# ORIGINAL RESEARCH PAPER

**Medicine**

## VALIDITY OF ASTHMA CONTROL TEST IN ASSESSMENT OF ASTHMATIC PREGNANT FEMALES IN THIRD TRIMESTER (SINGLE CENTER STUDY)

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**ABSTRACT**

**Background:** Asthma is a common chronic medical condition in pregnancy, with a worldwide prevalence.
The ACT has the added advantage that it does not require pulmonary function assessment.
Aims of study:
To assess asthma control through ACT score
**Methods:** A cross-sectional study with analytic elements recruiting 55 pregnant asthmatic patients aged 16 – 35 year old. Asthma control was assessed using the ACT score and FEV1.
**Results:** According to ACT score 15 patients (27.3%) were with poorly controlled asthma, 19 patients (34.5%) moderately controlled and 21(38.2 %) well controlled asthma.
Of these 55 patients 32 patients (58.2 %) where with ACT score of ≤ 19 and abnormal FEV1, only 2 patients (3.6%) with ACT score of ≤ 19 and normal FEV1, while there was 19 patients (34.5%) with ACT score of  19 and normal FEV1, and only 2 patients (3.60%) with ACT score of  19 and abnormal FEV1.
**Conclusion:** ACT can serve as an alternative reliable tool in assessing asthma control even without an aid of a spirometer.

## Introduction:

Asthma is a chronic inflammatory disorder of the airways, in which many cells and cellular elements play a role. The chronic inflammation is associated with airway hyper-responsiveness that leads to recurrent episodes of wheezing, breathlessness, chest tightness and coughing, particularly at night and in the early morning. These episodes are usually associated with widespread but variable airflow obstruction within the lung that is often reversible, either spontaneously or with treatment [1]. These variations are often triggered by factors such as exercise, allergen, irritant exposure, and change in weather or viral respiratory infection [2].

Asthma course may worsen, improve or remain unchanged during pregnancy, about one third of women with asthma experience improvement while they are pregnant, about one third get worse, and the other third stay about the same. The symptoms tend to be at their worst during weeks 24-36 (months 6-8). [3]

Both hormonal as well as mechanical changes can influence the respiratory functions and can lead to an exacerbation of asthma. [3]

Elevated serum progesterone levels stimulate respiratory drive and lead to an increased tidal volume and raised minute ventilation, with only a modest increase in O2 consumption. The subsequent fall in maternal $pCO_2$ facilitates fetal $CO_2$ transfer across the placenta; any cause of maternal hypercapnia leads quickly to fetal respiratory acidosis. Respiratory rate is unaffected by pregnancy. Elevation of the diaphragm occurs due to the enlarging uterus, leading to a reduced functional residual capacity (FRC), although diaphragm function is normal and VC is unaffected. Peak flow and FEV1 are unaffected by pregnancy. [4]

Most important goal of treating asthma in pregnancy is to optimize fetal as well as maternal health. Studies have shown that pregnant women with asthma have an increased risk of adverse perinatal outcomes (5). While controlled asthma is associated with reduced risks. [6,7]

Well- controlled asthma has been associated with favorable outcome in pregnancy whereas poorly controlled asthma has been associated with increased rates of preterm delivery, pre-eclampsia, low birth weight, growth restriction, cesarean delivery, and maternal morbidity and mortality. [8]

Achieving and maintaining asthma control are fundamental elements of asthma management. [9]

Practical tools are needed to assess asthma control in asthma management. Most tools used to evaluate asthma control consider airflow obstruction as a criterion. However, this is often very difficult to perform in developing countries such as Iraq because spirometers and peak flow meters are not widely available. A tool is required that measure the multidimensional nature of asthma control and that is easy and quick to administer and interpret in order to facilitate the assessment of asthma control in clinical practice. The ACT has proved to be a valid tool for this purpose [10,11,and12]

In the 2nd of May 2006… A simple five item questionnaire – the Asthma Control Test (ACT) that helps physicians and patients assess the level of asthma control has been launched by GlaxoSmithKline on the occasion of World Asthma Day 2006. [13]

The ACT helps quickly assess a patient's level of asthma control over 4 weeks just prior to the test and assigns a numerical score. The test encourages clear and concise communication between a patient and his doctor, it may be conducted with or without a lung function test which may not be possible during routine visits to the physician. [13]

The validated and international asthma control test (ACT) has been developed to facilitate and standardize the assessment of symptom control of asthma. The ACT survey is a patient-completed questionnaire with 5 items assessing asthma symptoms (daytime and nocturnal), use of rescue medications, and the effect of asthma on daily functioning. Each item includes 5 response options corresponding to a 5 – point rating scale. In scoring the ACT survey, responses for the 5 items are summed to yield a score

ranging from 5 to 25. The patient classified as uncontrolled if had a score < 15 and classified as partly controlled if had score 15 – 19 and classified as well controlled if had score 20 – 25. (14)

### Aim of the study

To assess the ACT as a swift tool alternative to FEV1 in evaluation of pregnant asthmatics.

