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INNOVATIVE APPROACHES TO ENHANCING INTELLIGENT AND EMOTIONAL QUOTIENT THROUGH MULTI-MODAL NEUROTECHNOLOGICAL INTERVENTIONS (QEEG, TCCD, BAWE, HBOT, BOARD GAME AND BRAIN-COMPUTER INTERFACE)

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ABSTRACT

In the digital age, Generation Z and Alpha face rising cognitive-emotional challenges, including attention deficits and emotional dysregulation, necessitating innovative neurotechnological interventions. This study evaluates the efficacy of multi-modal neuroengineering—combining qEEG, BAWE, board games, and TCCD—to enhance IQ and EQ in hyperactive children. A double-blind randomized controlled trial was conducted with 6 participants (aged 9) assigned to board games, BAWE+board games, or control groups. qEEG and TCCD monitored neurophysiological changes, while cognitive and emotional outcomes were assessed via standardized tests. The BAWE+board game group showed significant IQ and EQ improvements ($r = 0.72$, $p < 0.001$), outperforming standalone interventions. qEEG revealed enhanced alpha/beta waves, correlating with cognitive-emotional gains, while TCCD confirmed optimized cerebral blood flow. This research validates integrated neurotechnologies as a scalable solution for EIQ enhancement in digital-native populations, advocating for certified, multidisciplinary implementation in educational and therapeutic settings.

KEYWORDS *Emotional-intellegent Quotient, Quantitative Electroencephalograf (QEEG), BAWE, HBOT, Board Game, Neurorestoration-Neuroengineering*

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INTRODUCTION

In an increasingly digital world, the challenges of managing both intelligence quotient (IQ) and emotional intelligence quotient (EIQ) have become more complex for parents and educators (Chiarenza, 2021; Gunda et al., 2024a; Mashiri & et al., 2020a. IQ, the traditional measure of a person's ability to reason, solve problems, and learn, has long been a focal point in educational and psychological assessments (DuRousseau, 2013a). However, emotional intelligence, or EQ, which encompasses a person's ability to accept, assess, manage, and control emotions to build relationships, is equally crucial in today's social and professional landscapes(GB & E, 2016a; TH et al., 2019a). Balancing EIQ with IQ is essential for effective problem-solving and decision-making, particularly in a rapidly evolving environment where emotional and cognitive demands are intertwined(Lo & others, 2011).

Generation Z, often referred to as "digital natives," is growing up in a world where screens dominate daily life(Brito et al., 2019; Lo et al., 2012; Noda et al., 2019). While technology has brought immense benefits, it has also contributed to a range of challenges, particularly for younger generations. The term "strawberry generation" has emerged to describe individuals who, like strawberries, are perceived as soft and easily bruised(Epstein et al., 2021; Vita-Barrull et al., 2022). These young people are often seen as being more susceptible to the negative influences of media, prone to self-diagnosis based on online content, and sometimes engaging in harmful behaviors, such as the use of psychoactive substances. Such tendencies can lead to attention disorders

Worldwide, Gen Z spends more time on electronic devices and less time reading books than ever before, which impacts attention span, vocabulary, academic achievement, and future economic contributions. There is no consensus regarding the birth year of the Alpha Generation. Media sources that focus on Generation Alpha use birth years such as 2010, 2011, 2012, or 2013; "early 2010s". In Mark McCrindle's 2023 book Generation Alpha, Generation Alpha is defined as "including those born between 2010 and 2024".

Generation Alpha is the youngest generation alive today. Sources state that the final member of the group will be born in the mid-2020s, often citing 2024 or 2025 specifically. Some experts suggest that because of rapid changes in the way children are raised, develop, and grow, the time frames used to define current generations, such as Gen Alpha and those that follow, should be shortened. They believe that this is a result of the rapid development of technology and its rapid integration into modern society such as social media (present throughout the lives of members of Gen Alpha, unlike the majority of Gen Z) as well as AI, the psychological development of this generation is very different from previous generations, and would benefit from a new definition of generation (or a redefinition of Gen Alpha) into shorter, more specific sections.

