Asthma control test and pediatric asthma quality of life questionnaire association in children with poor asthma control

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The aim of this study was to evaluate the association between Pediatric Asthma Quality of Life Questionnaire (PAQLQ) and Asthma Control Test (ACT) in patients with poor asthma control. Children between 7-17 years of age with diagnosis of persistent asthma who are not on daily inhaler corticosteroid therapy were involved. At enrollment, sociodemographic and asthmatic characteristics were investigated and pulmonary function test (PFT), ACT and PAQLQ were administered. Patients were reevaluated following six week regular inhaler therapy and ACT, PAQLQ and PFT were performed. Out of 77 patients, 35 (45%) were female. The mean age was 11.62 ± 2.35 years. Following 6 weeks daily inhaler therapy, the scores of ACT, all the parameters of PAQLQ and all the parameters of PFT except FEV1/FVC were significantly increased ($p<0.05$). There was a significant correlation between ACT and PAQLQ scores ($r<0.5$, $p=0.001$). In conclusion, there is a correlation between ACT and PAQLQ.

Key words: asthma, children, pediatric asthma quality of life questionnaire, asthma control test.

Asthma is a heterogeneous disorder characterized by chronic inflammation of the airways that is most commonly observed in children. It is identified by respiratory symptoms of varying severity in time including wheezing, dyspnea, chest tightness, coughing, and concomitant expiratory airway obstruction of varying grades[1].

Well-established international diagnosis, treatment, and monitoring guidelines recommend asthmatic patients be treated and monitored based on asthma control levels. In addition to objective assessments, such as daytime/nighttime symptoms, number of attacks, pulmonary function test (PFT) parameters, the need to use relaxants, age-group-based asthma control tests (ACTs) have also recently been used because they are rapid and practical[2-5].

Controlling a patient's asthma with treatment alone does not necessarily mean the patient is healthy, as health is a complete state of wellness of the soul, body, and mind. Health can only be achieved by assessing "quality of life," and improving quality of life is the ultimate objective of healthcare[6,7]. In recent years, tools have been developed and used globally to assess the extent of the effect of asthma on children's quality of life[6].

In this study, we aimed to evaluate the association of asthma control test (ACT) with pediatric asthma quality of life questionnaire (PAQLQ) before and after 6 weeks of regular inhaler use in children diagnosed with persistent asthma who did not regularly use inhaler treatment.

Material and Methods

Seventy-seven patients between 7 and 17 years of age, who were under follow-up care at Istanbul Sisli Hamidiye Etfal Training and Research Hospital Pediatric Pulmonary outpatient clinics and diagnosed with persistent asthma as per NAEPP[5] asthma severity classification but who

did not use regular inhaler treatment, were included in the study. At initial presentation when patients were enrolled in the study, sociodemographic and asthmatic characteristics were investigated, and PFT, ACT, and PAQLQ were administered. In these patients, an appropriate line of treatment was initiated based on NAEPP and Global Initiative for Asthma GINA) guidelines. Following physical examination performed before and after regular inhaler treatment, PFT, ACT, and PAQLQ were administered. Criteria of exclusion from the study included previous asthma attack within the last 2 weeks, failure to complete the ACT and PAQLQ surveys as required, failure to complete PFT, and loss of follow-up. This study was approved by The Ethics Committee of Istanbul Sisli Hamidiye Etfal Training and Research Hospital. The children and their families also provided informed consent.

Pulmonary Function Test: We used a (MiniSpir®) calibrated MIR (Medical International Research Srl, Rome, Italy) spirometry device in our study. PFT measurement was conducted in accordance with spirometry application instructions at initial presentation and follow-up. The mean value of the best three PFT runs was calculated.

