



The effects of vitamin A on acute watery diarrhea in children 1-5 years old

Davood Kheirkhah¹, Mohammad Reza Sharif¹, Parisa Honarpisheh² and Alireza Sharif^{1*}

¹Infectious Diseases Research Center, Kashan University of Medical Sciences, Kashan, Iran

²Student Research Committee, Kashan University of Medical Sciences, Kashan, Iran

*Corresponding Email: arsharifmd@yahoo.com

ABSTRACT

Background: Diarrheal diseases is one of the major causes of mortality and the most common health problems in developing countries and have an important role in malnutrition of children. Due to the effects of diarrhea and malnutrition on each other, improving diarrhea treatment programs are important for children's health. The aim of this study was to evaluate the effect of vitamin A in improvement of watery diarrhea in 1-5 years old children. Methods: This study was performed on 227 children aged 1-5 years affected by acute watery diarrhea admitted to ShahidBeheshti hospital in 2014. Patients were divided into two groups, vitamin A group, and control group. Duration of diarrhea, the average of diarrheal episodes, and length of hospitalization were recorded. Data was analyzed by the use of Chi-squared and t-tests. Findings: The study included 227 patients in two groups of 116 patients (intervention group) and 111 patients (control group). It was found that the average duration of diarrhea in the group receiving vitamin A, was significantly lower (3.24 ± 1.64 days in the intervention group and 4.95 ± 1.73 days in the control group, $P < 0.001$) as well as Diarrhea frequency (5.78 ± 2.00 vs. 7.77 ± 1.58 respectively, $p < 0.001$) and length of hospitalization (4.03 ± 1.63 days in the intervention group and 5.36 ± 1.70 days in the control group, $P < 0.001$). Conclusion: Intramuscular vitamin A prescription in the treatment of diarrheal diseases in children reduces the duration and severity of diarrhea.

Keywords: Diarrheal disease, Vitamin A, Children

INTRODUCTION

Diarrheal diseases are one of important cause of mortality in developing countries. It causes the death of more than three million children a year annually [1]. This disease mostly occurs in deprived area and among the children with malnutrition [2]. Although mortality of diarrheal diseases is declining in general, the overall incidence of diarrhea has not changed and it still happen approximately 3.2 episodes per child annually. Reducing death by diarrheal diseases, despite of the constant rate, is due to improving the treatment of diarrhea as well as improving the nutrition of infants. These performances include oral rehydration treatment with home and hospital solutions as well as improving nutrition in duration of disease. Malnutrition increases the risk of diarrhea and mortality multiple times. Mortality in different regions varies based on the severity of malnutrition. The highest proportions are in Africa, South Asia and Latin America. There is more risk especially in cases of micronutrient malnutrition. The risk of death due to diarrhea, measles and malaria 20-24% is higher among children with vitamin A deficiency.

Most signs and symptoms of diarrhea syndromes are related to the type of pathogen and severity of the contamination. Other symptoms depend on the complications (e.g. dehydration and electrolyte imbalances) and the nature of pathogens. The most common presentation of gastrointestinal infection in children is diarrhea, abdominal cramps and vomiting. Fever is common in patients with inflammatory diarrhea.

Most complications of gastroenteritis are related to late diagnosis and treatment. Late and inadequate rehydration can cause dehydration and its consequences in many children with acute diarrhea. These consequences can be fatal for infants and kids. Inappropriate treatment can lead to prolonged diarrhea that can end up in malnutrition, and some problems such as secondary infections and deficiency of micronutrients (iron, zinc). In developing countries, Bacteremia is one of the known consequences of children affected by diarrhea and malnutrition [3].

Due to the effects of diarrhea and malnutrition on each other and malnutrition role in growth and development disorders, improvement of the diarrhea treatment programs plays an important role in children's health [3]. The duration of diarrhea depends on multiple factors. Malnutrition and loss of immunity are two important proven factors and Vitamin A deficiency can be related to both factors [5, 6]. Vitamin A is a fat-soluble vitamin that is derived from two sources: Carotenoids and Retinoids. Retinoids can be found in animal sources such as liver, eggs and dairy sources. Carotenoids such as β -Carotene are found in plants such as vegetables and carrots [4].

The most important role of vitamin A is in vision process, but it also has some other roles such as promoting the immune system and reducing the severity of infections, as well as restraining some cancers. Furthermore, deficiency of vitamin A can cause some disease such as vision impairment, skin diseases, increased severity of infections like measles, diarrheal, respiratory and parasitic diseases [5, 6, 7, 8, 9]. In various studies, the effect of vitamin A is also proven in reducing oxidative stress and myocardial infarction as well as acceleration of clinical healing after CABG, induction of apoptosis in prostate cancer cells, reducing the risk of ROP in preterm neonates, and prevention of BPD, especially in ELBW infants [10- 14].

