





# Comparison of the Effectiveness of Cognitive-Behavioral Therapy and Acceptance and Commitment Therapy on Cortisol Levels and Psychological Distress in Patients with Asthma

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## Article Info

### Article type:

Original Research

### How to cite this article:

Ghaffari, S. S., Badeleh Shamooshaki, M. T., Azizi Ziabari, L. S., & Asadi, J. (2024). Comparison of the Effectiveness of Cognitive-Behavioral Therapy and Acceptance and Commitment Therapy on Cortisol Levels and Psychological Distress in Patients with Asthma. *Journal of Assessment and Research in Applied Counseling*.  
<http://dx.doi.org/10.61838/kman.jarac.7.x.x>



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## ABSTRACT

**Objective:** The aim of the present study was to compare the effectiveness of Cognitive-Behavioral Therapy (CBT) and Acceptance and Commitment Therapy (ACT) on cortisol levels and psychological distress in patients with asthma.

**Methods and Materials:** The research design was quasi-experimental, with pre-test and post-test and a control group. The statistical population consisted of all asthma patients who sought treatment and disease management at healthcare centers in Tehran between April and July 2024. A total of 90 patients were selected through convenience sampling and randomly assigned to three groups: the CBT group (30 individuals), the ACT group (30 individuals), and the control group (30 individuals). The data collection tools included salivary cortisol measured through the spitting method and the Kessler Psychological Distress Scale (Kessler et al., 2003). The intervention therapies were conducted in 8 weekly sessions of 90 minutes each, while the control group did not receive any specific treatment during this period. Data were analyzed using Multivariate Analysis of Covariance (MANCOVA).

**Findings:** The results indicated that both CBT and ACT were effective in reducing cortisol levels and psychological distress in patients with asthma ( $P < 0.05$ ), and there was no significant difference in the effectiveness of the two therapeutic approaches ( $P > 0.05$ ).

**Conclusion:** These findings potentially have important practical implications for professionals and therapists in considering the effectiveness of these therapeutic methods in improving asthma outcomes.

**Keywords:** Cognitive-Behavioral Therapy, Acceptance and Commitment Therapy, Cortisol, Distress, Asthma

## 1. Introduction

sthma is a chronic disease that affects 5% of the global population, with more than 40% of individuals experiencing at least one hospitalization per year due to asthma attacks and heightened stress caused by the disease. As a result, asthma has gained attention from researchers as a psychosomatic disorder. With the increasing prevalence and severity of asthma in recent decades, this disease—characterized by chronic airway dysfunction and accompanied by outcomes such as inflammation, hyperreactivity, and airway spasms—significantly impacts individuals' cognitive, emotional, behavioral, and social functioning (Giordano et al., 2023). A review of research from the past two decades shows that the understanding of asthma pathology and treatment, once limited to purely biological and medical factors, has evolved into a comprehensive perspective incorporating physical, psychological, and social dimensions (Balazadeh et al., 2021).

Due to the chronic anxiety and stress experienced by asthma patients, stress activates the hypothalamic-pituitary-adrenal (HPA) axis, leading to increased cortisol secretion. Cortisol is a steroid hormone secreted by the adrenal glands, and elevated cortisol levels cause energy to be drawn from the digestive system and reduce the production of enzymes necessary for food digestion and nutrient absorption (Engel et al., 2023). Elevated cortisol levels have been reported in several previous studies. Research by Vink et al. (2013) and Kapoor et al. (2003) indicated elevated plasma cortisol levels in individuals experiencing severe asthma attacks (Kapoor et al., 2003; Vink et al., 2013). They noted that the HPA axis functions normally in asthma patients, leading to increased cortisol levels in proportion to the degree of stress. Asthma, as a psychosomatic disease, is associated with anxiety, depression, and distress (Ali Asgari et al., 2019). Previous studies show that asthma patients in many societies endure psychological consequences such as anxiety, stress, and depression, which exacerbate the physical symptoms of the disease. In fact, reviewing the disease process and the interaction between its physical and psychological effects reveals that psychological consequences contribute to the persistence of symptoms such as breathing attacks, coughing, shortness of breath, chest tightness, and wheezing in asthma patients. This increases stress in these individuals and elevates cortisol levels (Ghasemnejad et al., 2021). Therefore, elevated cortisol levels and psychological distress can be considered significant intertwined outcomes of asthma that warrant attention. Another variable examined in this study is the quality of life in asthma patients.