Asthma Control Tests: Self-reported asthma control test was employed for the assessment of asthma control, the childhood asthma control test (C-ACT) in the case of 7- to 11- year-old children and ACT for children aged 12 years or older[2,3]. C-ACT is a 7-item asthma control test. The child responds to the survey question using a response scale of 0–3 points, ranging between a sad face and smiling face. The parent/person responsible for the child's care assigned a score between 0 and 5 for each question for the last 3 questions. The highest score was 27 and the lowest score was 0. Asthma was considered to be uncontrolled, partly controlled, and controlled for patients with a score ≤19, between 20 and 24, and ≥25, respectively. The ACT consists of 5 questions and is scored between 1 and 5 points for each question; a total score of 25 indicates that asthma is completely controlled, a score between 10 and 24 indicates partial control, and a score <20 indicates lack of control. Both C-ACT and ACT were performed at initial presentation and at follow-up after 6 weeks of regular treatment in this group of patients. Both ACTs were tested for Turkish validity and reliability[8,9].

PAQLQ: PAQLQ was developed by Juniper et al.[10] for children between 7 and 17 years of age and has been tested by H Yuksel et al.[11] for Turkish reliability and validity. PAQLQ was administered twice to patients face-to-face by the same physician at initial presentation and at follow-up, following 6 weeks of regular inhaler use. Parents were not allowed into the outpatient clinic room during administration of the survey so the children could respond to questions by their own will without being affected by the environment. At the time of first presentation when the patients were enrolled in the study, the patients were asked to pick the 3 activities they found most difficult to perform due to asthma among 39 activities within the last week. The selected activities were recorded on the scale chart to be used in the scale to be administered during follow-up. The children were asked the scale questions at initial presentation and at follow-up, and while answering these questions, they were asked to respond by only assessing their last week. This scale is commonly used worldwide and contains 23 questions and 3 main topics. The questions are classified under three domains:

1) symptoms (questions 4, 6, 8, 10, 12, 14, 16, 18, 20, 23)

2) activity limitations (questions 1–3, 19, 22)

3) emotional functions (questions 5, 7, 9, 11, 13, 15, 17, 21)

Four scores, including 3 main topics and 1 total, are obtained from the scale. Each question on the scale is evaluated over 7 points. While 1 indicates excessive discomfort or constant complaining, 7 indicates absence of complaints in relation to scoring. A high score shows a higher quality of life.

Statistical Assessment: IBM SPSS Statistics 22 (IBM SPSS, Turkey) software was used for statistical analyses while assessing the results from the study. The compliance of the parameters to normal distribution was assessed using the Shapiro Wilks test while assessing the study data. In assessing study data, the One Way Anova test for inter-group comparisons of parameters with normal distribution and the Tukey HDS test for detecting the group resulting in the difference

Table I. Sociodemographic Features of Children and Their Families

			n	%
	Age, yr (Min-Max) (Mean ±SD)		7-17	11.62 ± 2.35
	Gender	female	35	45.5
		male	42	54.5
	Monthly income (TL)[a]	≤1000	32	41.6
		1000-2000	37	48.1
		≥2000	8	10.4
Mother	Age, yr (Min-Max) (mean±SD)		26-52	37.97 ± 6.0
	Educational level	Illiterate	11	14.3
		Primary school	48	62.3
		High school	16	20.8
		University	2	2.6
	Employed		16	20.8
Father	Age (Min-Max) (mean±SD)		29-59	41.91 ± 5.9
	Educational level	Illiterate	2	2.6
		Primary school	52	67.5
		High school	18	23.4
		University	5	6.5
	Employed		68	88.3
House setting	Family type	Extended family	10	13
		Elementary family	67	87
	Number of family members	≤4	43	55.8
		≥5	34	44.2
	Smoking	none	34	44.2
		1 member	29	37.7
		≥2 members	14	18.2
	Pet at home		8	10.4
Family history of asthma			27	35.1
Total IgE		high	42	54.5
Specific inhaled allergen		high	48	62.3

[a]Turkish Lira (TL)= 0.310 Euro

was used to compare quantitative data as well as descriptive statistical methods (mean, standard, deviation, frequency). Student *t* test was used to compare the parameters with normal distribution between the two groups. A paired sample *t*-test was used for intra-group comparisons of the parameters. As for comparison of the qualitative data, chi-square test, Fisher's Exact Chi-Square test, and Continuity (Yates) Correction was used. The correlations among ACT and PAQLQ scores were determined by using Pearson's test. The significance was set at $p<0.05$.