To determine the asthma control status in pregnant asthmatic females.

### Patients and methods

### Study design

A cross-sectional study with analytic elements.
Study setting:

The data collection was carried out in gynecology and obstetrics ward in the 4th floor of Baghdad Teaching Hospital, Baghdad city, Iraq.
The data collection was done between the 1st of November 2016 to the 1ST of April 2017.

### Inclusion criteria:
### Included all asthmatic pregnant female who were:

*   Gestational age from 27 to 36 weeks of gestation
*   Previously diagnosed asthmatic patients i.e. previously attend respiratory clinic and underwent spirometric test. Asthma diagnosis was confirmed by the clinical history and a previous increase of more than 12% in the one-second forced expiratory volume (FEV1) after bronchodilator use.

### Exclusion criteria:
### Excluded all asthmatic pregnant female with history of:

*   Hospitalization for acute upper or lower respiratory tract infection now or within 4 weeks prior to study.
*   Respiratory distress due to an exacerbation that required emergency department visit or admission.
*   A known respiratory disorder other than asthma

### Questionnaire:

Two part of questionnaire are used, the first part is self-constricted questionnaire form prepared by researcher and supervisor to collect information from the participants regarding selected variables, included age, parity, history of hospitalization and medical history. The second parts of the questionnaire included the international standard questionnaire for the asthma control test (ACT) was used to assess the control of asthma in pregnant asthmatic patients. The ACT standard questionnaire include 5 items for assessing asthma symptoms (daytime and nocturnal), use of rescue medications and the effect of asthma on daily functioning.

Each item includes 5 response options corresponding to a 5-point rating scale. In scoring the ACT survey, responses for each of the 5 items were summed to yield a score ranging from 5 (poor control of asthma) to 25 (complete control of asthma). A cut-off point ≤19 was used for uncontrolled asthma.

All information collected by direct interview. Time require for interview was about 10 minute.

### Asthma control test
### Q1: In the past 4 weeks, how often did your asthma prevent you from getting as much done at work, school or at home?

| All of the time | Most of the time | Some of the time | A little of the time | Not at all |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

### Q2: During the past 4 weeks, how often have you had shortness of breath?

| More than once a day | Once a day | 3 to 6 times a week | Once or twice a week | Not at all |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

### Q3: During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?

| 4 or more nights a week | 2 to 3 nights a week | 1 night a week | 2 to 3 nights a month | Not at all |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

### Q4: During the past 4 weeks, how often have you used your reliever medication (such as salbutamol)?

| Not at all | Once a week or less | 2 or 3 times per week | 1 or 2 times per day | 3 or more times a day |
|---|---|---|---|---|
| 5 | 4 | 3 | 2 | 1 |

### Q5: How would you rate your asthma control during the past 4 weeks?

| Completely controlled | Well controlled | Moderately controlled | Poorly controlled | Not controlled |
|---|---|---|---|---|
| 5 | 4 | 3 | 2 | 1 |

### pulmonary function test:

The pulmonary function test was done for all patients by using a spirometer in the pulmonary function measurement department at the respiratory outpatient clinic in Baghdad teaching hospital

spirometry model (master lab spirometer: jaegers 105052-175111: model 1998. Germany)
We use the FEV1 to assess degree of airway obstruction in these patients.
Normal FEV1 ≥ 80%                     Abnormal FEV1 < 80 %

- **Sensitivity** is the proportion of those who have the disease who are correctly identified by the test as positive. [17]

- **Specificity** is the proportion of individuals without the disease who are correctly identified by a diagnostic test. [18]

- **Accuracy** is the proportion of all individuals who were correctly identified by the test. [17]

### Ethical consideration:

An official permission obtained from medical department in college of medicine of Baghdad University and also from Baghdad Teaching Hospital. The procedure of study explained to participant to get verbal informed consent.

### Statistical analysis:

Data was analyzed using statistical package for the social sciences (SPSS version 23) computer software program.

Descriptive statistics presented as frequency tables. Chi square fisher exact test used to find association between two categorical variables with significant level ≤ 0.05. Screening test was used to assess significance of ACT test in detecting cases.

### Results

A total of 55 pregnant was surveyed, the age range was found to be between 16-35 years, the mean age was (25.4) years.

The majority of pregnant were multiparous 42 (76.4%), negative history of hospitalization 45 (81.8%) and abnormal FEV1 34 (61.8%) as in (Table 1).

