http://www.cjmb.org doi 10.34172/cjmb.2022.35

Open Access Original Article

Crescent Journal of Medical and Biological Sciences
Vol. 9, No. 4, October 2022, 213–217
eISSN 2148-9696

Association Between Nutritional Status and Quality of Life in Patients With Allergic Rhinitis

Elham Bagherinia[1*], Marzieh Bagherinia[2], Firoozeh Khamoushi[3], Akram Davoodi[1], Seyed Hamidreza Mortazavi[4]

Abstract

Objectives: Allergic rhinitis (AR) is a heterogeneous disorder with immune pathophysiology affecting quality of life (QOL) and productivity at work or education. This study aimed to evaluate the association between macro- and micro-nutrient intakes with QOL in AR patients.

Materials and Methods: Using convenience sampling method, this cross-sectional study included 60 AR patients in the age range of 15-60 years referred to the Allergy Clinic of Mohammad Kermanshashi hospital, Kermanshash, Iran from March to December 2018. Data including body composition, QOL, and nutritional status were collected. Independent t test, chi-square, and Pearson correlation were used for data analysis.

Results: According to the results of Spearman test, while cholesterol intake level was directly associated with low QOL ($P = 0.049$, r=0.283), dietary zinc intake had a negative correlation with low QOL ($P = 0.045$, r=-0.262). However, there were no significant associations between other macro- and micro-nutrient intakes and QOL in patients.

Conclusions: In this study, higher intake of cholesterol, unlike zinc, had a negative effect on QOL in AR patients.

Keywords: Rhinitis allergic, Quality of life, Nutritional status

Introduction

Rhinitis is a common global health problem defined as a chronic inflammatory in the upper respiratory tract and the presence of at least one of the classic symptoms, including rhinorrhea, sneezing, itching, nasal congestion, red and watery eyes, and swelling around the eyes (1, 2). This disorder affects about one fourth of the world population (3). The prevalence of this chronic inflammatory condition is about 10%-40%, and it continues to increase (1). Rhinitis can be related to allergic, non-allergic, hormonal, infectious, occupational, and other factors (3).

Allergic rhinitis (AR) may be caused by frequent exposure to airborne pollens (seasonal rhinitis) and indoor allergens such as mites, house dust, fungal spores and pet dander (perennial rhinitis), or intermittent exposure to allergens (episodic rhinitis), which is considered as an allergic response to specific allergens induced by IgE-mediated hypersensitivity reactions (4). The etiology of AR is not well-known, and its potential biological mechanisms are still unclear. Like other inflammatory allergic diseases, AR has complicated relationships with genetic and environmental factors (5).

Systematic study of the data on opposite-sex twins has shown that genetic factors play a bigger role than the environment in making people with eczema prone to AR. In addition, early life events and environmental incidents can considerably affect epigenetic regulation of the immune system and tissue cells. Environmental factors may also exacerbate AR because exposure to PM2.5 can increase DNA methylation of the promoter gene IFN-γ in CD4+T cells (6). Exposure of people with atopic dermatitis to outdoor environmental factors plays an important role in AR pathogenesis. Environmental exosome mainly consists of air pollutants in the environment or airborne allergens (pollens, molds, and house dust mites) (7). AR is largely associated with a shift in Th1 response toward Th2 immunity. This disorder, similar to asthma, can noticeably affect different aspects of quality of life (QOL) in patients, including work, productivity, and education (8). Several studies indicated that moderate to severe form of AR tends to cause sleep problems (insomnia and nocturnal awakening), depression, fatigue, obstructive sleep apnea, impaired memory, and work productivity deterioration, all of which reduce the QOL (9, 10). Moreover, the costs of controlling and treating AR negatively affect the socioeconomic aspects of the patients' life (10).

QOL is usually considered as wellbeing, welfare, and satisfaction of life. Meanwhile, health-related quality of life (HRQOL) is a part of QOL related to health (11). Since

Received 29 August 2021, **Accepted** 20 December 2021, **Available online** 14 September 2022

[1]Student Research Committee, Department of Immunology, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran. [2]Department of Midwifery and Reproductive Health, Students Research Committee, School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences, Tehran, Iran. [3]Student Research Committee, School of Nutritional Sciences and Food Technology, Kermanshah University of Medical Sciences, Kermanshah, Iran. [4]Department of Pediatrics, School of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran.

***Corresponding Author:** Elham Bagherinia, Tel: +989184724656, E-mail: e.bagherinia@gmail.com

primary symptoms of AR significantly exert negative effects on the patients' life, QOL is routinely measured using a proper instrument, such as specific validated questionnaires.

