Original Article

Impact of Negative Air Ions on Hematological and Hormonal Parameters in Cerebral Palsy

Ammara Rafique[*1]

[1] Indus College of Physical Therapy & Rehabilitation, Indus University of Health Sciences, Karachi, Pakistan

Corresponding author: https://orcid.org/0000-0003-0473-6392; ammara.rafique@tih.org.pk

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Ammara Rafique[*1]

Abstract

Background: Cerebral Palsy (CP) is a group of permanent disorders characterized by non-progressive disruptions that occur during the development of the fetal or infant brain. These disruptions affect movement, posture, and various physiological and cognitive functions, including blood parameters, cognition, communication, hearing, metabolism, oral health, sensation, speech, swallowing, and vision.

Objective: This study aimed to investigate the impact of negative air ions (NAIs) on the hematological and hormonal parameters of CP patients.

Methods: Conducted over two months in 2021 at a specialized rehabilitation center in Karachi, Pakistan, the study involved 31 structured NAI exposure sessions over six weeks. Participants were randomly divided into control and intervention groups, with the latter exposed to 10,000 NAIs/cm³ for 40 minutes, five times per week. Hematological assessments, including complete blood count (CBC) and differential analysis, were performed using automated and manual methods. Serum cortisol levels were measured for hormonal assessment. Statistical analysis utilized paired t-tests for within-group comparisons using SPSS version 25.

Results: Both groups showed normal parameters at baseline. The control group had significant increases in hemoglobin ($p<0.05$), MCV ($p<0.05$), MCH ($p<0.05$), and PCV ($p<0.01$) and decreased platelet count ($p<0.01$). The intervention group exhibited reductions in leukocyte and platelet counts ($p<0.05$). No significant changes were observed in cortisol levels.

Conclusion: NAI therapy is safe with no adverse hematological or hormonal effects, suggesting its potential as a progressive, non-pharmacological, and cost-effective therapy for CP patients.

1   Introduction

Cerebral Palsy (CP) is a group of permanent disorders characterized by non-progressive disruptions that occur during the development of the fetal or infant brain. These disruptions often result in limitations in movement and posture, restricting physical activity and leading to a spectrum of additional complications. Patients with CP frequently experience a wide range of health issues, including cognitive impairments, communication difficulties, hearing and speech problems, metabolic anomalies, and challenges related to oral health, sensation, swallowing, and vision (1, 2). Furthermore, CP is associated with biochemical disturbances in amino acids, ammonia, calcium, chloride, cholesterol ethers, creatine phosphokinase, iron, phosphate, potassium, protein, magnesium, sodium, urea, uric acid, and growth status (3-6). Various risk factors contribute to CP, with a higher prevalence observed in males and significant associations with birth asphyxia occurring during the prenatal developmental phase (1, 7-9). While CP affects approximately 17 million individuals globally, the epidemiology and etiology of the disorder remain poorly understood in Pakistan (10, 11).

The deficiency of ions, particularly the lack of Negative Air Ions (NAIs), is increasingly recognized as a pivotal factor contributing to the onset of numerous illnesses. NAIs, which are naturally occurring particles found in certain environments, have been demonstrated to alleviate a range of health issues, including allergies, attention deficits, asthma, behavioral problems, cognitive impairments, depression, memory deficits, mental

health disorders, metabolic anomalies, mood disorders, performance deficits, delayed reaction times, sleep disorders, spasticity, stress, and various physiological dysfunctions (12-16). Previous studies suggest that environments enriched with NAIs can have positive effects on behavior, spasticity, and cognitive outcomes in CP patients, leading to the hypothesis that an NAI-rich environment may facilitate rehabilitation for individuals with CP (17).

To date, there is limited research on the effects of NAIs on the hematological and hormonal parameters of CP patients. This study aims to investigate the impact of NAIs on the hematological and hormonal parameters of CP patients. The study is conducted at a specialized rehabilitation center in Karachi, Pakistan, providing a structured approach to examine the potential therapeutic benefits of NAIs. By assessing hematological and hormonal parameters, the research seeks to determine whether exposure to NAIs could represent a progressive, non-pharmacological, and cost-effective therapeutic strategy for improving the quality of life in CP patients. The results of this study have the potential to contribute valuable insights into the non-invasive treatment options for CP, offering a new perspective on the management of this complex disorder.

2   Material and Methods

Figure 1 represents the study protocol. The study was conducted at the Al-Umeed Rehabilitation Association, a specialized center for CP patients in Karachi, Pakistan, over a period of two months from February to April 2021. Ethical approval was obtained from the University of Karachi's ethical committee, adhering to the principles outlined in the Declaration of Helsinki (IBC-2017). Informed consent was secured from the parents of all participants prior to their inclusion in the study. Participants were randomly allocated into control and intervention groups. The intervention group received exposure to NAIs using a 'JHQ-801 ionizer', which generated a consistent concentration of 10,000 NAIs/cm³ during each session, as measured by a 'KT-401 air ion tester'. Sessions were conducted for 40 minutes, five times a week, over a six-week period.