**Table (1):** Frequency distribution of study sample by different variable.

| Variables | Frequency | Percent |
|---|---|---|
| **Age** | 28 | 50.9% |
| •   **≤20 years** | 27 | 49.1% |
| •   **>20 years** | | |

| Parity • Multi | 42 13 | 76.4% 23.6% |
|---|---|---|
| History of hospitalization • Negative | 45 10 | 81.8% 18.2% |
| FEV1 • Normal | 21 34 | 38.2% 61.8% |



**Pia chart**

- >20 well control — 38 %
- 16-19 partially control — 34 %
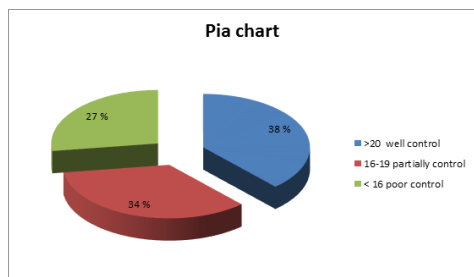- < 16 poor control — 27 %

**Figure (10): Distribution of the study sample by ACT result.**

The percentage of uncontrolled test is high in more than 20 years (81%), and there was a statistically significant association between age and uncontrolled result by ACT ( P VALUE=0.003).

The percentage of uncontrolled test among women with multiple pregnancy is high (72%) in compare with first pregnancy (31%), and there was a statistically significant association between number of pregnancies and uncontrolled result by ACT (P value=0.02).

The percentage of uncontrolled test among women with Negative history of hospitalization related to asthma during pregnancy was (54%), while the prevalence among women with positive history of hospitalization was (100%) and there was a strong statistically significant association between history of hospitalization and uncontrolled result by ACT (P value=0.009). as in (Table 2)

**Table (3 – 2) : Distribution of study group by result of ACT and selective variable.**

| Variables | ACT Controlled (≥ 20) | Uncontrolled ( 19) | Total | P value |
|---|---|---|---|---|
| Age ≤20 years >20 years | 16 (57%) 5 (18%) | 12(42%) 22(81%) | 28 27 | 0.003 |
| Parity Prime Multi | 9 (69%) 12(28%) | 4(31%) 30(72%) | 13 42 | 0.02 |
| History of hospitalizatin Negative Positive | 21(46%) 0 (0) | 24(54%) 10(100%) | 45 10 | 0.009 |
| FEV1 Normal ( ≥ 80%) Abnormal ( 80 %) | 19(90.5%) 2 (5.9%) | 2(9.5%) 32(94.4%) | 21 34 | 0.001 |

Asthma control test was highly sensitive (94%) so it ability to detect case of uncontrolled asthma was high. ACT was also highly specific (90%) so it ability to detect control case of asthma was high.

55 patients 32 patients (58.2 %) were with ACT score of <19 and abnormal FEV1, only 2 patients (3.6%) with ACT score of <19 and normal FEV1, while there were 19 patients (34.5%) with ACT score of ≥ 20 and normal FEV1, and only 2 patients (3.6%) with ACT score of ≥ 20 and abnormal FEV1.

The Sensitivity of ACT was 94%.
The specificity of ACT was 90%
The accuracy of test was 92 %
Positive predictive value was 94%
Negative predictive value was 90.4%

**Discussion**
The results in this study are similar to the results that were found in a study performed in Brazil in 2014 showed 32 patients (44, 4%) well controlled, 32 patients (44, 4%) partially controlled, and 8 patients (11, 2%) poorly controlled [19]

In this study the sensitivity of ACT was 94% , specificity of the ACT was 90% , negative predictive value of (90.4%) and a positive predictive value of (94%) , which is the same result found in a study performed in Korea [20] ,and also in china [21] , similar findings to this study were founded in a study performed in brazil in September 2014 carried on 40 pregnant female with history of asthma, with a sensitivity of (95.4 %)specificity of (68.8 %) negative predictive value of (91.7%) and a positive predictive value of ( 80.5%) . [22]

These results were similar to those found in a study performed in Philippine in which 86 patients were included, Significant association between ACT and FEV1 as % predicted (p-value 0.023). There appeared to be an association between a lower ACT score and a more severe symptom severity. ACT was 92.3% sensitive and 90.5% specific. The positive predictive value was 98% and the negative predictive value is 79%. [23]

In another study performed in Iraq in 2016 enrolling 71 patients of them 66 (92.96%) had an ACT score of ≤ 19 and 5 patients (7.04%) had an ACT score of > 19, it had been found the number of male is (27) and [26] out of them had an ACT<19and only (1) had ACT>19 and number of female is (44), (40) out of them had ACT<19 and (4) had ACT>19, this study showed a stronger correlation between the ACT scores and mean FEV 1 (p < 0.001) [24].

**Conclusions**
1 - ACT is associated with high sensitivity, specificity and accuracy in correlation with FEV1 spirometery.
2 – ACT is alternative reliable tool in assessing asthma control in pregnant asthmatic patients without the aid of FEV1 measurement.

**Recommendation**
1- The ACT is easily and quickly completed by pregnant asthmatic patients and can serve as a useful tool in everyday practice to guide adjustments in asthma therapy.
2- The ACT is a reliable and simple tool that does not require spirometery measurements. This might be a significant asset in the management of pregnant female outpatients with asthma.

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