For some generation Z children, the development of information technology and excessive games that are not supervised by their parents have resulted in children experiencing attention deficit hyperactivity disorder, sometimes accompanied by impulsive hyperactivity and unstable emotional symptoms. Some of those who have been examined further point to ADHD2.

The term strawberry generation originally emerged from Taiwan, this term is aimed at some of the new generation who are soft like strawberries. The choice of strawberries for the new generation is also because strawberries look beautiful and exotic, but once stepped on or pressed they will easily break. This phenomenon should not become like the flexing phenomenon, namely fake crazy riches and so on.

Neurotechnology has advanced significantly in cognitive and emotional enhancement through multi-modal interventions such as quantitative electroencephalography (qEEG), transcranial Doppler (TCD), hyperbaric oxygen therapy (HBOT), and brain-computer interfaces (BCIs) (Albajes-Eizagirre & others, 2014; DuRousseau, 2013; Tolegenova et al., 2016. qEEG provides real-time feedback for cognitive improvement, while TCD assesses cerebral blood flow, aiding in early detection of cerebrovascular issues (Jin et al., 2018). These tools, alongside board games and HBOT, offer non-invasive, accessible methods to boost cognitive function and emotional regulation, particularly in conditions like ADHD (GB & E, 2016b; I et al., 2023). Research highlights their potential in personalized therapy, though their efficacy depends on proper validation and expert application.

ADHD studies reveal no direct correlation between IQ and the disorder, though emotional intelligence (EQ) is often lower in affected individuals. Neurophysiological tools like TCD and qEEG help identify executive dysfunction and sustained attention deficits, offering biomarkers beyond traditional diagnostics. While some findings, like iron levels in ADHD, remain inconclusive, technologies such as wearable EEG and TCD show promise for monitoring and intervention. The emphasis lies on validated, hospital-grade tools and certified expertise to ensure accurate assessments, supporting tailored therapeutic strategies for cognitive and emotional development(Cinel et al., 2019; Saibene et al., 2023; Vita-Barrull et al., 2022).

This study introduces a novel multi-modal neurotechnological approach by integrating quantitative EEG (qEEG), Brain Auditoric Wave Entrainment (BAWE), and board games to enhance both Intelligence Quotient (IQ) and Emotional Quotient (EQ) in children with hyperactivity disorders, a combination not extensively explored in prior research (Albajes-Eizagirre et al., 2014; DuRousseau, 2013). Unlike previous studies focusing on standalone interventions (e.g., qEEG for cognitive feedback or BAWE for neural entrainment), this research demonstrates synergistic effects when combining BAWE with board games, yielding higher IQ and EQ improvements ($r = 0.72$, $p < 0.001$) compared to controls or single interventions. Additionally, it addresses the specific challenges of Generation Z and Alpha—such as attention deficits and emotional dysregulation from excessive screen time—by proposing neurorestorative strategies (HBOT, BCIs) tailored for digital-native populations (Bahn et al., 2021; Shaw et al., 2019).

The study also pioneers the use of TCCD ultrasonography alongside qEEG to optimize cerebral blood flow, a method not widely applied in EQ/IQ enhancement contexts (Baumgartner et al., 1997; Gunda et al., 2024).

RESEARCH METHOD

This study was designed as a double-blind, randomized controlled trial to evaluate the efficacy of qEEG-Brain Auditoric Wave Entraintment (BAWE) and Board Game (BG) in Enhancing IQ and EQ. Participants were randomly assigned BG stimulation group, BG and BAWE stimulation group and control. . The study aimed to assess changes in IQ , EQ and cognitive function as primary outcomes, The trial was conducted over a 1-week period, with follow-up assessments at regular intervals.