Vitamin A deficiency is one of the major problems in developing countries. Therefore, the World Health Organization recommend vitamin A supplement for the pregnant women and children. Even Some researchers have recommended prescribing vitamin A supplement up to five years old [15]. One of the most important causes of prolonged diarrhea and its complications is the delay in repair of the intestinal mucosa. As vitamin A has an important role in stimulation of epithelial intestinal cells synthesis, prescription of Vitamin A can help shortening the duration of diarrhea, especially for invasive diarrhea [16]. The lack of vitamin A can prolong diarrhea duration [17].

A lot of studies with different and even conflicting results have been done with regards to the role of oral vitamin A in the prevention and treatment of diarrhea diseases. One important point in these studies is that vitamin A has been prescribed in oral form. It may cause different results in the study due to possibility of intolerance to oral form of drugs in the patients and differences in the intestinal absorption due to underlying diseases. Therefore, in this study, in order to avoid the mentioned problems, injectable vitamin A is used. Also in many studies the same dose of vitamin A is prescribed for children in different ages; while in this study, vitamin A is prescribed with specific dose (1000u/kg) based on child's weight. As A + D supplements drop is prescribed for only up to one year old in the national program in Iran, this study is conducted on 1 to 5 years old children who are not normally treated with vitamin A.

MATERIALS AND METHODS

This clinical trial study was conducted on 250 children who were 1-5 years old with acute gastroenteritis. We selected patients complaining of acute watery and non-inflammatory diarrhea who had been hospitalized in 2014 in Beheshti Hospital. Selected patients did not have malnutrition or other diseases except gastroenteritis and had not received outpatient treatment. Patients distributed to the intervention and control groups randomly. In one of groups shot of vitamin A at a rate of 1,000 units per kg were injected intramuscularly and the other group didn't receive vitamin A. For both groups, treatment protocols of acute watery diarrhea (rehydration) were performed. Then condition of patients in terms of the daily visit for the continuance and frequency of diarrheal episodes within the last 24 hours was recorded in questionnaires.

The same instructions about nutrition and hygiene issues were described to two groups. Patients were monitored during their hospitalization and were excluded if discharged with their personal satisfaction, or developed a fever or bloody diarrhea during hospitalization or did not follow the recommended diet. After collecting the information, data was compiled by SPSS software and kolmogorov-smir tests were conducted to check the normality of data as well as chi-square and t-test for statistical analysis.

RESULTS

Finally this study was performed in two groups of 116 people (intervention group) and 111 people (control group). The study findings show that the average age of the study group who were receiving vitamin A, is 18.03 months and without vitamin A, is 17.06 months. So, there was not a significant difference between the two groups in terms of age. ($P=0.229$) (Table1). Also not any significant difference was seen based on Sex distribution in the two groups, as it were 129 boys (56.8%) and 98 girls (42.3%) affected by acute watery diarrhea ($P=0.805$) (Table2).

Table 1. The mean and standard deviation of the patients' age in the two groups

| Variable | Groups | Number | Mean | Standard deviation | PV |
|------------|-------------------|--------|-------|--------------------|-------|
| Age(month) | With Vitamin A | 111 | 17.06 | 6.79 | 0.229 |
| | Without Vitamin A | 116 | 18.03 | 7.26 | |
| Sum | | 227 | 17.54 | 7.02 | |

Table2. Distribution of the two groups according to sex

| Gender | Groups | | Sum |
|--------|----------------|-------------------|-------|
| | With Vitamin A | Without Vitamin A | |
| Boy | 64 | 65 | 129 |
| | 57.7% | 56% | 56.8% |
| Girl | 47 | 51 | 98 |
| | 42.3% | 44% | 43.2% |
| sum | 111 | 116 | 227 |

P: 0.805

The disease duration before treatment in the intervention group was 2.65 days and in the control group was 2.48 days. Therefore, no significant difference was observed in disease duration before receiving vitamin A in the two groups ($P=0.424$)(Table3).The mean duration of diarrhea in the group without vitamin A was 4.95 days and in the group receiving vitamin A was 3.24 days. So, there is a significant difference in terms of duration of diarrhea in the two groups ($P < 0.001$) (Table4). The average frequency of diarrhea in the group without vitamin A was 7.77 times a day and in the group receiving vitamin A was 5.78 times a day. It shows there is a significant difference in terms of frequency of diarrhea per day, in two groups ($P < 0.001$) (Table5).

