



Effectivity of alkaline water on the clinical improvement in laryngopharyngeal reflux

Muhammad Rizka Yahya, Rery Budiarti, Dwi Antono, Farokah, Muyassaroh*

Department of Otolaryngology-Head and Neck Surgery, Dr. Kariadi Central Hospital Semarang, Indonesia.

ABSTRACT

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Laryngopharyngeal reflux (LPR) is the reflux of gastric acid through the upper oesophageal sphincter causing mucosal damage of the larynx, the gastrointestinal tract, and the upper airway. Alkaline water has the ability to withstand acidic conditions in the body, the formation of carbonic anhydrase, and reepithelization. This study aimed to investigate the effect of alkaline water on the clinical improvement in LPR patients. A randomized control trial with pre-test and post-test control group design on LPR patients aged 18 to 60 y.o. was conducted at the ENT-HS outpatient clinic of Dr Kariadi Central Hospital, Semarang, Central Java, Indonesia. Thirty subjects were recruited and divided into two group with 15 subjects in each group. In the control group, the subjects were given standard therapy and mineral water. In the treatment group, the subjects were given standard therapy and alkaline water. The diagnosis of LPR was made if the reflux scoring index (RSI) was ≥ 13 , and the reflux finding score (RFS) was >7 . After two weeks of intervention, the clinical improvements were evaluated by reassessing the RSI score. The data were analyzed using the Shapiro-Wilk test and independent t-test. The results showed that the most common main complaint was throat clearing [11 subjects (37%)]. Based on the RSI score, there were clinical improvements in both the control ($p < 0.001$) and the treatment groups ($p < 0.001$). However, there was no significant difference in the RSI score before and after the intervention in the control ($p = 0.058$) and the treatment groups ($p = 0.322$). In conclusion, there is an effect of alkaline water on the clinical improvement of LPR patients. However, there is no significant difference in the clinical improvement between the control and the treatment groups.

ABSTRAK

Laryngopharyngeal reflux (LPR) adalah naiknya cairan lambung melewati sfingter esofagus atas yang mencederai mukosa laring, faring, dan mukosa sepanjang saluran cerna dan saluran napas atas. Air alkali dapat mempertahankan enzim keasam dalam tubuh, pembentukan enzim karbonat anhidrase, dan re-epitelisasi. Penelitian ini bertujuan untuk mengkaji pengaruh pemberian air alkali terhadap perbaikan klinis penderita LPR. Penelitian merupakan penelitian eksperimental dengan *randomized control trial pre-post test design* pada penderita LPR umur 18 hingga 60 tahun di klinik THT RSUP Dr. Kariadi Semarang, Jawa Tengah, Indonesia. Tiga puluh subjek direkrut dan dibagi dalam dua kelompok dengan masing-masing kelompok 15 subjek. Kelompok kontrol diberikan terapi standar dan air mineral. Kelompok perlakuan diberikan terapi standar dan air alkali. Diagnosis LPR ditegakkan dengan *reflux scoring index* (RSI) ≥ 13 , *reflux finding score* (RFS) >7 . Pada hari ke 14 setelah intervensi, subjek dievaluasi perbaikan klinisnya dengan penilaian ulang skor RSI. Analisis statistik menggunakan uji *Saphiro wilk* dan *independent t test*. Hasil penelitian menunjukkan keluhan terbanyak berupa *throat clearing* sebanyak 11 subjek (37%). Rerata skor RSI mengalami perbaikan klinis baik pada kelompok kontrol ($p < 0,001$) maupun kelompok perlakuan ($p < 0,001$). Namun, rerata Skor RSI sebelum dan sesudah terapi tidak berbeda bermakna pada kelompok kontrol ($p = 0,058$) dan kelompok perlakuan ($p = 0,322$). Dapat disimpulkan bahwa terdapat pengaruh pemberian air alkali pada perbaikan klinis penderita LPR. Namun demikian, tidak terdapat perbedaan bermakna pada perbaikan klinis kelompok kontrol dan kelompok perlakuan.

Keywords:

laryngopharyngeal reflux;
alkaline water;
clinical improvement;

INTRODUCTION

Laryngopharyngeal reflux (LPR) is the reflux of gastric acid into the larynx, pharynx, trachea, and bronchi. The prevalence of LPR is 15% - 20% of the total patients visiting the ENT specialists.¹ LPR occurs due to the high acid level. Alkaline water is currently used to neutralize the acidity because alkaline water with a pH of 8.8 can help to reduce acid reflux. The high pH level will inactivate pepsin, an enzyme involved in protein breakdown and the main cause of lower acidity. Apart from that, alkaline water has also been shown to reduce the acidity of stomach contents.^{2,3,4}