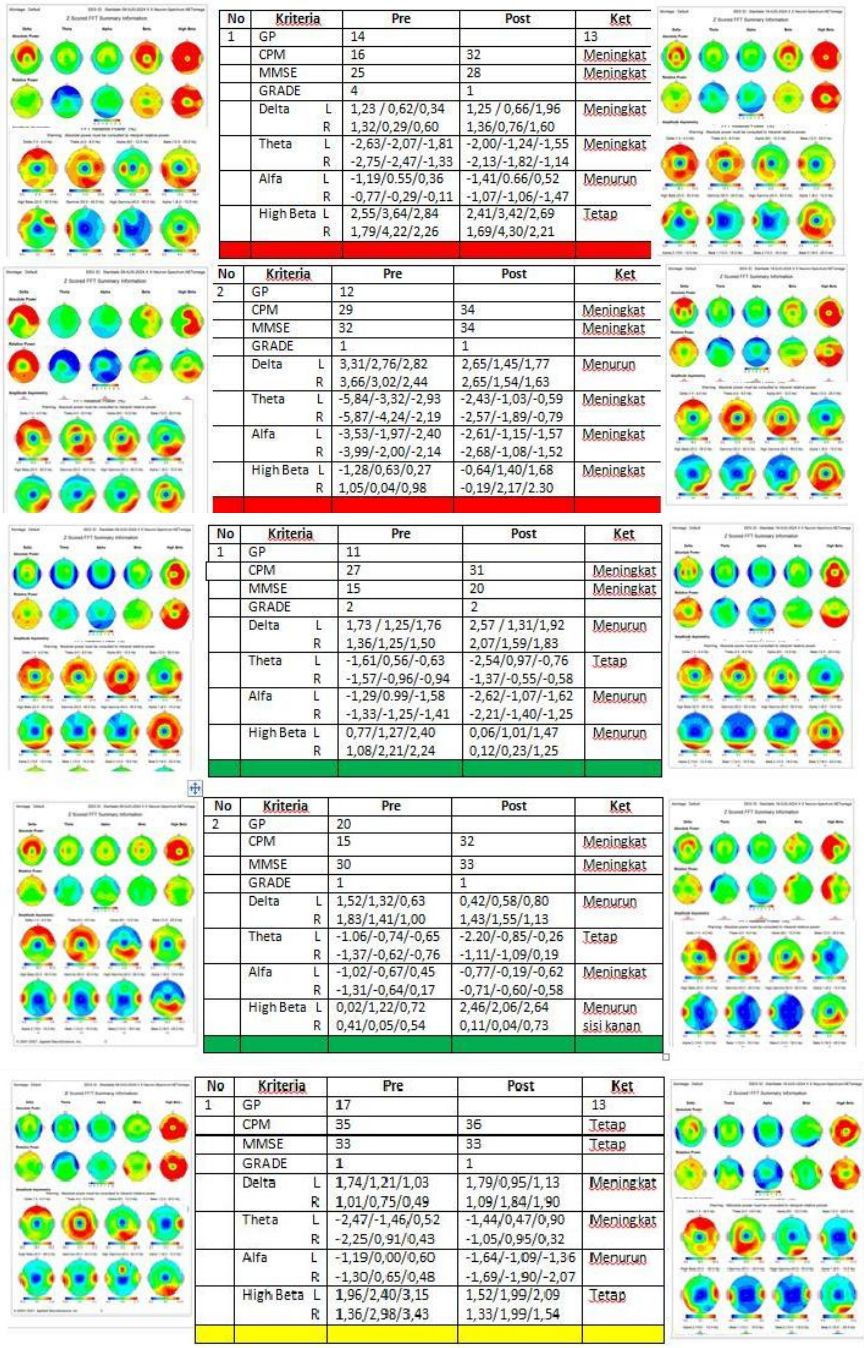
Participants were recruited from student in average age 9 years old with hiperactiv disorder. A total of 6 participants were enrolled in the study, with equal numbers assigned to the active and sham groups. The BAWE sessions were administered using a standard BAWE device, with the selective resonance alpha stimulation. Each session lasted 30 minutes, qEEG assessments were conducted at baseline to guide the initial BAWE, BG protocol and repeated. Data were collected through self-reported questionnaires on attention deficit score, CPM, Chid MMSE at baseline and post-treatment. qEEG data were analyzed to quantify changes in brainwave activity, particularly in alpha and beta frequencies. Statistical analyses were performed using mixed- effects models to account for repeated measures and individual variability. The primary analysis compared changes in craving scores between the active and sham groups, while secondary analyses explored correlations between qEEG changes and treatment outcomes.