In addition to AR-related clinical symptoms, AR patients exhibit other symptoms such as fatigue, psychomotor retardation, restlessness, and mood and cognitive disorders. A combination of these factors can cause social isolation of the patients and influence their QOL (12). The disease has serious direct social and economic impacts. Moreover, if we consider the impairment in performance of AR patients caused by sleepiness and cognitive and mood disorders that result from taking antihistamines, the total estimated costs related to AR will increase (13).

So far, the Rhinitis Quality of Life Questionnaire (RQLQ) has been used in various studies to determine the severity of disease and investigate impacts of different treatments on it (1, 3, 14, 15). For example, one study showed that QOL of patients with persistent AR was more troublesome (15). Other studies also indicated that the severity of disease had adverse effects on psychological and physical health of the patients (3, 16).

Although several studies have revealed the negative effects of AR and other diseases of respiratory tract on QOL, currently there is no report on the effects of nutritional status on QOL of patients suffering from AR. Therefore, this study aimed to evaluate the association between macro- and micro-nutrient intakes with QOL in AR patients.

Materials and Methods

Using convenience sampling method, this cross-sectional study included 60 AR patients in the age range of 15-60 years referred to the Allergy Clinic of Mohammad Kermanshashi hospital, Kermanshash, Iran from March to December 2018. All patients were diagnosed based on the Practical Guideline for the Management of Allergic Rhinitis (17). No subject was under treatment with a drug affecting the immune system and weight loss diet at least six months before the study. AR patients suffered from one or more AR symptoms, such as nasal congestion, rhinorrhea, frequent sneezing, and nasal itching for a minimum of four days per week and a period of at least four successive weeks. In the study by Soleimani et al, the sample size was determined as 58 (M1 = 66.7, SD1 = 13.8, M2 = 76.5, SD2 = 12.84, Power = 80%, and $\alpha = 0.05$). In this study, based on the QOL variable in AR patients and using the Stata software (Module sampsi), the sample size was determined as 60 (18).

The Quality of Life

The RQLQ was similar to those used in previous studies (1, 3). The reliability and validity of the Persian version of the questionnaire were previously approved by Shariat et al (3). The RQLQ contains 23 questions on different aspects of QOL, including performance problems during the day (2 items), activity limitation (2 items), eye symptoms (3 items), nasal problems (3 items), general sleep problems (1 item), and emotional and other symptoms (12 items). There are seven options for answering each item depending on the severity of symptoms. The mean score of each subject was calculated according to the answers to the QOLQ and the mean scores for each patient were determined. The investigators were blinded to patients' information and contributed to the study without any costs. The individuals were interviewed by a researcher and all the essential details were provided from the questionnaires. The validity of the QOL questionnaire was reviewed and approved by eight faculty members at Kermanshah University of Medical Sciences. Evaluation of stability by internal consistency method on 20 AR patients yielded Cronbach's alpha value of 0.75.

Key Messages

- Cholesterol had a negative effect on QOL in AR patients.
- Zinc played an important role in QOL of AR patients.

Nutritional Status

The Food Frequency Questionnaire (FFQ), as a valid and reliable tool confirmed in several studies, was used to assess the diet of the participants (19). The FFQ has 147 items and is used to evaluate diet (20). The calculation method is that the amount of food is converted to grams by using household measures (21). Using the Nutritionist 4 software modified for Iranian food, the amount of energy and nutrients was calculated (22).

Body Composition

Weight was measured by a digital scale to the nearest 0.1 kg. Height was measured by a fixed tape meter to the wall with an accuracy of 1 cm in the standard position without shoes while the shoulders, heels, and buttocks were in contact with the wall. Body mass index (BMI) was calculated by dividing weight in kilograms by height squared in meters (kg/m^2).

Statistical Analysis

Data were analyzed using SPSS 25 software (IBM, Chicago, Illinois). Descriptive statistics were used for frequencies, means, and standard deviations to describe the characteristics, clinical symptoms, and macro- and micro-nutrient intakes of AR patients. To compare the age, weight, and BMI in the two groups, the independent sample t-test (based on the results of the Kolmogorov-Smirnov test) was used. Chi-square test was applied to analyze the gender of participants. A Pearson correlation determined the statistical relationship between macro- and micro-nutrient intake with QOL scores. The significance level was considered as $P < 0.05$.

