

Effect of Using Oral Bee Honey on Postoperative Pain and Wound Healing for Children undergoing Tonsillectomy

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Abstract: Tonsillectomy is one of the most common surgical procedures performed worldwide, especially for children. Severe pain and difficulty swallowing are common complaints encountered in children after tonsillectomy. Oral honey administration after tonsillectomy in pediatric cases may decrease the need for analgesics through relieving postoperative pain. Additionally, honey has been increasingly used in modern medicine as a potent wound healing agent due to its anti-bacterial and anti-inflammatory effects.

Aim of the study: to evaluate the effect of using oral bee honey on postoperative pain and wound healing for children after tonsillectomy.

A Quasi-experimental design: was used to achieve the aim of the study.

Setting: The study was conducted at the ENT department in Benha health insurance hospital affiliated to Ministry of Health. **Subjects:** A simple random sample of 556 tonsillectomy children who selected according to the study formula based on the total number of children who admitted to the above setting during 2013. These were randomly allocated into two groups; study group who, received oral bee honey in addition to ordinary treatment, control group who, received only ordinary treatment.

Tools of data collection: Three tools were used; a structural interviewing questionnaire sheet to collect personal data, postoperative assessment tool to evaluate the wound healing through the ability of the child to speak, swallow, and eating. Additionally, it used to assess daily analgesic consumption and number of awake at night due to pain. Also, numerical pain rating scale was used to assess the severity of pain.

Results: postoperative pain, daily analgesic consumption, number of awake at night due to pain and wound healing in oral bee honey group was significantly less than in the control group at different time of assessment started from first till 5 days after surgery ($p < 0.001$).

Conclusion: Based on the result of the present study it can be concluded that, the research hypothesis is accepted, while it was found that the administration of oral bee honey after wake up, following tonsillectomy significantly enhancing wound healing, reduce postoperative pain and may substantially decrease the need for analgesics and number of awake at night due to pain.

Recommendation: Oral bee honey can be a part of hospitals' protocols for pain and wound healing after tonsillectomy. Also, further researches are needed to assess the potential use of bee honey in wound healing and pain relief after tonsillectomy in other care setting to generalize the finding result.

Keywords: Tonsillectomy, children, wound healing, bee honey, postoperative pain.

I. Introduction

Tonsillitis refers to inflammation of the pharyngeal tonsils (glands at the back of the throat, visible through the mouth). The inflammation may involve other areas of the back of the throat, including the adenoids and the lingual tonsils (tonsil tissue at the back of the tongue). There are several variations of tonsillitis: acute, recurrent, and chronic tonsillitis and peritonsillar abscess. It is most often occurs in children, but rarely in those younger than two years old. Tonsillitis caused by bacteria (streptococcus species) that, typically occurs among children at age group of 5 to 15 years, while viral tonsillitis is more common in younger children⁽¹⁾.

Tonsillectomy remains one of the most common Otorhinolaryngology (ENT) surgical procedures performed worldwide, especially for children. Severe pain and difficulty swallowing are common complaints encountered in children after tonsillectomy⁽²⁾. In particular, intense postoperative pain can have adverse effects, such as increased heart rate and blood pressure, which lead to elevated cardiac output and postoperative exhaustion. Additionally, intense postoperative pain may necessitate the use of non-steroidal anti-inflammatory drugs (NSAIDs) and their negative effects on homeostasis may be associated with increased postoperative hemorrhage⁽³⁾.

Pain following tonsillectomy is mainly the result of the disruption of the mucosa and irritation of open nerve endings of the gloss pharyngeal and vagus nerves, as well as of spasms of the exposed pharyngeal and palatal muscles due to mechanical or thermal damage to the surrounding tissue. Oral flora may also increase

throat pain by inducing inflammation and infection⁽⁴⁾. Therefore, adequate pain management is important for these children to prevent potential complications associated with ineffective postoperative pain control⁽⁵⁾.

Management of Pain can help children recommence food intake and prevent dehydration secondary to low food intake. Several pain management techniques have been developed for use during and after surgery, including treatment with steroids, analgesics, antibiotics, and anti nausea medications, all of which have shown some positive outcomes in randomized trials without increasing serious complications such as postoperative bleeding. However, no ideal pain management strategy has been developed for tonsillectomy children^(6,7,8).