Results

The sociodemographic features of the patients included in the study and their parents are presented in Table I. The study was performed with 77 cases total, including 35 females (45.5%) and 42 males (54.5%). The patients' ages ranged between 7 and 17 years, with a mean age of 11.62±2.35 years. While 41.6% of the cases had a monthly income ≤1,000 TL, 48.1% had a monthly income between 1,000 and 2,000 TL and 10.4% had an income ≥2,000 TL (TL=0.310 Euro). The mean age of the mothers was 37.97±6.02 years. Reviewing

Table II. Distribution of ACT Results at Presentation and After 6 Weeks of Inhaler Therapy (Follow-Up) by the Status of Control

*ACT		Total
		n (%)
Presentation	Partly controlled	6 (%7.8)
	Uncontrolled	71 (%92.2)
	Controlled	9 (%11.7)
Follow-up	Partly controlled	48 (%62.3)
	Uncontrolled	20 (%26)

*ACT: asthma control test Fisher's Exact Test and Chi-square Test

the level of education, 14.3% (n=11) were illiterate, 62.3% (n=48) were primary school graduates, 20.8% (n=16) were high-school graduates and 2.6% were university graduates. 20.8% (n=16) of the mothers were employed. The mean age of the fathers was 41.91±5.91 years. While 2.6% (n=2) of the fathers were illiterate, 67.5% (n=52) were primary school graduates, 23.4% (n=18) were high school graduates and 6.5% (n=5) were university graduates. 88.3% (n=68) of the fathers were employed. 87% (n=67) of the cases were in an elementary family, while 44.2% (n=34) were in a family with ≥ 5 members. While 44.2% (n=34) did not have any smoking family members, 55.8% (n=43) had ≥ 1 smoking family member. 10.45 (n=8) of the cases had pets. 35.1% (n=27) of the cases had family history of asthma. While 54.5% (n=42) had a total IgE that was high by age, 62.3% (n=48) were reported to have a high specific inhaled allergen level.

ACT assessments before and after regular inhaler treatment are presented in Table II. While 92.2% (n=71) of the patients had uncontrolled asthma before treatment, 26% (n=20) still had uncontrolled asthma following regular inhaler treatment. The mean scores for ACT, PFT, and PAQLQ at initial presentation and after 6 weeks of regular inhaler treatment are presented in Table III. A statistically significant increase was detected in all PFT parameters except the FEV1/FVC ratio, the ACT score, and the PAQLQ scores after 6 weeks of regular inhaler treatment (p=0.001).

The correlation between ACT and PAQLQ scores before and after regular treatment and the change in score was investigated (Table IV). A correlation was detected between pre and post treatment ACT and PAQLQ 3 subunit and PAQLQ total scores (r=0.385–0.584, p=0.001). There was also a correlation between post-treatment ACT score change and PAQLQ 3 subunit and total score change (r=0.360–0.489, p=0.001).

The association between the change in PAQLQ scores and sociodemographic features are presented in Table V. A significant correlation was detected for total PAQLQ score changes in patients with a family consisting of ≥ 5 members (p=0.037). There was a significant correlation between the mean increase in PAQLQ total and 3 subunit scores, and the presence of pets in the house (p=0.026, 0.008, 0.018, and 0.006, respectively). A significant correlation was detected between high specific inhaled allergen level, activity score, emotional function score change, and total score change except PAQLQ symptoms score (p=0.034, 0.005, and 0.009). No statistically significant correlation was detected between the other sociodemographic features and the PAQLQ scores (p>0.05).