Table 3. The mean and standard deviation of illness duration before receiving vitamin A in the two groups

| Variable | Groups | Number | Mean | Standard deviation | PV |
|--|-------------------|--------|------|--------------------|-------|
| Duration of illness before treatment (day) | With Vitamin A | 111 | 2.48 | 1.43 | 0.424 |
| | Without Vitamin A | 116 | 2.65 | 1.73 | |
| Sum | | 227 | 2.56 | 1.58 | |

Table 4. The mean and standard deviation of illness duration after treatment in the two groups

| Variable | Groups | Number | Mean | Standard deviation | PV |
|---|-------------------|--------|------|--------------------|--------|
| Duration of illness after treatment (day) | With Vitamin A | 111 | 4.95 | 1.73 | <0.001 |
| | Without Vitamin A | 116 | 3.24 | 1.64 | |

Table 5. The mean and standard deviation of Frequency of diarrhea in the two groups after treatment

| Variable | Groups | Number | Mean | Standard deviation | PV |
|--|-------------------|--------|------|--------------------|--------|
| Frequency of diarrhea in a day after treatment | With Vitamin A | 111 | 7.77 | 1.58 | <0.001 |
| | Without Vitamin A | 116 | 5.78 | 2.00 | |

The mean duration of hospitalization in the group without vitamin A was 5.36 days and in the group receiving vitamin A was 4.03 days that shows a significant difference in terms of duration of hospitalization in the two groups ($P < 0.001$) (Table6).

Table 6. The mean and standard deviation of duration of hospitalization in the two groups

| Variable | Groups | Number | Mean | Standard deviation | PV |
|-----------------------------|-------------------|--------|------|--------------------|--------|
| duration of hospitalization | With Vitamin A | 111 | 5.36 | 1.70 | <0.001 |
| | Without Vitamin A | 116 | 4.03 | 1.63 | |

DISCUSSION

In this study, no significant differences in terms of age, sex, duration of disease before treatment in the two groups were observed and the results of this study showed that administration of intramuscular vitamin A in 1 to 5 years old children with acute watery diarrhea, may reduce the duration and the frequency of diarrhea, as well as length of hospitalization. In a study by Rahman and partners in Bangladesh, prescription of vitamin A reduces diarrhea in

children and coadministration of vitamin A and zinc, had a better effect in increasing the level of vitamin A [18] which can be due to the interaction of these two drugs [19].

Another study is done in South Africa by Nigel and his colleagues about the effect of vitamin A supplementation for children 6 -60 months suffering from severe diarrhea. In the study, the first group received 60 mg oral vitamin A at onset of illness and the second group got few days after the disease. It showed that the duration of illness in those who consumed vitamin A in onset of illness was longer than those who received that few days after the disease [20]. In a study at a children's hospital in New Delhi by Dewan and his colleagues, Found that Prescribing oral vitamin A in children with gastroenteritis did not help reducing diarrhea. However, it had positive effects in malnourished children with diarrhea [21].

In another study in Australia in 2005 that was conducted on children with acute watery diarrhea, it was found that zinc supplementation, vitamin A, or a combination of the two compared with placebo had no significant effect on the duration of diarrhea and hospitalization rate [22]. Another study by Yurdakok and colleagues in 2006 in Ankara on infants 6-12 months, who were not suffering from malnutrition, showed that oral vitamin A supplementation is ineffective on serum levels of vitamin A, duration of diarrhea, and weight gain during acute diarrheal disease [23]. A study in children in Peru showed that adding zinc to iron supplementation improved hemoglobin response, growth as well as positive effects on diarrhea in children. But no additional effect was observed with coadministration of vitamin A and zinc [24].

Another study in South India showed that vitamin A had no effect on respiratory infections and diarrhea [25]. Another study in 2006 by the Long KZ in Mexico about the effects of oral vitamin A and zinc on the prevention of diarrhea and acute respiratory infections, showed that administration of vitamin A increases these diseases in the children [17], but in another study, he showed the effect of vitamin A supplementation on diarrheal episodes depends on the pathogen and may vary depending on the type of pathogen [26].

As you saw a lot of studies have been done with different or even contrast results, in the role of oral vitamin A in the treatment of diarrheal diseases. Some of them confirm our study and some of them conflict with it. It is noticeable that in studies carried out so far, oral form of vitamin A was prescribed. So, maybe patients with gastroenteritis cannot tolerate the oral form of vitamin A or may reduce absorption of it due to intestinal involvement in these patients that may cause different results and create inconsistencies in the studies. In this study, in order to avoid these kinds of problems, injectable vitamin A is used.

CONCLUSION

The result of this study showed that intramuscular administration of vitamin A in 1 to 5 years old children with acute watery diarrhea, can reduce the duration of diarrhea, reduce the frequency of diarrhea and reduce the length of hospitalization. Since the administration of a single dose of vitamin A is cost benefit, it is recommended that the administration of vitamin A should be included in the treatment of children with acute watery diarrhea.

Suggestions

It is suggested that studies be conducted on the effect of vitamin A on the improvement of acute watery diarrhea caused by pathogens.

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