Honey has nutritive value as well as healing properties when applied to wounds. Honey is prepared by honey bees from the natural sugar solutions called the nectar obtained from flowers or other secretions of plants and contains mixture of sugars. By addition of enzymes and evaporation of water in it, honey bees transform it into a sweet liquid. It was the sweetening agent known to the early man, and naturally found its way into traditions, rituals, customs, and food of Indian households. It is the most complete natural food and ensures to get the daily doses of essential nutrients like; carbohydrates, minerals, amino acids, proteins, and vitamins. Honey provides 3000 calories per kilogram and a table spoon of honey provides 100 calories; honey has nutritive value as well as healing properties when applied to wounds⁽⁹⁾.

Nowadays Honey is one of a remedies being used in widespread cultures as medicine and food. It has been used successfully in the treatment of burns, graft donor sites, necrotizing fasciitis, neonatal postoperative wound infections and ulcers. Additionally, it has been reported to be particularly effective as a wound treatment for children receiving chemotherapy, in which the physiological process of wound healing is impaired and prolonged^(10,11). Clinical and experimental studies have documented that honey prevents infection around wounds, decreases inflammation, and expedites tissue healing and epithelization⁽¹²⁾. In recent years, honey has been increasingly used in modern medicine as a potent wound healing agent due to its anti-bacterial and anti-inflammatory effects^(13,14).

Significance of the Study:

Tonsillectomy continues to be a common operation performed in children. Despite significant improvements in anesthetic and surgical techniques, post-tonsillectomy pain is the most common morbidity associated with tonsillectomy. Oral honey administration after tonsillectomy in pediatric cases may decrease the need for analgesics through relieving postoperative pain. Moreover, Honey show a desirable broad spectrum activity against Gram-positive and negative bacteria making antibacterial activity an intrinsic property of honey and a desirable source for new drug development⁽¹⁰⁾. However, there is no consensus on whether postoperatively administered honey effectively reduces morbidity after tonsillectomy such as pain and wound healing. Hence, the present study conducted to assess the efficacy of oral bee honey as a treatment for postoperative pain and wound healing to provide healthcare providers with information that allows them to follow effective postoperative practices which decrease such morbidity and improve the postoperative children experience

Aim of the Study:-

The aim of the present study was to evaluate the effect of using oral bee honey on postoperative pain and wound healing for children after tonsillectomy.

Research Hypothesis:

Children who use oral bee honey postoperative will experience less pain intensity, less analgesic consumption and awake at night after tonsillectomy more than children who don't.

Children who use oral bee honey postoperative will report earlier wound healing after tonsillectomy more than children who don't.

II. Subject And Methods

A quasi experimental design was utilized to attain of the present study.

Setting:

The current study was carried out at the ENT department in Benha Health Insurance Hospital affiliated to the Egyptian Ministry of Health. This hospital was chosen because this hospital has the highest capacity of children undergoing tonsillectomy.

Sampling:

A-Type: A simple random sample .

B-Size: Sample size was calculated based on the previous year tonsillectomy report of the ENT department at Benha Health Insurance Hospital. The total number of children with tonsillectomy delivery was 2800 (**Benha Health Insurance Hospital Census, 2013**)⁽¹⁵⁾. Sample size was calculated utilizing the following

formula⁽¹⁶⁾.

$$n = \frac{N}{1 + N(e)^2}$$

where:

n=sample size

N=total population

e=margin error (0.05)

A total 556 of tonsillectomy children were recruited in the current study. They were randomly allocated into two groups: group (1) control group included (268) tonsillectomy children receiving only parenteral antibiotic, Diclofenac sodium and acetaminophen. Group (2) study group included (288) tonsillectomy children receiving oral bee honey in addition to parenteral antibiotic, Diclofenac sodium and acetaminophen.

C-Technique: Control group related intervention and assessment were firstly applied at the first half of time of data collection (1st 3 months). This was applied to avoid and reduce bias during sample collection. Additionally, none of the children's and their caregiver knew what their group is, as well as the surgeon. Study group related intervention and assessment were applied at the second half of time of data collection (2nd 3 months).