Among modern psychotherapies, a variety of interventions with differing content, such as mindfulness-based cognitive therapy, metacognitive therapy, exposure-based cognitive-behavioral therapy, group stress management therapy, music therapy, and relaxation therapy, have been employed to address psychological issues related to asthma (Ali Asgari et al., 2019; Ansari Bahjat et al., 2021; Bonnert et al., 2020; Feldman et al., 2016; Khosrovirad & Malakouti Far, 2021; Nasiri Kalmarzi et al., 2018).

In recent decades, cognitive-behavioral interventions have gained significant empirical and scientific support due to their effectiveness in reducing problems associated with psychosomatic disorders (Pateraki & Morris, 2017). This form of intervention disrupts the problematic cycle and encourages the patient to explore the connection between negative thoughts and their sense of inadequacy. Cognitive-behavioral therapy (CBT) aims to challenge individuals' negative thoughts and beliefs, thereby weakening patients' conviction in these negative views (Luyster et al., 2020). Given the relatively high prevalence of asthma in the general population and its association with outcomes such as elevated psychological distress and cortisol levels, CBT can be expected to positively impact these variables.

Among the various treatments applied to individuals with chronic illnesses such as asthma, Acceptance and Commitment Therapy (ACT) is notable. The main focus of ACT is to change and modify the patient's relationship with internal experiences and avoidance behaviors. This therapy includes six core processes that ultimately lead to psychological flexibility: acceptance, cognitive defusion, self-as-context, being present, values, and committed action (Chong et al., 2019). ACT is a form of behavior therapy that aims to address experiential avoidance and the attempt to control distressing experiences. By being open to traditional clinical practices, emphasizing behavioral performance over etiological analysis, and promoting psychological flexibility, ACT demonstrates why experiential and cognitive avoidance are harmful (Zargar et al., 2022).

Based on previous research, both CBT and ACT have shown promising results in improving psychological symptoms in asthma patients (Abbasi et al., 2020; Ansari Bahjat et al., 2021; Bahodirovna et al., 2023; Sicouri, 2023). Therefore, the present study selected these two therapies for comparison. Comparing these two interventions is essential because it provides a clearer understanding of effective treatments for psychosomatic disorders, particularly asthma. This information can help in selecting the best initial

psychological intervention or combining interventions for working with asthma patients.

Given that previous studies in Iran have not compared the effects of these two therapies on psychological outcomes in asthma patients, this simultaneous examination of their effectiveness seems necessary. Considering the increasing prevalence of asthma in recent years, the primary aim of the present study was to compare the effectiveness of CBT and ACT on cortisol levels and psychological distress in asthma patients.

## 2. Methods and Materials

### 2.1. Study Design and Participants

This research was an applied study. The research design was quasi-experimental, with pre-test, post-test, and control groups. The statistical population included all asthma patients who sought treatment and disease management at healthcare centers in Tehran between April and July 2024. The sample size was 90 individuals, selected using purposive sampling. The selected sample was randomly assigned to three groups: the CBT group (30 individuals), the ACT group (30 individuals), and the control group (30 individuals). The initial sample consisted of 96 participants, but 6 participants withdrew for various reasons, such as the distance from the intervention site, other commitments during the session times, and lack of spousal permission. Based on the division of Tehran into four regions, one hospital from each region was selected: Day Hospital (north), Imam Sajjad Hospital (east), Lolagar Hospital (west), and Amir al-Mu'minin Hospital (south). Inclusion criteria included at least one year of asthma history, diagnosis of asthma less than a year ago, absence of other chronic diseases, age between 18 and 60 years, literacy, no history of psychological disorders, and no prior psychotherapy. Exclusion criteria included unwillingness to continue participation, incomplete questionnaire responses, worsening health conditions, or any problem preventing participation.