Alkaline water has been established as fit for consumption and beneficial for the human body. One of its most important benefits is its ability to neutralize acidity in the body by reducing excess acid content in the stomach. Furthermore, alkaline water can boost the immune system, as well as neutralize acidity in the body caused by poor diet, stress, and environmental toxins. Alkaline water can also be absorbed by the body, and is rich in alkaline minerals. With the -availability of abundance electrons, alkaline water allows the body cells to eliminate the harmful free radicals.^{5,6}

Alkaline water with a pH of 8.8 can help reduce gastric acid reflux because higher pH levels will inactivate pepsin, an enzyme involved in dietary protein breakdown and the main cause of lower acidity.^{7,8} However, study concerning the effect of alkaline water on LPR patients has never been conducted. This study aimed to investigate the effect of alkaline water on the clinical improvement of LPR patients.

MATERIALS AND METHODS

Design and sample size

This was a randomized control trial with a pre-test and post-test control

group design, conducted at the ENT-HS outpatient clinic of Dr. Kariadi Central Hospital, Semarang, Central Java. This study had obtained ethical approval from the Health Research Ethics Committee of Dr. Kariadi Central Hospital, Semarang.

The sample size for each group was determined by the calculation formula used in previous studies. With the standard deviation of 4.7, α of 0.05, and power of 90%, the sample size obtained was 13.8, which was then rounded to 14. Then a drop-out count of 10% was added and the final sample size for each group consisted of 15 people.

Protocol of study

The diagnosis of LPR was conducted based on the reflux scoring index (RSI), a complete ENT examination, and reflux finding score (RFS) using flexible laryngoscopy/ fiberoptic laryngoscope (FOL). The diagnosis of LPR was established if the RSI score was ≥ 13 and the RFS score was >7 . The samples were collected using consecutive sampling and single blinding methods.

The inclusion criteria of this study included: 1) patients with LPR (RSI of ≥ 13 ; RFS of >7), 2) aged 18-60 years old, and 3) willing to take part in the study. Meanwhile, the exclusion criteria included: 1) patients with head and neck malignancies, 2) patients with acute lower and upper respiratory tract infections (rhinitis, pharyngitis, tonsillitis, or bronchitis), and 3) had a previous history of undergoing radiotherapy in the neck area.

In the control group, 15 subjects were given standard therapy consisting of 20 mg of omeprazole every 12 hours and 1.8 L of mineral water per day for 2 weeks. Meanwhile, in the treatment group, 15 subjects were given 1.8 L of alkaline water per day and 20 mg of omeprazole every 12 h for two weeks. Both of groups

were evaluated after two weeks by reassessing clinical improvement using the RSI score.

Statistical analysis

aA normality test of the data was performed using the Shapiro-Wilk test, which showed a normal data distribution. Finally, the data were analyzed using the

independent t-test or Wilcoxon test or Fischer's exact test. A p value < 0.05 was considered significant.

RESULTS

A total of 30 subjects who met the inclusion and exclusion criteria were randomized into two groups i.e. treatment and control groups.

TABLE 1. Data distribution

Variables	Groups		P
	Control	Treatment	
Sex			
• Male [n (%)]	2 (13.3)	3 (20)	1.000*
• Female [n (%)]	13 (86.7)	12 (80)	
Age (mean ± SD years)	43.20 ± 9.76	45.60 ± 8.73	0.484**
Age categories [n (%)]			
• 15 – 20	0 (0)	0 (0)	
• >20 – 30	2 (7)	1 (3)	
• >30 – 40	3 (10)	4 (13)	
• >40 – 50	7 (23)	6 (20)	
[n (%)]>50 – 60	3 (10)	4 (13)	

Notes: *Independent t-test; **Fischer's exact test.

TABLE 1 shows the characteristics of the subjects based on sex in the two groups, consisting of 5 (16.7%) male and 25 (83.3%) female subjects. The sex distribution in the two groups were homogeneous (p = 1.0). The distribution of subjects based on age show that the

highest number of subjects was in the 41-50 years age group, which were 13 (43%) subjects. The age distribution in the two groups were homogeneous (p = 0.484). The mean age in both groups was 43 ± 9.756 years, with an age range of 21-60 years.

TABLE 2. Distribution of chief complaints

Chief complaints	n (%)
Hoarseness	4 (13)
Throat clearing	11 (37)
Mucus in the throat	5 (17)
Swallowing difficulty	2 (7)
Coughing after eating or lying down	1 (3)
Breathing difficulty	0 (0)
Nagging cough	1 (3)
A lump in the throat	6 (0.2)
Heart-burn, chest pain, indigestion, gastric acid reflux	0 (0)

The most frequent main complaint that brought subjects for treatment was throat clearing [11 patients (37%)], followed by mucus in the throat [5

patients (17%)]. Meanwhile, complaints of heartburn and difficulty in breathing were not the main complaints that brought subjects to come for treatment.