Inclusion Criteria:

All children diagnosed with tonsillectomy were included after fulfillment of the following criteria:

- Male & Female children
- Age ranged from 6-15 years
- No medical disorder & other ENT problem
- No sensitivity to oral honey or its products
- Free from intra operative complications

Tools of Data Collection:

Three tools were utilized to collect data pertinent to the current study.

Tool I: A Structured Interviewing Questionnaire Sheet: It was designed by the researchers and included the personal characteristic for the studied children such as, (age, sex, education level, residence, weight, and height).

Tool II: Post-operative assessment tool: It was adopted from Boroumand et al., (2013)⁽¹⁷⁾ & Park et al., (2014)⁽¹⁸⁾ and modified by the researchers to suit the study. It is used to evaluate wound healing through the ability of the children to speak, swallow, and eating after surgery. Additionally, it used to assess daily analgesic consumption and number of awake at night due to pain. A score of two was given to children able to eat, swallow solid, and semisolid food, and sleep well; a score of one was given to children able to eat, swallow only semi solid food, and had sleep disturbances; while a score of zero was given to children not able to eat, swallow and sleep well. The scores categorized as; good (2); moderate(1); and poor(0).

Tool III: Numerical Pain Rating Scale

It was adapted from Williamson & Hoggart (2005)⁽¹⁹⁾ to assess the severity of pain. Children and their caregivers were instructed to choose a number from 0 to 10 that best describes own pain and record the appropriate number. 0 would mean "no pain" and 10 would mean "sever pain". It was scored as no pain (0), mild pain (1-3), moderate pain(4-7), and severe pain(8-10). The researchers will use different colors to color the areas of mild, moderate, and severe pain to help younger children and their caregiver, the colors will be as the following; white color(no pain); yellow color(mild pain); orange color(moderate pain); and red color(severe pain).

Validity and reliability of study tools:

Data collection tools were submitted to five experts (two medical surgical and 3 pediatric nursing field) from the Faculty of Nursing Ain Shams and Zagazig Universities, to test the content validity. Modifications of the tools were done according to the expert's judgment on clarity of sentences, appropriateness of content and sequence of items. The experts' agreed on the content. Internal consistency reliability of all items of the tools were assessed using coefficient alpha. It was 0.76 for postoperative assessment tool and 0.89 for numerical pain rating scale.

Pilot study:

A pilot study was carried out with 10.0% of the total sample size (approximately 56 children; 29 for the study group and 27 for the control group) over a period of one month (February, 2014). The purpose was to

ascertain the feasibility of the study and the clarity and applicability of the tools. It also helped to estimate the time needed for filling out the forms. Based on the results of the pilot, no modifications were needed and pilot study subjects were excluded from the sample of the study.

Ethical and Legal Considerations:

The present study was conducted under the approval of the Faculty of Nursing ethical committee, Benha University. Then an official permission for data collection was obtained from the hospital manager and head of ENT department in the previously mentioned setting after explaining the purpose of the study through submission of official letters issued from the dean of Faculty of Nursing, Benha University. The aim of the study was explained to each guardian included in the study before participating in the current study to gain their confidence and trust. An oral consent was obtained from each guardian to participate in the study. Data were collected and treated confidentially. Each child and guardian has the right to withdraw at any time the study without giving any reason.

Filed work

Data were collected from the beginning of March, till the end of August 2014. Once permission was granted to conduct the study, the researchers were initiated data collection. The researchers introduced themselves and a brief explanation about the objective of the study was given to the children and their caregiver and then an oral consent was obtained. According to the hospital policy, ENT operation are performed three day per week. The researchers were available in the first and second day of operation at the morning and afternoon shifts during data collection to make any required clarifications about questionnaires to the subjects.