Hematological assessments included a complete blood count (CBC) with differential analysis. Blood samples of 1.8 ml were collected from participants and analyzed using the automated XN-550 Sampler. Differential analysis was performed using two slides per sample on an 'Eclipse E-100' microscope at 100x magnification to observe white blood cell count and cellular morphology. Hormonal assessments focused on cortisol levels, measured between 7 and 10 A.M. using a Cobas e 601 analyzer for serum samples. All laboratory tests were conducted at 'The Laboratory' in Karachi, Pakistan, ensuring standardization and accuracy in the testing procedures.

Data collection involved recording baseline hematological and hormonal parameters prior to the intervention and reassessment at the end of the six-week period. The study design allowed for the evaluation of within-group changes over time. Statistical analyses were performed using SPSS version 25, employing paired t-tests to assess changes in hematological and hormonal parameters within each group. The level of significance was set at $p<0.05$.
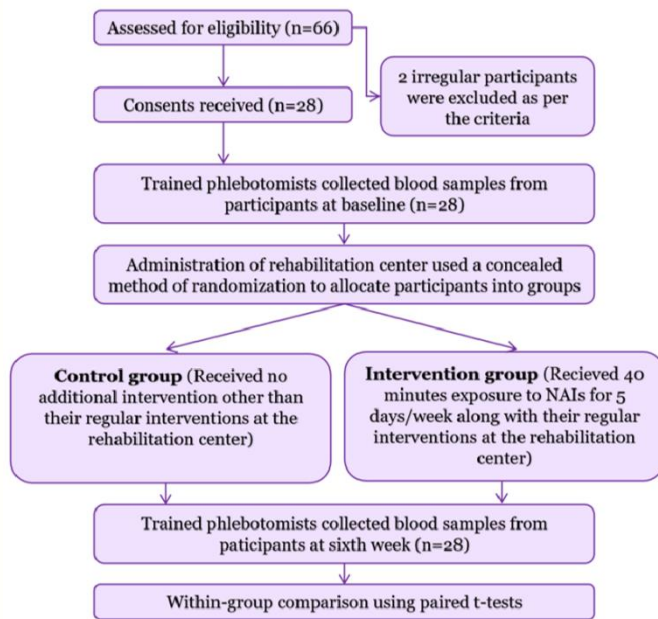
Figure 1 Study Protocol

Participants were screened based on inclusion and exclusion criteria, ensuring that they were stable enough to undergo the intervention without interference from other ongoing treatments. The study aimed to explore the impact of NAIs on the hematological and hormonal profiles of CP patients, hypothesizing potential improvements in these parameters as a result of the intervention. The controlled environment of the rehabilitation center provided a consistent setting for the study, minimizing external variables and focusing on the effects of NAIs exposure. By adhering to ethical standards and employing rigorous data collection and analysis methods, the study sought to provide insights into the non-pharmacological treatment potential of NAIs for enhancing the health outcomes of individuals with CP.

3   Results

The study enrolled participants in both the control and intervention groups to assess the impact of NAIs on hematological and hormonal parameters. The baseline characteristics of the participants are summarized in Table 1, detailing age, sex, and initial health status to ensure comparability between groups whereas, Table 2, detailing the physical characteristics of all inducted participants.

Table 1: Baseline Characteristics of Participants

Characteristic	Control Group (n=12)	Intervention Group (n=16)
Age (years)	14 ± 5	14.5 ± 7.1
Male/Female Ratio	11/1	8/8
Initial Health Status*	Normal	Normal

*Initial health status was determined based on clinical assessment and laboratory parameters.
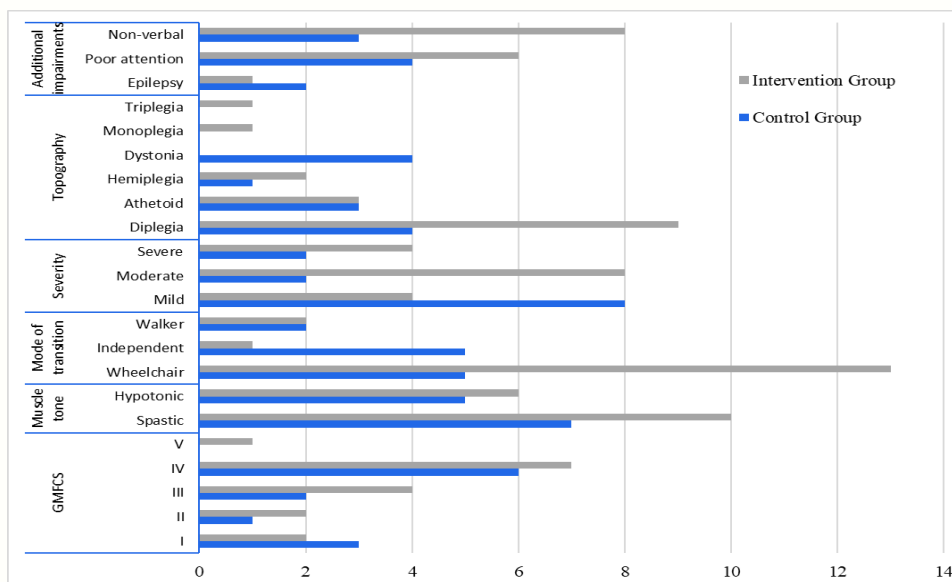
Figure 2 Physical Characteristics of Participants

Statistical analysis using paired t-tests revealed significant changes in several hematological parameters within both groups. These results are presented in Table 2, showing mean values at baseline and after six weeks, along with *p*-values indicating statistical significance.