### 2.2. Measures

#### 2.2.1. Salivary Cortisol

In this study, saliva was collected using the spitting method. Saliva collection occurred half an hour before any physical activity (between 7 and 8 AM). Asthma patients were instructed to clean their mouths using hygienic methods, such as brushing and flossing, and to avoid

consuming food 90 minutes before the test. Unstimulated saliva was collected for 10 minutes using the spitting method, sealed with parafilm, and promptly transferred to the laboratory under refrigeration. The samples were frozen at  $-70^{\circ}\text{C}$  until analysis. Cortisol levels were measured using the ELISA method.

#### 2.2.2. Psychological Distress

The Kessler Psychological Distress Scale (Kessler et al., 2003) was used to assess the patients' psychological status over the past month. The 10-item scale uses a 5-point Likert scale ranging from 0 to 4, with a maximum score of 40. Higher scores indicate higher levels of psychological distress. This questionnaire has been found to have adequate sensitivity and specificity for screening individuals with anxiety and depression and is suitable for post-treatment monitoring. Criterion validity is confirmed through a cutoff point that reflects its correlation with the criterion variable (the Composite International Diagnostic Interview), with a reported cutoff point of 8. Vasiliadis et al. (2015) reported acceptable reliability and content validity for this questionnaire (Vasiliadis et al., 2015). Romero-Gonzalez et al. (2021) found high reliability for this scale, with a coefficient of 0.93 (Romero-González et al., 2021). In Iran, Pourhosseini Dehkordi et al. (2019) calculated its reliability using Cronbach's alpha, obtaining a coefficient of 0.85 (Pourhosseini Dehkordi et al., 2019).

### 2.3. Intervention

#### 2.3.1. Cognitive-Behavioral Therapy (CBT)

CBT was conducted in 8 weekly 90-minute sessions, using a model based on the package developed by Fat'hali Lavasani and generally modeled after Beck's approach (Ghasemnejad et al., 2021).

Session 1: The session begins with welcoming the participants, explaining the group rules, and familiarizing the group members with each other. The focus is on understanding asthma as a chronic illness and introducing the Cognitive-Behavioral Therapy (CBT) approach. Participants undergo a pre-test, and a psychoeducation session on the psychological and physiological aspects of asthma is provided.

Session 2: In this session, participants are taught relaxation techniques and breathing exercises to manage their physical symptoms. These exercises are demonstrated,

and participants are assigned homework to practice the exercises for the following session.

Session 3: After reviewing the homework, the focus shifts to desensitization techniques. A hierarchy of avoided situations is created, and participants are guided to combine exposure with relaxation exercises. Homework is assigned for continued practice.

Session 4: The session begins with a review of the previous homework. The group then focuses on worry management by identifying common concerns, learning worry management techniques, and recognizing cognitive distortions. The benefits and drawbacks of worry are analyzed. Participants are assigned related tasks for the next session.

Session 5: After reviewing the previous homework, techniques such as worry postponement and attention refocusing are introduced. Participants are also guided in activity planning to maintain structure in their lives, with homework assignments to practice these techniques.

Session 6: The homework is reviewed, and the connection between depressive moods and inactivity is discussed. The group is introduced to behavioral activation techniques and is guided in identifying goal-oriented activities. Participants are assigned tasks to implement these activities before the next session.

Session 7: Cognitive restructuring is introduced in this session. Participants learn to identify negative thoughts and challenge them, replacing them with more realistic and balanced thoughts. Homework involves practicing these cognitive exercises.

Session 8: The final session includes a review of previous homework and training on stress management and problem-solving skills. Participants also receive education on adopting a healthy lifestyle. A post-test is conducted, and the session concludes with feedback from participants.

### 2.3.2. *Acceptance and Commitment Therapy (ACT)*

The content of the ACT sessions was based on the protocol developed by Hayes et al. (2003), delivered over 8 weekly 90-minute sessions (Hayes et al., 2003).

Session 1: The session starts with participants completing research questionnaires. Group members introduce themselves, and group rules (e.g., confidentiality, regular attendance) are discussed. The ACT approach and its goals are explained, followed by an assessment and conceptualization of problematic behaviors. Homework

involves identifying problematic behaviors and their causes and consequences.

Session 2: The homework is reviewed, and participants discuss their problematic behaviors. The session focuses on exploring painful experiences and evaluating them, introducing the concept of "creative hopelessness" to reduce the desire to control behaviors and emotions. Metaphors like "man in a hole" and "tug of war with a monster" are used to explain this concept. Homework involves documenting weekly experiences along with corresponding thoughts and emotions.