Results

In this study, 60 male and female patients with AR were divided into two groups as follows: 1) patients with high QOL scores (the mean of clinical problems scores <3); and 2) patients with low QOL scores (the mean of clinical problems scores ≥3). The comparisons between the demographic and other characteristics of AR subjects with low and high QOL are shown in Table 1. The age range of patients with the high QOL scores was 15-52 years, while it was 18-60 years for patients with low QOL scores. The youngest patient was 15 and the oldest one was 60 years old. Five complaints were considered as AR symptoms, including nasal congestion, nasal and eye itching, rhinorrhea, frequent sneezing, and tearing. Out of 60 AR patients, 59 (98.3%) had nasal symptoms, 57 (95%) had practical problems, 47 (78.3%) had activity limitation, 43 (71.7%) had eye symptoms, 35 (58.3%) had sleep problems, and 33 (55 %) had emotional and other symptoms. The means ± SD of clinical features of patients are shown in Table 2.

The Correlation Between Nutritional Status and QOL in Patients With AR

The mean ± standard deviation (SD) of the energy intake of one-gram carbohydrate, fat, and protein in AR patients were 492.44 ± 195.44, 99.42 ± 43.75, and 107.09 ± 36.10, respectively. The mean ± SD of the energy intake of other nutrients are indicated in Table 3. The results of Spearman test indicated that cholesterol intake was positively associated with a low QOL (P = 0.049, r = 0.283, Figure 1A), while this significant correlation was negative for zinc (P = 0.045, r = -0.262, Table 3). Other results indicated no significant association between other nutrients and QOL (Table 2).

Table 1. Characteristics of Participants

Variable	QOL Scores		*P* Value*
	High (Mean Scores <3)	Low (Mean Scores ≥3)	
Age (year)	31.53±10.57	35.30±10.83	0.178
Gender			0.194
Female	11 (36.7%)	16 (53.3%)	
Male	19 (63.3%)	14 (46.7%)	
Weight (kg)	75.68±17.24	72.95±12.42	0.545
BMI (kg/m^2)	25.77±4.28	25.66±3.54	0.924

BMI, Body mass index.
Values are presented as mean ± SD for continuous variables and frequency (%) for categorical variables;
*Using independent sample *t* test for age, weight, BMI and Chi-square test for gender.

Table 2. The Mean ± SD of Clinical Symptoms of Allergic Rhinitis Patients

Variable	Mean ± SD (n=60)
Sleep problems	2.18±2.28
Activity limitation	2.99±2.04
Practical problems	3.88±1.71
Nasal symptoms	4.61±1.25
Eye symptoms	2.30±1.77
Emotional and other symptoms	1.29±0.95

Discussion

AR, as a very common disorder, affects people of all ages, especially teenagers (23). Its symptoms are among the most common problems elucidating to physicians (24). These symptoms are frequently ignored, underdiagnosed, misdiagnosed, and mistreated, while can negatively affect various aspects of the patient's life (8). Several studies

Table 3. Correlation Coefficient Between Micro- and Macro-nutrients and the QOL Scores

Variable	Mean ± SD (n=60)	Spearman Correlation	*P* Value*
Total energy (kcal)	3191.41±1150.59	-0.152	0.247
Carbohydrate (g)	492.44±195.44	-0.159	0.226
Fat (g)	99.42±43.75	-0.089	0.501
Protein (g)	107.09±36.10	-0.143	0.275
Cholesterol (mg)	289.16±150.39	0.283	0.049
Saturated fat (g)	29.84±13.57	-0.189	0.148
MUFA (g)	30.84±13.77	-0.118	0.369
PUFA (g)	20.75±11.02	-0.022	0.866
Fiber (g)	70.11±34.03	-0.016	0.906
Sugar (g)	176.68±92.51	-0.157	0.230
Caffeine (mg)	81.07±61.22	0.082	0.532
Vitamin A (µg)	809.81±482.80	-0.038	0.772
Vitamin D (µg)	2.26±2.05	0.050	0.702
Vitamin E (mg)	15.79±8.15	-0.022	0.866
Vitamin K (µg)	194.62±219.01	-0.077	0.559
Vitamin C (mg)	295.35±224.19	0.018	0.889
Thiamine (mg)	2.84±1.11	-0.167	0.201
Riboflavin (mg)	2.61±1.02	-0.159	0.224
Niacin (mg)	32.63±11.51	-0.069	0.602
Pantothenic acid (mg)	7.64±2.93	-0.176	0.178
Vitamin B6 (mg)	2.61±1.00	-0.074	0.577
Biotin (mg)	44.27±23.50	-0.095	0.470
Folate (µg)	757.23±251.66	-0.124	0.347
Vitamin B12 (µg)	4.20±2.57	-0.030	0.818
Sodium (mg)	4502.94±1719.62	-0.233	0.073
Potassium (mg)	5093.66±2230.77	-0.063	0.632
Phosphorus (mg)	1931.57±753.17	-0.184	0.160
Calcium (mg)	1340.66±548.15	-0.132	0.316
Iron (mg)	25.11±10.29	-0.136	0.300
Magnesium (mg)	562.95±268.29	-0.174	0.184
Zinc (mg)	15.59±6.19	-0.262	0.045
Copper (mg)	2.55±1.10	-0.093	0.482
Manganese (mg)	8.52±5.63	-0.174	0.183
Selenium (µg)	159.14±88.91	-0.178	0.175
Fluoride (mg)	1540.46±1039.11	0.129	0.325
Chromium (µg)	0.18±0.24	-0.174	0.183