Table 2: Hematological Parameters (Mean ± SD)

Parameter	Group	Baseline	Sixth Week	*p*-value
Hemoglobin (g/dL)	Control	13.4 ± 1.71	13.9 ± 1.58	<0.05*
	Intervention	13.1 ± 0.71	13.4 ± 1.01	>0.05
Packed Cell Volume (%)	Control	39.2 ± 4.73	41.0 ± 4.98	<0.01**
	Intervention	37.8 ± 4.45	38.3 ± 4.81	>0.05
Mean Corpuscular Volume (fL)	Control	80.4 ± 4.81	84.2 ± 4.90	<0.05*
	Intervention	83.1 ± 7.19	82.6 ± 7.45	>0.05
Mean Corpuscular Hemoglobin (pg)	Control	27.0 ± 1.81	28.2 ± 1.55	<0.05*
	Intervention	27.5 ± 3.13	27.3 ± 3.22	>0.05
Platelet Count (per cmm)	Control	336,500 ± 89,272	263,700 ± 35,634	<0.01**
	Intervention	341,375 ± 106,438	298,687.5 ± 103,991	<0.05*

*Significant at *p*<0.05, **Significant at *p*<0.01.

The control group demonstrated statistically significant increases in hemoglobin, packed cell volume, mean corpuscular volume, and mean corpuscular hemoglobin, along with a decrease in platelet count. Conversely, the intervention group showed significant reductions in leukocyte and platelet counts, although these changes remained within normal ranges. The hormonal parameters, specifically cortisol levels, were assessed to evaluate the impact of NAI exposure. The results are outlined in Table 3.

Table 3: Hormonal Parameters - Cortisol Levels (µg/dL, Mean ± SD)

Parameter	Group	Baseline	Sixth Week	p-value
Cortisol (µg/dL)	Control	11.7 ± 4.36	12.1 ± 4.78	>0.05
	Intervention	11.9 ± 5.03	13.7 ± 5.65	>0.05

No significant changes in cortisol levels were observed in either the control or intervention group after six weeks of exposure to NAIs. The values remained within the normal range, indicating no adverse hormonal effects.

4   Discussion

The present study investigated the impact of NAIs on the hematological and hormonal parameters of patients with CP, revealing insights into a novel, non-pharmacological intervention. The findings indicated that NAI exposure did not lead to any adverse changes in the hematological or hormonal profiles of CP patients, with all parameters remaining within normal physiological ranges. This is significant, as it suggests that NAI therapy might be a safe adjunct to current CP treatments.

Previous research has demonstrated the beneficial effects of NAIs on various health outcomes, including allergies, attention deficits, asthma, behavioral problems, cognitive impairments, depression, memory deficits, mental health disorders, metabolic anomalies, mood disorders, performance deficits, delayed reaction times, sleep disorders, spasticity, stress, and various physiological dysfunctions [12-16, 18, 19]. The study's findings are consistent with these reports, particularly in the observed nominal increase in lymphocyte count, which might suggest improved immune function [18]. However, the lack of significant changes in cortisol levels challenges previous studies that indicated potential stress-reducing effects of NAIs [19]. This discrepancy might be attributed to the specific population under study, as CP patients could have unique physiological responses compared to the general population.

The study's strengths included its randomized design, ethical rigor in obtaining consent and approvals, and comprehensive baseline assessments ensuring participant comparability. However, several limitations should be considered. The sample size was relatively small, primarily due to the challenges in securing parental consent for participation, which might have limited the statistical power to detect subtle changes in the parameters assessed. Additionally, the study duration of six weeks may not have been sufficient to capture long-term effects of NAI exposure on hematological and hormonal parameters.

The findings underscore the need for further research to explore the potential mechanisms underlying the observed benefits of NAI exposure in CP patients. Future studies should aim to include larger, more diverse samples and extend the duration of NAI exposure to assess long-term safety and efficacy [20]. Furthermore, it would be beneficial to investigate the impact of NAIs on additional biomarkers of health and disease, particularly those related to inflammation and oxidative stress, given their relevance to CP pathology [13].

5 Conclusion

In conclusion, this study contributes to the growing body of evidence supporting the use of NAI therapy as a potentially effective and safe intervention for individuals with CP. While the current findings did not achieve anticipated levels of significance, the absence of adverse effects suggests that NAIs could complement existing therapies, providing a non-invasive, cost-effective option for enhancing health outcomes in CP patients. Continued research in this area is warranted to substantiate these findings and elucidate the potential therapeutic benefits of NAI exposure for individuals with CP.

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