Session 3: After reviewing the homework, the session introduces control as a problem, using metaphors like "falling in love," "polygraph," and "jelly donut" to illustrate the ineffectiveness of controlling thoughts and emotions. The concept of willingness is also introduced, with daily willingness exercises assigned as homework.

Session 4: The homework is reviewed, and the concept of cognitive defusion is introduced through metaphors like "passengers on the bus" and "mind walking." The session also discusses the difference between clean and dirty suffering and encourages participants to detach from anxious thoughts. Homework involves identifying clean versus dirty suffering in daily experiences.

Session 5: The session begins with a review of the homework and introduces the concept of self-as-context through metaphors such as "chessboard" and "furniture in a house." Participants reflect on reducing personal investment in individual events. The session concludes with a discussion on shifting perspective on self.

Session 6: The focus of this session is on mindfulness techniques, such as the "five senses" exercise, sitting meditation, and a brief pause technique. Participants are assigned mindfulness exercises to practice daily for 15-20 minutes.

Session 7: After reviewing the previous homework, the session explores values clarification. Participants are guided through exercises to identify what they want to pursue in life and to prioritize their values. Homework involves completing a values clarification worksheet.

Session 8: The final session includes a discussion on willingness and commitment, using metaphors like "the beggar at the door" and "planting a tree." Participants complete post-intervention questionnaires related to cortisol levels and psychological distress. The session concludes with feedback from the participants and closing remarks.

2.4. Data analysis

In addition to descriptive statistics, multivariate analysis of covariance (MANCOVA) was used to test the study's hypotheses. Data were analyzed using SPSS version 26.

3. Findings and Results

The demographic characteristics of the study sample are as follows: The age range of participants in the Cognitive-Behavioral Therapy (CBT) group was between 21 and 40 years, with a mean age of 32.13 years. In the Acceptance and Commitment Therapy (ACT) group, participants' ages ranged from 22 to 39 years, with a mean age of 30.17 years. The control group had participants aged 23 to 38 years, with

a mean age of 31.47 years. In terms of education, in the CBT group, 17 participants (56.7%) had a diploma or lower education, 9 participants (30%) had an associate's or bachelor's degree, and 4 participants (13.3%) had a master's degree or higher. In the ACT group, 14 participants (46.7%) had a diploma or lower, 10 participants (33.3%) had an associate's or bachelor's degree, and 6 participants (20%) had a master's degree or higher. In the control group, 15 participants (50%) had a diploma or lower, 11 participants (36.7%) had an associate's or bachelor's degree, and 4 participants (13.3%) had a master's degree or higher.

Table 1 presents the means and standard deviations of the dependent variables in the pre-test and post-test stages, categorized by intervention groups.

Table 1

Descriptive statistics for research variables (cortisol and psychological distress) in the studied groups

Variable	Stage	Group	Mean	Standard Deviation
Cortisol	Pre-test	Cognitive-Behavioral Therapy	14.73	3.13
		Acceptance and Commitment Therapy	14.63	3.034
		Control	14.97	3.09
	Post-test	Cognitive-Behavioral Therapy	9.47	3.18
		Acceptance and Commitment Therapy	9.60	2.93
		Control	14.67	3.28
Psychological Distress	Pre-test	Cognitive-Behavioral Therapy	27.83	2.67
		Acceptance and Commitment Therapy	27.73	3.26
		Control	27.33	3.13
	Post-test	Cognitive-Behavioral Therapy	17.17	2.96
		Acceptance and Commitment Therapy	16.17	3.43
		Control	27.00	3.03

Given that the research design was a pre-test-post-test with a control group, the data were analyzed using Multivariate Analysis of Covariance (MANCOVA). The assumptions for using this test—such as the normal distribution of scores, homogeneity of variances between the experimental and control groups, and homogeneity of the variance-covariance matrix—were confirmed through M-

Box testing. Since all assumptions were met, the results of the data analysis, as shown in Table 2, indicate that there was no significant difference between the three groups in the pre-test stage. However, after controlling for the pre-test effect, the differences between the groups in the post-test stage were statistically significant ( $P < 0.001$ ).

