46.7 | 0.133 | 0.299 |
| Caesarian section | 11 | 36.7 | 16 | 53.3 | | |
| Onset of hyperbilirubinemia/day | | | | | | |
| 2 | 6 | 20.0 | 6 | 20.0 | 3.27 | 0.351 |
| 3 | 15 | 50.0 | 18 | 60.0 | | |
| 4 | 6 | 20.0 | 6 | 20.0 | | |
| 5 | 3 | 10.0 | 0 | 0.0 | | |
| 5 | | | | | | |

t=independent t-test,

$\bar{x} \pm SD$ (mean and stander deviation)

Table (1): Described the bio- characteristics of the neonates participating in this study. It was found that, less than two thirds of neonates of the study group and more than half of neonates of the control group were males (60 %, 53.3% respectively). The mean birth weight of study and control groups was $2.52 \pm .44$ Kg & 2.53 ± 0.6 Kg respectively. 63.3% of the study group compared to 53.3% of the control group were delivered by caesarian section. The mean onset of hyperbilirubinemia in study and control groups was 3.2 ± 0.89 day & 3 ± 0.64 day respectively. There were no statistically significance differences between study and control groups as regards neonatal characteristics.

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Table (2): Mean and standard deviation of daily total serum bilirubin among the study and control groups (n= 60 .)

| Variable | Study group (n=30) | Control group (n= 30) | t | P. value |
|----------------------------|--------------------|-----------------------|--------|----------|
| Serum Bilirubin/day | $\bar{x} \pm SD$ | $\bar{x} \pm SD$ | | |
| Before study | 11.3±2.27 | 12.6±4 | -1.628 | 0.109 |
| 2 nd | 10.2±2.24 | 12.8±3.13 | -3.631 | <0.001** |
| 3 rd | 8.7±2.45 | 12.6±2.61 | -5.900 | <0.001** |
| 4 th | 6.7±1.95 | 9.9±3.31 | -4.611 | <0.001** |
| 5 th | 4.7±2.06 | 9.4±4.41 | -5.302 | <0.001** |
| 6 th | 2.5±1.48 | 7.4±3.43 | -7.266 | <0.001** |

t= - independent t-test , ** Significant difference at p. value<0.01, $\bar{x} \pm SD$ (mean and stander deviation)

Table (2): Showed that, $\bar{x} \pm SD$ of total serum bilirubin (TSB) between study and control groups before the study denoted near to equal mean scores related to Total Serum Bilirubin (TSB) level between both groups (11.26±2.27 vs 12.63±4 respectively). No statistical significant differences between the both groups (t = -1.628, p = 0.109), while the mean TSB level in the 2nd, 3rd, 4th 5th and 6th day of the study was decreased among the study group than the control group (10.21±2.24 vs 12.77±3.13, 8.74±2.45 vs 12.6±2.61, 6.7±1.95 vs 9.93±3.31, 4.73±2.06 vs 9.44±4.41 and 2.47±1.48 vs 7.42±3.43 respectively) with statistical significant differences between both groups (p< 0.001 respectively).

Table (3): Mean and standard deviation of daily stool passage frequency among study and control groups (n=60).

| Variable | Study group (n=30) | Control group (n=30) | t | P. value |
|----------------------------|--------------------|----------------------|-------|----------|
| Stool frequency/day | | | | |
| Before study | 2.4±0.5 | 2.2±0.43 | 1.387 | 0.171 |
| 2 nd | 2.6±0.5 | 2±0.45 | 4.871 | <0.001** |
| 3 rd | 2.8±0.61 | 1.7±0.65 | 6.751 | <0.001** |
| 4 th | 2.8±0.76 | 1.8±0.41 | 6.346 | <0.001** |
| 5 th | 2.7±0.47 | 1.9±0.84 | 4.541 | <0.001** |
| 6 th | 3±0.45 | 2.2±0.61 | 5.757 | <0.001** |

t=- Independent t-test, ** Significant difference at p. value<0.01

Table (3): Showed the $\bar{x} \pm SD$ of stool passage frequency was increased among study group than the control group (2.6±0.5 vs 2±0.45, 2.8±0.61 vs 1.7±0.65, 2.8±0.76 vs 1.8±0.41, 2.7±0.47 vs 1.9±0.84 and 3±0.45 vs 2.2±0.61 respectively) with statistical significant differences between both groups (p < 0.001 respectively) in the 2nd, 3rd, 4th 5th and 6th day of the study.