Discussion

Asthma is the most common chronic lower-respiratory-tract disease of childhood and has physical, emotional, and social effects on life. Although asthma has a low mortality rate, it is of high importance with respect to morbidity and chronicity. Current treatment guidelines recommend using asthma control levels for treatment follow-up[4,5]. If an asthmatic child experiences concentration impairment with a difference in disease perception or has social loss, complete recovery cannot be considered even if the asthma control level has been improved because health is a complete state of wellness of the soul, body, and mind. Patients benefit from asthma treatment not

Table III. The Mean Scores for ACT, PFT and PAQLQ at Initial Presentation and After 6 Weeks of Inhaler Treatment (Follow-Up)

			mean±SD	p
ACT		Presentation	14.38 ± 3.60	0.001**
		Follow-up	21.05 ± 3.13	
PFT	FVC	Presentation	2.9 ± 0.77	0.001**
		Follow-up	3.04 ± 0.81	
	% FVC	Presentation	101.64 ± 13.24	0.001**
		Follow-up	106.44 ± 13.02	
	FEV1	Presentation	2.45 ± 0.71	0.001**
		Follow-up	2.6 ± 0.72	
	% FEV1	Presentation	98.48 ± 15.59	0.001**
		Follow-up	103.58 ± 14.38	
	FEV1/ FVC	Presentation	0.84 ± 0.08	0.155
		Follow-up	0.85 ± 0.07	
PAQLQ scores	Symptoms score	Presentation	37.05 ± 11.7	0.001**
		Follow-up	56.61 ± 11.6	
	Activity limitation	Presentation	18.14 ± 5.04	0.001**
		Follow-up	26.51 ± 5.23	
	Emotional functions score	Presentation	39.08 ± 11.01	0.001**
		Follow-up	48.92 ± 8.28	
	Total score	Presentation	94.27 ± 24.45	0.001**
		Follow-up	132.04 ± 22.68	

ACT: asthma control test PFT: pulmonary function test PAQLQ: pediatric asthma quality of life questionnaire
Paired Sample t Test **p<0.01

Table IV. The Correlation Between ACT and PAQLQ Scores Before and After Regular Treatment (Follow Up) and the Change in Score

			ACT	
			r	p
PAQLQ score	Symptoms score	Presentation	0.526	0.001**
		Follow-up	0.565	0.001**
		Change in score	0.489	0.001**
	Activity limitation	Presentation	0.385	0.001**
		Follow-up	0.550	0.001**
		Change in score	0.378	0.001**
	Emotional functions score	Presentation	0.455	0.001**
		Follow-up	0.461	0.001**
		Change in score	0.360	0.001**
	Total score	Presentation	0.536	0.001**
		Follow-up	0.584	0.001**
		Change in score	0.486	0.001**

ACT: asthma control test PAQLQ: pediatric asthma quality of life questionnaire
Pearson correlation analysis *p<0.05 **p<0.01

Table V. The Association Between the Change in PAQLQ Scores and Sociodemographic Features