TABLE 3. Pre-test and post-test RSI score results

Variables	Groups		p
	Control	Treatment	
Pre-test	22.27 ± 3.26	24.47 ± 2.83	0.058*
Post-test	18.27 ± 2.92	17.33 ± 2.09	0.322*
p	<0.001**	<0.001**	

Notes: *Independent t-test (significant if the p value was <0.05)

TABLE 3 shows an insignificant decrease in the RSI score ($p > 0.005$) after two weeks of intervention both in the treatment and control groups. The mean pre-test RSI scores in the control and treatment groups were 22.27 ± 3.26 and 24.47 ± 2.83 respectively. Meanwhile, the mean post-test RSI scores in the

treatment and control groups were 18.27 ± 2.92 and 17.33 ± 2.09 , respectively. The results of statistical tests showed no significant differences ($p > 0.05$) in the mean RSI score before and after the intervention both in the treatment and control groups.

TABLE 4. Pre-test and post-test RSI score analysis in the treatment and control groups

RSI	Groups	
	Control	Treatment
Hoarseness	0.008	<0.001
Throat clearing	0.004	<0.001
Mucus in the throat	0.002	0.001
Swallowing difficulty	0.414	0.034
Coughing after eating or lying down	0.020	0.021
Breathing difficulty	0.157	0.109
Nagging cough	0.020	0.001
A lump in the throat	0.008	0.001
Heartburn, chest pain, indigestion, gastric acid reflux	0.248	0.013

Notes: *Wilcoxon test; **Significant

Based on the statistical analysis (TABLE 4), we found a significant improvement in RSI score of the control group, in exception to swallowing difficulty, breathing difficulty, heartburn, chest pain, indigestion, and gastric acid reflux complaints. Meanwhile, in the treatment group, we found improvements in almost all complaints, except for breathing difficulty.

DISCUSSION

This study involved 30 LPR patients, with a mean age of 43 ± 9.756 y.o (range 21 to 60 years). The highest number of subjects was found in the 51 to 60 years age group (23%). This result was different from previous studies, where LPR was mostly found in the 41-50 age

groups (43%). Other studies showed that LPR cases were mostly found in subjects aged over 60 years. The results of this study indicated that LPR cases were more frequently found in female subjects (83.3%) compared to male subjects (16.7%), with a ratio of 1.7:1.^{9,10}

The most frequent main complaint that brought subjects for treatment was throat clearing [11 patients (37%)]. Meanwhile, complaints of heartburn and difficulty in breathing were not the main complaints that brought subjects to come for treatment.

RSI scoring measurement analysis

No significant difference in mean pre-test and post-test RSI scores between the treatment and the control groups

($p > 0.05$) was observed. This result might be caused by the gastric feedback mechanism to detect an increased pH, thus signalling the gastric wall to produce more chloric acid to return normal gastric acidity (pH of 4), and causing lesions on the laryngeal mucosa. All of these conditions eventually affect the RSI score measurement.^{11,12}

It was found that the RSI scores increased in almost all complaints in the treatment group compared to the RSI scores in the control group (TABLE 4). These improvements include improvement in symptoms of hoarseness, throat clearing, mucus in the throat, swallowing difficulty, coughing after eating or lying down, nagging cough, a lump in the throat, heartburn, chest pain, indigestion, and gastric acid reflux. Meanwhile, in the control group, there were only a few improvements in several complaints, such as hoarseness, clearing throat, mucus in the throat, nagging cough, and a lump in the throat. These results might be caused of the omeprazole given to each subject in both groups. Omeprazole was believed to reduce the complaints, given its function as a proton-pump inhibitor (PPI) agent.^{13,14} This statement was proved by subjects in the treatment group, who received omeprazole-alkaline water regimen, experienced more improvements compared to subjects in the control group. These symptoms may be caused by high hydrogen content in alkaline water acting as an anti-oxidant to reduce the reactive oxygen species (ROS) levels in the body. ROS is a very reactive molecule formed primarily in the electron transport chain in mitochondria. ROS plays an important role in the normal physiological process, such as regulation of protein phosphorylation redox, ion channel, and transcription process. Excessive production of ROS would cause cell and tissue damage leading to an urgent need for an anti-oxidant to neutralize the ROS. Alkaline water with

pH of 8.8 may help reducing acid reflux because higher pH level will inhibit pepsin, an enzyme involved in dietary protein breakdown and the main cause of decreased acidity.^{6,7,15}

CONCLUSION

There are clinical improvements both in the control and treatment groups. However, the clinical improvements are not significantly different between subjects given either alkaline water or mineral water. Future studies are needed with a consideration of the duration of therapy based on the LPR management guidelines to improve the clinical improvements.

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