Table (4): Mean and standard deviation of daily weight gain among the study and control groups (n= 60).

| Variable | Study group (n=30) | Control grou (n=30) | t | P. value |
|-----------------------|--------------------|---------------------|--------|----------|
| Wight Gain/day | $\bar{x} \pm SD$ | $\bar{x} \pm SD$ | | |
| Before study | 2.6±0.39 | 2.7±0.31 | -1.136 | 0.261 |
| 2 nd | 2.6±0.36 | 2.7±0.31 | -1.397 | 0.168 |
| 3 rd | 2.6±0.39 | 2.7±0.32 | -0.938 | 0.352 |
| 4 th | 2.7±0.37 | 2.7±0.34 | -0.590 | 0.557 |
| 5 th | 2.8±0.41 | 2.7±0.31 | 0.650 | 0.519 |
| 6 th day | 2.8±0.45 | 2.8±0.35 | 0.264 | 0.792 |

$\bar{x} \pm SD$ (mean and stander deviation)

Table (4): It was clear from, no statistical significant differences between both groups before study (P= 0.261), also at 2nd ,3rd ,4th , 5th and 6th days (p=0.168, 0.352, 0.557,0.519 & 0.792 respectively) regarding weight gain.

Table (5):Comparison of the length of hospital stay/hours between study and control groups (n= 60)

| Variable | Study grou(n=30) | | Control grou(n=30) | | χ^2 | P. value |
|---------------------------------------|------------------|------|--------------------|------|----------|----------|
| | No | % | No | % | | |
| Length of hospital stay/ hours | | | | | | |
| 48 - | 13 | 43.3 | 4 | 13.3 | 10.926 | <0.027* |
| 72- | 7 | 23.3 | 4 | 13.3 | | |
| 96 - | 5 | 16.7 | 15 | 50.0 | | |
| 120 - | 3 | 10.0 | 4 | 13.3 | | |
| 144 | 2 | 6.7 | 3 | 10.0 | | |
| $\bar{x} \pm SD$ | 50.13± 15.52 | | 75.46± 15.53 | | t=6.319 | <0.001** |

*Statistically significant differences , **Highly Statistically significant differences, $\bar{x} \pm SD$ (mean and stander deviation)

Table (5): Illustrated that less than half of neonates (43.3%) of the study group compared to only 13.3% of the control group were discharged with highly statistically significant difference ($\chi^2= 10.926, p < 0.027$).

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Table (6): Correlations between total serum bilirubin level and stool passage frequency among the study and control groups (n=60).

| Total Serum Bilirubin Level | Stool Frequency | | | |
|----------------------------------|--------------------|----------|----------------------|-------|
| | Study group (n=30) | | Control group (n=30) | |
| | R | P | r | P |
| Serum Bilirubin Before study/day | .220 | .225 | .182 | .319 |
| 2 nd | -0.263 | 0.160 | -0.037 | 0.846 |
| 3 rd | -0.464 | 0.010* | -0.243 | 0.212 |
| 4 th | -0.498 | 0.005** | -0.230 | 0.222 |
| 5 th | -0.618 | <0.001** | -0.194 | 0.305 |
| 6 th | -0.763 | <0.001** | -0.118 | 0.370 |

*Statistically significant differences , **Highly Statistically significant differences

Table (6): Indicated that no association was detected before the study between total serum bilirubin level & stool frequency among both groups, while in the 3rd , 4th 5th & 6th day of the study there was negative significant association among the study group (r = -0.464, p = 0.010*, r = -0.498, p = .005**, r = -0.618, p =0.001** & r= -0.763 , P = 0.001** respectively), and no significant association was detected among the control.

Discussion:

Neonatal jaundice is a frequent problem of the newborn with various etiologies. It requires early treatment to prevent complications and the possible accumulation of bilirubin in the white matter of the brain, which leads to irreversible neurological sequelae: kernicterus. Phototherapy has been the gold standard treatment of neonatal jaundice as it is able to significantly and quickly decrease total serum bilirubin (Makhoul et al., 2018). However, long durations of phototherapy as well as using high wave intensities can have some undesirable effects in newborns such as hyperthermia, erythematous rashes, burns dehydration, hyperthermia caused by removing neonates' clothes, Bronze baby syndrome, increased risk of melanoma later in life and diarrhea (Nourozi et al., 2011).