Table 2

Results of covariance analysis for testing the between-group effects on cortisol and psychological distress

Variable	Source	Sum of Squares	Degrees of Freedom	Mean Square	F	Significance	Eta Squared
Cortisol	Group	496.17	2	248.08	27.84	0.001	0.40
	Error	757.30	85	8.91			
	Total	12762.000	85				
Psychological Distress	Group	2174.72	2	1087.36	112.81	0.001	0.726
	Error	819.27	85	9.64			
	Total	39414.000	85				

To examine whether the interventions had a significant impact on cortisol levels and psychological distress, and to determine which treatment was more effective on the dependent variables, a follow-up LSD test was performed. As shown in Table 3, there was a significant difference

between the groups. No significant difference was found between Cognitive-Behavioral Therapy (CBT) and Acceptance and Commitment Therapy (ACT), but both therapies were significantly more effective compared to the control group.

**Table 3**

*LSD post-hoc test results to determine the more effective method on cortisol and psychological distress among the studied groups*

Dependent Variable	Groups	Mean Difference	Significance
Cortisol	CBT and Control	-5.075	0.001
	ACT and Control	-4.92	0.001
	CBT and ACT	-0.157	0.84
Psychological Distress	CBT and Control	-9.94	0.001
	ACT and Control	-10.92	0.001
	CBT and ACT	0.97	0.23

#### 4. Discussion and Conclusion

This study aimed to compare the effectiveness of Cognitive-Behavioral Therapy (CBT) and Acceptance and Commitment Therapy (ACT) on cortisol levels and psychological distress in patients with asthma. The results indicated that both therapeutic interventions were effective in reducing cortisol levels and psychological distress compared to the control group. However, there was no significant difference in the effectiveness between the two interventions, meaning that both CBT and ACT had comparable positive effects on the dependent variables. These findings align with previous research (Abbasi et al., 2020; Ansari Bahjat et al., 2021; Ghasemnejad et al., 2021; Scott et al., 2023; Sicouri, 2023; Zargar et al., 2022).

In explaining the effectiveness of CBT in reducing cortisol levels and psychological distress, it is important to emphasize the core mechanisms of CBT. This therapy focuses on changing maladaptive cognitive processes and replacing them with more adaptive and functional thoughts. In CBT, the therapist works to shift the patient's perception and cognition regarding themselves and their illness. According to psychological theories of psychopathology, the way individuals interact with their thoughts, cognitions, and emotions is a key factor in maintaining psychological disorders. CBT techniques, such as identifying cognitive distortions, challenging negative thoughts, and conducting behavioral experiments, contribute to its effectiveness in altering the patient's perspective on themselves, others, and their negative thoughts about asthma (Ghasemnejad et al., 2021; Luu et al., 2020).

Psychological distress and emotional stress stimulate the hypothalamus, leading to the secretion of corticotropin-releasing hormone, which triggers increased cortisol release from the adrenal glands (Bonnert et al., 2020). The interaction between psychological distress and cortisol secretion is important for understanding how therapies reduce cortisol levels. In asthma patients, much of their psychological distress is not solely due to the disease itself but rather due to cognitive distortions such as catastrophizing, overgeneralization, and dysfunctional beliefs about the uncontrollability and unpredictability of their symptoms. These factors can lead to heightened psychological distress, which in turn elevates cortisol levels. CBT helps patients recognize and challenge these maladaptive thoughts, reducing distress and subsequently lowering cortisol levels.

Additionally, cortisol is recognized as a stress hormone, and its secretion increases in response to stressors such as asthma symptoms. By reducing psychological distress through techniques like cognitive restructuring, relaxation exercises, and activity planning, CBT can help decrease cortisol secretion. Teaching cognitive and behavioral strategies, such as problem-solving, managing negative thoughts, and engaging in pleasurable activities, significantly helps patients manage asthma symptoms, including elevated cortisol levels.