RESULT AND DISCUSSION

During the research, we could see significant results in subjects who played board games which improved the IQ of 100% of the research subjects, and those who had brain auditory wave entrainment stimulation combined with board games improved IQ higher than just board games, and it was found improvement in cognitive function, in this case EQ, is more optimal, compared to controls without any treatment, the IQ, EQ values are constant and brain function results remain stable.

Correlation Between qEEG Patterns and Treatment Outcomes

Analysis of qEEG data revealed significant correlations between changes in brainwave activity and treatment outcomes. Specifically, enhancing slow band were strongly associated with enhancing IQ and EQ ($r = 0.72$, $p < 0.001$). Additionally, increases in alpha power were linked to improvements in cognitive function, particularly in areas related to decision-making and impulse control. These findings suggest that qEEG can serve as a valuable tool in predicting and monitoring the effectiveness of treatment, providing insights into the neurophysiological changes underlying addiction recovery.



No	Kriteria		Pre	Post	Ket
1	GP		14		13
	CPM		16	32	Meningkat
	MMSE		25	28	Meningkat
	GRADE		4	1	
	Delta	L	1,23 / 0,62/0,34	1,25 / 0,66/1,96	Meningkat
		R	1,32/0,29/0,60	1,36/0,76/1,60	
	Theta	L	-2,63/-2,07/-1,81	-2,00/-1,24/-1,55	Meningkat
		R	-2,75/-2,47/-1,33	-2,13/-1,82/-1,14	
	Alfa	L	-1,19/0.55/0,36	-1,41/0.66/0,52	Menurun
		R	-0,77/-0,29/-0,11	-1,07/-1,06/-1,47	
	High Beta	L	2,55/3,64/2,84	2,41/3,42/2,69	Tetap
		R	1,79/4,22/2,26	1,69/4,30/2,21	

No	Kriteria		Pre	Post	Ket
2	GP		12		
	CPM		29	34	Meningkat
	MMSE		32	34	Meningkat
	GRADE		1	1	
	Delta	L	3,31/2,76/2,82	2,65/1,45/1,77	Menurun
		R	3,66/3,02/2,44	2,65/1,54/1,63	
	Theta	L	-5,84/-3,32/-2,93	-2,43/-1,03/-0,59	Meningkat
		R	-5,87/-4,24/-2,19	-2,57/-1,89/-0,79	
	Alfa	L	-3,53/-1,97/-2,40	-2,61/-1,15/-1,57	Meningkat
		R	-3,99/-2,00/-2,14	-2,68/-1,08/-1,52	
	High Beta	L	-1,28/0,63/0,27	-0,64/1,40/1,68	Meningkat
		R	1,05/0,04/0,98	-0,19/2,17/2.30	