Therefore, finding a way to reduce the use of harmful drugs to maintain bilirubin level at a normal range seems to be necessary. Massage is one of the most common complementary medicine

therapies and one of the most popular complementary therapies in nursing care (Karbandi et al., 2016)

The present study revealed that, there were no statistically significance differences between study and control group as regards neonatal characteristics. This confirms that these two groups were homogenous. As regards the total serum bilirubin level, this study revealed that, from the 2nd to 6th days was lower among the study group than control group with statistically significant difference. These results were supported with other results by Lin et al., (2015) & Moslem and Naghavi, (2014) & Kianmehr et al., (2014) who carried study entitled" effects of neonate massage on jaundiced neonates undergoing phototherapy" which revealed that, bilirubin level in neonates was significantly lower in the study group than control group on the third and fourth days of massage therapy. From the researchers point of view this result may be due to field massage increasing number of stool passage frequency and this lead to increase the bilirubin excretion from neonates'

bowel and then the serum bilirubin level was decreased.

Moreover, the current results showed that the number of stool passage frequency were increased in the full term neonates in the massage group compared to those in the control group; a statistically significant difference was seen from 2-6 days after intervention. Similar results were reached by **Basiri-Moghadam et al., (2015) & Chen and Sadakata, (2011)**, who carried study entitled " baby massage ameliorates neonatal jaundice in full term newborn neonates " reported that, the stool frequency increased from 1- 4 day after intervention. The researchers opinion, the increase in stool passage frequency in the neonates receiving massage could be due to the stimulation of the vagal nerve which can be causes stimulation of the peripheral nerves, which can increase the production of digestive enzymes so it can maximally absorb the foods and decrease bilirubin level into the normal level. The more often the stimulation of massage performed to the neonate, the more effect will be gained in association with the digestive process and metabolism.

Concerning about the possible effect of massage on gaining weight demonstrated no significant difference among the study and control groups. The same findings were reported by **Lin, et al., (2015), Basiri-Moghadam, et al., (2012), Serrano et al., (2010), Yilmaz and Conk, (2009) and Lee, (2006)** about "the effect of massage by mothers on growth in healthy full term neonates" who showed that, 5 days of massage therapy cannot cause significant differences in weight gain, while **Diego et al., (2014)** and an Egyptian recent study conducted by **El Said, et al., (2013)**, who illustrated that, babies with oil massage had significantly higher weight on day. These differences may be related to the age of neonates ranged between 4th to 5th days after life. In addition, it is possible that the duration of massage therapy was too short to increase

weight gain and normally newborn lose 10% of total weight during 1st week of life.

Nearly two thirds of neonates in the study group were discharge within the first three days, while half of the neonates in the control group were discharged after three days of admission, with highly statistically significant difference were found between two group. This result was in the same line with **Torkaman and Mohammad (2016)** who carried study entitled "the effect of massage on reducing hospitalization duration in neonates with hyperbilirubinemia" reported that massage reduced the length of hospital stay, also **Zhang, (2012)** who mentioned that, touching together with phototherapy can significantly shorten the length of hospital stay in experimental groups.

On the 2nd day of field massage therapy, the study revealed that there was a negative significant association between the study and control groups as regards total serum bilirubin level and number of stool frequency while on 5th day of the study there was a statistical significant association. This finding supported and explained by **Huang (2009)** carried out in China, indicated that by adding to the bowel movements, massage facilitates the excretion of meconium, and shortens the bilirubin change time and its re-absorption to blood via liver-port system resulting in a lower incidence of hyperbilirubinemia. The researchers' opinion the more regular stimulation of massage performed on the neonates, the more effect on the digestive process and increase the performance of the metabolism as well as decrease total serum bilirubin level.

Conclusion

Based on the results of the present, the study concluded that, in the study group, field massage therapy with phototherapy among neonates with hyperbilirubinemia were more effective in

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increasing stool passage frequency, reducing serum bilirubin levels, and lowering the length of hospital stay than neonates in the control group who had phototherapy only. Field massage can prevent excessive bilirubin elevation and then reduces the long need for phototherapy and exchange transfusion.

Recommendation

Based on the results of the current study, the study recommended that:

1. Training program should be provided for nurses about field massage as non-pharmacological intervention to reduce serum bilirubin level.
2. Applying field massage in the hospital as a routine care for neonates with hyperbilirubinemia under phototherapy.
3. It also recommends that the postnatal mothers can be trained for the use of field massage for their newborns at home.
4. Further studies are recommended to discuss the relationship between effect of field massage on serum bilirubin level and stool passage frequency.

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