The significant effect of ACT on reducing psychological distress and cortisol levels was also evident in this study. ACT focuses on psychological flexibility, helping patients accept their internal experiences without attempting to control or avoid them. Techniques such as cognitive defusion and acceptance allow patients to reduce their attachment to distressing thoughts and focus on their values

and long-term goals. ACT encourages patients to engage in meaningful actions aligned with their values, even in the presence of distressing symptoms of asthma, thereby reducing their psychological distress (Karimzadeh, 2022). The decrease in distress then contributes to the reduction of cortisol levels. Rather than focusing on changing thoughts or avoiding negative emotions, ACT teaches patients to experience these events without letting them interfere with their lives. This shift in perspective may reduce the psychological burden, leading to lower cortisol levels.

Despite the distinct theoretical foundations and techniques of CBT and ACT, the study found no significant difference between the two in terms of their effectiveness. Both therapies focus on reducing maladaptive cognitive and emotional processes, and both emphasize enhancing psychological flexibility and reducing avoidance behaviors. These shared goals may explain why the two interventions were equally effective in lowering psychological distress and cortisol levels. Both CBT and ACT require continued practice and time for patients to fully integrate the skills learned during therapy, which could lead to sustained improvement over time.

Given the effectiveness of both CBT and ACT, this study highlights the importance of applying psychotherapeutic interventions in the treatment of psychosomatic conditions such as asthma. The multifaceted nature of asthma, involving both physical and psychological components, requires treatments that address both aspects. The integration of CBT and ACT into treatment protocols for asthma could provide patients with effective tools to manage both their physical symptoms and psychological distress.

However, this study has some limitations. The sample population was limited to asthma patients, which may restrict the generalizability of the findings to other psychosomatic conditions. Future research should investigate the applicability of CBT and ACT to other chronic illnesses with similar psychological and physiological components. Additionally, long-term follow-up studies are necessary to evaluate the sustained effects of these therapies on both cortisol levels and psychological well-being.

In conclusion, both Cognitive-Behavioral Therapy and Acceptance and Commitment Therapy were effective in reducing cortisol levels and psychological distress in asthma patients. These therapies provide valuable tools for helping patients manage the psychological and physiological challenges associated with asthma. The findings underscore the need for a biopsychosocial approach to treatment that

incorporates psychological, emotional, and behavioral interventions alongside medical care. Encouraging the use of these therapies in clinical settings, along with support from healthcare institutions and team-based approaches, could improve patient outcomes and reduce the economic burden of chronic diseases like asthma.

## 5. Limitations & Suggestions

One limitation of this study is that it focused exclusively on asthma patients, limiting the generalizability of the results to other chronic or psychosomatic conditions. Additionally, the sample size was relatively small, and participants were drawn from a specific geographical region, which may not fully represent broader populations. The study also did not include a long-term follow-up to assess the lasting effects of the interventions, and reliance on self-reported psychological distress could introduce response bias. Finally, the study did not consider other factors such as medication adherence or lifestyle changes that may have impacted cortisol levels and psychological distress.

Future research should explore the effectiveness of Cognitive-Behavioral Therapy (CBT) and Acceptance and Commitment Therapy (ACT) across a broader range of chronic and psychosomatic illnesses, such as diabetes, hypertension, and chronic pain, to assess the generalizability of these findings. Larger and more diverse sample populations across different cultural and socioeconomic backgrounds should be included to enhance the applicability of the results. Long-term follow-up studies are necessary to examine the sustainability of the effects of these therapies over time. Additionally, future research could investigate the combined effects of psychotherapeutic interventions with medical treatments to provide a more holistic understanding of patient outcomes.

Clinicians and healthcare providers should consider incorporating both Cognitive-Behavioral Therapy and Acceptance and Commitment Therapy into treatment plans for asthma patients to address both psychological and physiological aspects of the disease. These therapies can be particularly effective in reducing stress-related symptoms, such as elevated cortisol levels, which are commonly associated with asthma exacerbations. Integrating these psychotherapeutic approaches into multidisciplinary treatment teams can improve patient outcomes by addressing the biopsychosocial components of chronic illnesses. Additionally, healthcare institutions could provide training for professionals in these therapeutic modalities to ensure

more comprehensive care for patients with psychosomatic disorders.

### Acknowledgments

We would like to express our appreciation and gratitude to all those who cooperated in carrying out this study.

### Declaration of Interest

The authors of this article declared no conflict of interest.

### Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

### Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

### Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

### Authors' Contributions

All authors equally contributed in this article.

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