Abbreviations: MUFA, Monounsaturated fatty acids; PUFA, Polyunsaturated fatty acids.
* Spearman test.

have been conducted on the effects of AR symptoms on QOL of patients and roles of dietary factors in developing asthma and AR in subjects (9, 10, 25). However, as far as the researchers of this study investigated, no study has evaluated the effect of nutritional status on QOL in AR patients.

Dietary factors have an indispensable role in the prevalence and progression of allergic disorders worldwide. Many studies have provided convincing evidence showing that high intakes of protein-rich and fat-rich foods were associated with higher prevalence of allergic diseases such as AR (25-27). Rhee et al reported that the prevalence of AR is associated with daily intake of less mackerel and more carrots, bread, and bean curd (28). Other studies demonstrated that nutritional conditions during pregnancy may contribute to the development of allergic diseases in infants (27). In a systematic review and meta-analysis, Beckhaus et al reported a protective impact of maternal intake of vitamin D, vitamin E, and zinc against childhood wheeze, but this effect was not observed on asthma or other atopic conditions (29).

As mentioned above, nutritional factors can be considered as a risk factor for the prevalence and development of AR, but there is no report indicating the associations of dietary factors with QOL of patients suffering from allergic disorders. Our data revealed that the level of cholesterol intake had a direct relationship with the QOL scores of AR patients, but there was an inverse association between the QOL scores and zinc intake in patient with AR. However, there was no correlation between QOL of AR patients and other dietary factors. Trakaki et al evaluated the relationship between cholesterol levels and AR and showed a relationship between serum cholesterol levels and AR and its symptoms (30), which confirm our results. A cross-sectional study on children indicated that vitamin E levels were considerably lower in children with AR. The low serum vitamin E levels could be related to the development of AR in the children. Nevertheless, no relationship was found between vitamin E levels and AR severity (31). These results are not in agreement with those of the present research, possibly due to the fact that the evaluated outcomes were somewhat different. These findings suggest that micro and macro-nutrient intakes not only participate in the development of allergic diseases, but also can exert protective and/or negative effects on QOL in AR patients.

The results of this study, for the first time, indicated that some dietary factors such as cholesterol and zinc play important roles in QOL of AR patients. Our results propose that QOL of AR patients can be managed by reducing and/or enhancing daily intake of some macro- and micro-nutrients. However, further studies are required to investigate the possible effects of other dietary factors on QOL in allergic patients and confirm our findings.

The main limitation of this study includes the cross-sectional design of the study, which impedes establishing a causal relationship. Further clinical trials and cohort studies are recommended to confirm the existence of causal relationships. Also, we failed to compare the effects of nutritional factors on QOL in AR patients and healthy individuals.

Conclusions

According to our results, higher intake of cholesterol, unlike zinc, had a negative effect on QOL in AR patients.

Authors' Contribution

EB collected and analyzed the data. MB contributed to drafting, editing, and interpretation of data. FKh helped in the data collection and data analysis. AD contributed to the content of the manuscript and data collection. SHM helped in the designing the study and contributed to the writing process. All authors read and approved the final manuscript.

Conflict of Interests

The authors declared no conflict of interest.

Ethical Issues

The purpose of the study was explained to all patients prior to the study, and the confidentiality of the data was assured. Also, all patients signed an informed consent form and the study protocol was approved by the Ethics Committee of Kermanshah University of Medical Sciences (IR.KUMS.REC.1397.222).

Financial Support

Financial support was provided by the deputy of research of Kermanshah University of Medical Sciences.

Acknowledgments

The authors wish to thank all participants and the Student Research Committee of Kermanshah University of Medical Sciences.

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