For the Control Group, The personal data for children were filled in and completed by the child and their caregiver on the same day of admission; it lasts about 10-15 minutes. All children in the control group were received parenteral antibiotic, Diclofenac sodium, and acetaminophen. The postoperative assessment tool was filled in by the researchers through assessing the child's ability to swallow, eat, and speak for assessing wound healing. In addition, daily consumption of pain and number of awake at night due to pain were assessed. Also, Pain was assessed by using Numerical Pain Rating Scale. This assessment was made in the first, and the second day after surgery in the ward, and then reassessed on the third, fourth, and the fifth day after discharge by telephone follow-up. **For the Study Groups,** the personal data for children were filled in and completed by the child and their caregiver on the same day of admission; it lasts about 10-15 minutes. All children in the study group were received oral bee honey in addition to parenteral antibiotic, Diclofenac sodium, and acetaminophen. Administration of honey was started at the 4th hours after recovery from anesthesia, and withdrawal of the effect of sedative or narcotics; the children began to have oral intake of two table spoons of bee honey (10 ml) twice daily, over a period of 5 days. If the child unable to swallow oral bee honey alone, honey can be mixed with juice, yogurt, or cold fluids. The postoperative assessment tool was filled in by the researchers through assessing the child's ability to swallow, eat, and speak for assessing wound healing. In addition, daily consumption of pain and number of awake at night due to pain were assessed. Also, Pain was assessed by using Numerical Pain Rating Scale. This assessment was made in the first, and the second day after surgery in the ward, and then reassessed on the third, fourth, and the fifth day after discharge by telephone follow-up.

Statistical Analysis:

The collected data were revised, organized, tabulated and analyzed by using IBM SPSS statistical software version 20. Descriptive statistics with mean and standard deviation (SD) for continuous variables and frequency for categorical variables were analyzed. Qualitative variables were compared using Chi square test (X^2) as the test of significance and independent (t) test was used to compare mean score between two groups. The p-value is the degree of significant. A significant level value was considered when p-value ≤ 0.05 and a highly significant level value was considered when p-value ≤ 0.001 , while p-value > 0.05 indicates non-significant results.

III. Results

Table (1): Illustrates the personal characteristics of children under the study; it was observed that, the mean age were (10.45 \pm 2.07 & 10.98 \pm 2.14 years) in the study and the control groups respectively. In addition, the same table manifests that, 69.1% & 71.3% of them were recruited at the primary schools in both the study and the control groups respectively. Concerning residence, 52.1% & 54.1% of the study and the control groups respectively were residing at rural settings. Moreover, this table reveals that, there were no statistically significant difference between the study and the control groups related to all personal characteristics.

Table (2): Presents the postoperative wound healing mean scores between the study and the control groups at the different time of assessment, it was pointed that, there were no statistically significant differences in both groups

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on the first day of surgery. While, in the second, third, fourth, and the fifth days after surgery, there were highly statistically significant differences between the study and the control groups regarding the ability to swallow, eat, and speak after tonsillectomy (P <0.0001**).

Table (3):Shows the postoperative analgesic consumption mean scores between the study and the control groups at the different time of assessment, it was revealed that, From the second to fifth day after the operation, the need to analgesics was significantly lower in honey group compared to the control group (P <0.0001**).

Table (4):Presents the postoperative awake at night mean scores between the study and the control groups at the different time of assessment, it was observed that, from the second to fifth day after surgery, the wake at night due to pain significantly reduce in honey group compared to the control group (P <0.0001**).

Table (5):Reveals the postoperative pain mean scores between the study and the control groups at the different time of assessment, it was pointed that, there were no statistically significant differences in both groups on the first day of surgery. While, in the second, third, fourth, and the fifth days after surgery, there were highly statistically significant differences between the study and the control groups regarding pain intensity after tonsillectomy p<0.001.

Table (1): Personal Characteristics of Studied Children (n=556).

Characteristics	Study group n=288		Control group n=268		Chi square test	P value
	No	%	No	%		
Age in years					.314	>0.05
6-	57	19.8	55	20.5		
9-	142	49.3	136	50.7		
12-15	89	30.9	77	28.8		
Mean ±SD	10.45±2.07		10.98±2.14			
Educational level					.313	>0.05
Primary	199	69.1	191	71.3		
Preparatory	89	30.9	77	28.7		
Residence					.228	>0.05
Urban	138	47.9	123	45.9		
Rural	150	52.1	145	54.1		
Body weight (Kg) (Mean ±SD)	30.74±2.09		28.95±2.16		.283	>0.05
Height (Cm) (Mean ±SD)	138.1±8.5		142.6±7.9		.430	>0.05

Table (2): Postoperative Wound Healing Mean Scores between The Study and The Control Groups at the Different Time of Assessment (n=556).