		Change in symptoms score	Change in activity limitation	Change in emotional functions score	Change in total score
		Mean±SD	Mean±SD	Mean±SD	Mean±SD
Gender	Female	19.77 ± 12.3	9.31 ± 5.3	12.29 ± 11.0	41.37 ± 24.9
	Male	19.38 ± 12.8	7.57 ± 6.1	7.81 ± 9.4	34.76 ± 24.7
	[1]p	0.893	0.195	0.060	0.249
Monthly income	≤1000 TL[a]	18.78 ± 12.4	8.06 ± 5.4	10.38 ± 9.3	37.22 ± 22.4
	1000-2000 TL	19.24 ± 13.3	8.27 ± 6.4	9.43 ± 11.0	36.95 ± 27.6
	>2000 TL	24.13 ± 9.4	10 ± 4.9	9.63 ± 12.9	43.75 ± 22.8
	[2]p	0.554	0.703	0.932	0.777
Type of family	Extended family	21.1 ± 15.7	9.6 ± 5.9	16.8 ± 14.7	47.5 ± 31.4
	Elementary family	19.33 ± 12.1	8.18 ± 5.8	8.81 ± 9.3	36.31 ± 23.7
	[1]p	0.680	0.478	0.126	0.187
Number of family members	≤4	17.21 ± 12.2	7.23 ± 6.1	8.07 ± 9.8	32.51 ± 24.4
	≥5	22.53 ± 12.5	9.79 ± 5.2	12.09 ± 10.8	44.41 ± 24.2
	[1]p	0.065	0.056	0.093	0.037*
Smoking	None	18.97 ± 12.0	7.5 ± 6.0	11.68 ± 9.4	38.15 ± 24.0
	1 member	19.45 ± 11.6	8.48 ± 5.1	7.9 ± 9.3	35.83 ± 21.2
	≥2 members	21.21 ± 16.0	10.21 ± 6.6	9.43 ± 14.2	40.86 ± 34.2
	[2]p	0.855	0.346	0.356	0.823
Pets at home	Yes	28.88±12.1	13.5±5.5	18±13.4	60.38±27.0
	No	18.48±12.2	7.77±5.6	8.9±9.6	35.14±23.4
	[1]p	0.026*	0.008**	0.018*	0.006**
Family history of asthma	Yes	16.3 ± 11.0	7.37 ± 5.6	8.52 ± 8.9	32.19 ± 22.2
	No	21.32 ± 13.0	8.9 ± 5.95	10.56 ± 11.1	40.78 ± 25.9
	[1]p	0.094	0.277	0.386	0.150
IgE	High	18.21 ± 12.5	8.45 ± 5.6	9.86 ± 10.7	36.52 ± 24.8
	Normal	21.17 ± 12.6	8.26 ± 6.1	9.83 ± 10.1	39.26 ± 25.3
	[1]p	0.307	0.885	0.991	0.635
Inhaled Allergen	High	21.6 ± 12.3	9.46 ± 5.7	12.4 ± 10.3	43.46 ± 24.2
	Normal	16.17 ± 12.4	6.55 ± 5.6	5.62 ± 9.3	28.34 ± 23.4
	[1]p	0.066	0.034*	0.005**	0.009**
Mother's education	İlliterate	22.55 ± 14.5	10 ± 6.8	13.82 ± 13.6	46.36 ± 31.9
	Primary school	19.73 ± 12.4	8.15 ± 5.7	10.02 ± 9.5	37.9 ± 23.5
	High school	17.28 ± 11.8	7.94 ± 5.5	6.94 ± 10.1	32.17 ± 23.5
	[2]p	0.548	0.607	0.224	0.334
Mother-professional status	Yes	20.81 ± 13.7	10.19 ± 5.9	10 ± 8.1	41 ± 21.8
	No	19.23 ± 12.3	7.89 ± 5.7	9.8 ± 10.9	36.92 ± 25.7
	[1]p	0.657	0.163	0.947	0.563
Father-educational status	Primary school	19.41 ± 11.9	8.06 ± 5.8	11.04 ± 10.5	38.5 ± 24.5
	High school	19.91 ± 14.1	9.09 ± 5.9	7.04 ± 9.6	36.04 ± 26.2
	[1]p	0.873	0.483	0.124	0.695
Father-professional status	Yes	19.87 ± 12.4	8.41 ± 5.9	9.53 ± 9.8	37.81 ± 24.7
	No	17.22 ± 13.6	8 ± 5.2	12.22 ± 14.2	37.44 ± 27.5
	[1]p	0.556	0.844	0.470	0.967

PAQLQ: pediatric asthma quality of life questionnaire
[a]TL: 0.310 Euro [1]Student t Test [2]One-Way ANOVA test *p<0.05 **p<0.01

only in physical terms but also in social and emotional respects. Health-related quality-of-life surveys should be used in assessing this[10]. A large number of studies demonstrate that asthma control provides a better quality of life, thereby leading to a reduction in physical and

emotional variability in social relations[6,12-15].