Characteristic	Study group n=288	Control group n=268	Independent test	P value
	Mean ± SD	Mean ± SD		
1st day				
Ability to swallow	2.3403±.47463	2.5933±.58913	16.39	>0.05
Ability to eat	2.4514±.49850	2.6716±.59051	16.76	>0.05
Ability to speak	2.4792±.50044	2.6716±.57117	17.67	>0.05
2nd day				
Ability to swallow	2.4236±.49499	1.5933±.58913	17.92	<0.001**
Ability to eat	2.5729±.49552	1.6716±.59051	19.42	<0.001**
Ability to speak	2.5451±.49883	1.6716±.57117	19.14	<0.001**
3rd day				
Ability to swallow	2.6354±.48215	1.7090±.59743	17.92	<0.001**
Ability to eat	2.7743±.41877	1.7910±.58795	19.42	<0.001**
Ability to speak	2.8160±.38818	1.7836±.58524	19.14	<0.001**
4th day				
Ability to swallow	2.6354±.48215	1±.59743	20.03	<0.001**
Ability to eat	2.7743±.41877	1.7910±.58795	22.56	<0.001**
Ability to speak	2.8160±.38818	1.7836±.58524	24.32	<0.001**
5th day				
Ability to swallow	2.8611±.34643	1.8396±.65372	22.77	<0.001**
Ability to eat	2.8889±.31482	1.8918±.62370	23.53	<0.001**
Ability to speak	2.9271±.26045	1.9179±.60644	25.16	<0.001**

Table (3): Postoperative Analgesic Consumption Mean Scores between The Study and The Control Groups at the Different Time of Assessment (n= 556).

Assessment time	Study group n=288		control group n=268		Independent t test	P value
	Mean	± SD	Mean	± SD		
1 st day	2.8738±.60450		2.8769±.32921		14.81	>0.05
2 nd day	1.9181±.63021		2.8396±.36771		16.62	<0.001**
3 rd day	1.8785±.43675		2.7425±.43805		23.27	<0.001**
4 th day	1.1875±.41687		2.5522±.49819		34.89	<0.001**
5 th day	.4340±.65929		2.1716±.71397		29.75	<0.001**

Table (4): Postoperative Mean Scores of Awakening at Night due to Pain between The Study and The Control Groups at the Different Time of Assessment (n= 556).

Assessment time	Study group n=288		control group n=268		Independent t test	P value
	Mean	± SD	Mean	± SD		
1 st day	.6875±.46432		.6896±.36771		4.29	>0.05
2 nd day	.5139±.50068		.7463±.43596		5.84	<0.001**
3 rd day	.3646±.48215		.7015±.45846		8.44	<0.001**
4 th day	.2535±.43576		.5336±.49980		7.02	<0.001**
5 th day	.1667±.37333		.4590±.49924		7.77	<0.001**

Table (5): Postoperative Pain Mean Scores between the Study and the Control Groups at Different Time of Assessment (n= 556).

Times of assessment	Study group n=288			Control group n=268			Independent t test	P value
	Mean	±	SD	Mean	±	SD		
1 st day	8.4861		.57819	8.4701		.59574	.320	>0.05
2 nd day	5.7674		.68689	7.8582		.74606	34.30	<0.001**
3 rd day	3.9028		.80780	6.5858		1.27056	29.46	<0.001**
4 th day	1.2049		.76717	5.6567		.76049	68.68	<0.001**
5 th day	.5590		.52464	3.3582		1.90565	23.97	<0.001**

IV. Discussion

Post-tonsillectomy pain is a universal complaint of children and remains a considerable clinical problem. It impairs post-operative recovery, delays the improvement and discharging, disorder eating, and cause dehydration that resulting in longer hospitalization and receiving intravenous fluids. Non-steroidal anti-inflammatory drugs (NSAIDs) are usually used after tonsillectomy to create analgesia. However, as increases the platelet adhesion and bleeding, it is a controversial method^(20,21). Applying oral honey; promotes wound epithelization; reduces inflammation, edema, and exudation; accelerates collagen synthesis; and increases DNA content in granulation tissue⁽²²⁾.