In our study, asthma control, ACT scores, PAQLQ scores, and all PFT parameters, except the FEV1/FVC ratio, were significantly increased following 6 weeks of regular inhaler treatment. Of the PFT parameters, FEV1 and FVC increased similarly; thus, the FEV1/FVC ratio did not increase. A statistically strong correlation is detected between pre-treatment and post-treatment ACT and PAQLQ scores. We believe that the improvement in asthma control achieved by appropriate regular treatment is favorably reflected in patients' quality of life. There are many studies in the literature that report a strong correlation between ACT and PAQLQ[16-18].

In a study by Ramirez et al.[19] quality of life was found to be better in asthmatic children in a regular asthma program who used regular treatment. In another study, PAQLQ score was detected to be significantly lower in asthmatic children compared to healthy controls. In the same study, patients with asthma diagnosis were observed to have a very low PAQLQ score. It was concluded that an asthma diagnosis was enough for a patient to perceive quality of life as low even if the patient's asthma was under control. A similar contradiction was also observed in the study by Juniper et al[21].

In our study, reviewing the association between sociodemographic features and the PAQLQ score differences, PAQLQ score was detected to be significantly increased with treatment in patients with ≥5 family members. This suggests that as the number of family members increases, the social network also increases and, thus, the patient's quality of life improves. In contrast to the opinion that a crowded family is associated with poor life conditions, the presence and supply of the family is important for the patient to address these life changes, as is the case in other chronic diseases. In a study performed in children, pediatric patients with more than one sibling were detected to have a higher 3 domain score and total PAQLQ score[11].

In our study, we detected a significant increase in all PAQLQ scores following treatment in patients with pets at home. We believe that the emotional connection established between children and pets favorably impacts the quality of life. Although removing pets from the houses of children sensitive to pet allergens is reportedly very effective at controlling allergic symptoms, the same cannot be said for improving asthmatic symptoms or reducing sensitivity[22]. The relationship between the pet and the owner is always emotional; therefore, before investigating the presence of allergens based on suspicion and taking relevant measures, a test needs to be performed to establish the presence of the allergen. An association between pet feeding and asthma cannot be clearly elucidated[23].

In our study, we observed a significant increase in the total PAQLQ score and in the sub-scores of the activity limitation score and emotional function score, but not the symptoms score, in cases with a high level of specific inhaler allergens following treatment. This suggests that patients with a high specific inhaled allergen level have a more severe course of asthma due to their atopic nature and have a more marked improvement in their quality of life as they respond more dramatically to regular inhaler treatment. However, there are many studies in the literature that report that a history of atopy does not affect the patient's quality of life[16, 24, 25].

There is no association between the type of family, educational or professional status of the parents, asthma history in the family, monthly income, exposure to smoking, and high IgE level and changes in the PAQLQ score. Although there are studies suggesting the presence of an association between the mother's educational and professional status, family's monthly income, and PAQLQ scores, the association to passive smoking is contradictive[26-28].

The limitation of our study is that our sample may not reflect global asthmatic children. Additionally, because patients were administered the ACT and PAQLQ surveys for the second time at follow-up, they may have responded the questions in a biased manner. This study was conducted in children from low soscioeconomic levels. The factors such as education of patients and parents, and monthly income should be considered in order to improve the follow up and treatment of these children.

In conclusion, there is a statistically significant correlation between pre-treatment and post-treatment ACT and PAQLQ scores. Patients benefit from asthma treatment not only

physically but also socially and emotionally; to assess these benefits, health-related quality-of-life surveys should be used. Quality-of-life surveys represent a bridge in perceiving the difference between the child's personal concerns about asthma and the asthma control level. Therefore, we need to use quality-of-life scales more in regular treatment and follow-up of chronic diseases such as asthma.

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