Regarding personal characteristic of the studied children, the present study founded that, there was no significant difference in age among the honey and the control groups. These findings are in the same line with **Boroumand et al., (2013)**⁽¹⁷⁾ who conducted a study to evaluate the effects of honey on the incidence and severity of postoperative pain in patients undergoing tonsillectomy, they pointed out that, there was no significant difference between the study and the control groups regarding their age.

The present study showed that, oral bee honey when used in tonsillectomy children from the first to the fifth day post operatively was significantly reduced the pain intensity at the site of operation objectively evidence by eliminating daily times of using analgesic and decrease number of awake at night due to pain. These findings support the hypothesis; that administration of oral bee honey for children after tonsillectomy will relieve pain, decrease analgesic consumption, and number of awake at night. In addition, these findings are in harmony with study carried in Malaya by **letchumanan et al., (2013)**⁽²⁾ who revealed that oral honey when used in post tonsillectomy patients from day 1 post operatively in the 4th hourly till day 8th, has significantly reduced the pain at the operation site, reduce pricking sensation in the throat, reducing radiating pain to the jaws, minimizing dryness of the mouth, and minimized the doses of intake of acetaminophen. In the same vein, **Mohebbi et al., (2014)**⁽²³⁾ who conducted the study to investigate the effect of honey on reducing pain after tonsillectomy in children 5-15 years old. They showed that, acetaminophen consumption, the frequency of awakening at night in children who received honey is significantly less than the control group.

The findings of the current study revealed that, postoperative wound healing was enhanced among oral bee honey group; the healing score was higher among oral bee honey group as compared with the control group. From the point of view of the researchers, this may be due to the ability of bee honey to lower prostaglandin concentration (a mediators for inflammation and pain) that could explain decrease inflammation, pain, irritating symptoms of the wound, and faster healing. This is proved with the statement from **Al-Waili et al., (2011)**⁽¹⁴⁾ who

stated that, honey has anti-inflammatory and antioxidant activities that make it a suitable natural subject for wound healing and help in the eradication of microbial infections. Also, honey increases nitric oxide, which is important for wound healing, and decreases prostaglandins, which are mediators of inflammation. In this regard, **Benhanifaetal., (2011) &Majtanetal.,(2010)**^(10, 24) added that, honey is speed up the healing process in wound by motivating monocytes and keratinocytes to secrete inflammatory cytokines like Interleukin (IL)-1B, IL-6, and tumor necrosis factor (TNF)-alpha; these mediators play an important role in healing, and tissue repair. Its acidity increases the release of oxygen from hemoglobin thereby making the wound environment less favorable for the activity of destructive proteases. However, the high osmolarity of honey draws fluid out of the wound bed to create an outflow of lymph that beneficial to the healing process. These findings are in agreement with **Mat lazimetal., (2013)**⁽²⁵⁾ who conducted a study to investigate the effect of Tualang honey in enhancing healing process in post tonsillectomy patients, they found that, wound healing was significantly faster in the study group in both tonsillar fossae compared to the control group. Again, A retrospective study performed by **Gupta et al., (2011)**⁽²⁶⁾ demonstrated that honey has a significant effect in reducing infection rate and accelerating healing on burn wound.

So, study results support the finding that using of oral bee honey is effective for improving pain and enhancing wound healing after tonsillectomy. Therefore, health care provider should use it postoperatively as an adjunctive regimen because it is easy in use, cheap, has sweet taste and minimal side effects when used regularly.

V. Conclusion

Based on the result of the present study it can be concluded that, the research hypothesis is accepted, while it was found that the administration of oral bee honey after wake up, following tonsillectomy significantly enhancing wound healing, reduce postoperative pain and may substantially decrease the need for analgesics and number of awake at night due to pain.

VI. Recommendations

In the light of the present study, the following recommendations are suggested:

1. Oral bee honey can be a part of hospitals' protocols for pain and wound healing after tonsillectomy.
2. Further researches are needed to assess the potential use of honey in wound healing and pain relief after tonsillectomy in other care setting to generalize the finding result.

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