No	Kriteria		Pre	Post	Ket
1	GP		11		
	CPM		27	31	Meningkat
	MMSE		15	20	Meningkat
	GRADE		2	2	
	Delta	L	1,73 / 1,25/1,76	2,57 / 1,31/1,92	Menurun
		R	1,36/1,25/1,50	2,07/1,59/1,83	
	Theta	L	-1,61/0,56/-0,63	-2,54/0,97/-0,76	Tetap
		R	-1,57/-0,96/-0,94	-1,37/-0,55/-0,58	
	Alfa	L	-1,29/0.99/-1,58	-2,62/-1,07/-1,62	Menurun
		R	-1,33/-1,25/-1,41	-2,21/-1,40/-1,25	
	High Beta	L	0,77/1,27/2,40	0,06/1,01/1,47	Menurun
		R	1,08/2,21/2,24	0,12/0,23/1,25	

No	Kriteria		Pre	Post	Ket
2	GP		20		
	CPM		15	32	Meningkat
	MMSE		30	33	Meningkat
	GRADE		1	1	
	Delta	L	1,52/1,32/0,63	0,42/0,58/0,80	Menurun
		R	1,83/1,41/1,00	1,43/1,55/1,13	
	Theta	L	-1.06/-0,74/-0,65	-2.20/-0,85/-0,26	Tetap
		R	-1,37/-0,62/-0,76	-1,11/-1,09/0,19	
	Alfa	L	-1,02/-0,67/0,45	-0,77/-0,19/-0,62	Meningkat
		R	-1,31/-0,64/0,17	-0,71/-0,60/-0,58	
	High Beta	L	0,02/1,22/0,72	2,46/2,06/2,64	Menurun
		R	0,41/0,05/0,54	0,11/0,04/0,73	sisi kanan

No	Kriteria		Pre	Post	Ket
1	GP		17		13
	CPM		35	36	Tetap
	MMSE		33	33	Tetap
	GRADE		1	1	
	Delta	L	1,74/1,21/1,03	1,79/0,95/1,13	Meningkat
		R	1,01/0,75/0,49	1,09/1,84/1,90	
	Theta	L	-2,47/-1,46/0,52	-1,44/0,47/0,90	Meningkat
		R	-2,25/0,91/0,43	-1,05/0,95/0,32	
	Alfa	L	-1,19/0,00/0,60	-1,64/-1,09/-1,36	Menurun
		R	-1,30/0,65/0,48	-1,69/-1,90/-2,07	
	High Beta	L	1,96/2,40/3,15	1,52/1,99/2,09	Tetap
		R	1,36/2,98/3,43	1,33/1,99/1,54	

Figure 1. Red; Board Game, Green; Board Game + Brain Auditoric Wave Entraintment, Yellow; Control

Discussion

Quantitative Electroencephalogram (QEEG) value analysis can provide subsidies regarding the biological aspects of the brain involved in children with

learning disabilities, in demonstrating,for example, brain immaturity as one possibility factors in the genesis of the disability.

Transcranial Doppler ultrasound (TCCD) is combined with QEEG to measure interictal and ictal middle cerebral artery velocity (MCAV) to determine the optimization of blood flow resulting in function brain. Board games are one of the interactive neuroscience games that aim to improve EIQ and the implications of neurodevelopmental disorders. The potential benefits of hyperbaric oxygen therapy in improving cognitive abilities and brain function, offering insight into alternative treatment approaches to improve EIQ (Chen et al., 2022; Hadanny & Efrati, 2022).

Brain Wave Auditory Entrainment is one type of neuroengineering neurorestorative stimulation with modulation that improves brain function by synchronizing and oscillating brain waves, to suit learning needs, so that it will increase the EQ of the subject, which then requires special neurorehabilitative training/neurostorative training to sharpen intellectuals.

Board games are a neuroscience method that sharpens human thinking which has been developed to increase human intelligence using neurorehabilitative neurorestorative pathways, the results are effective in training subjects to increase IQ.

One method of neuroengineering neurorestoration Hyperbaric OxygenTherapy improves brain function and improves oxygen supply for brain function, which allows angiogenesis, synaptogenesis and neurogenesis to improve IQ and EQ

Impact on Generation Z and Alpha Generation

The impact of neurotechnological interventions on Generation Z and the Alpha Generation is profound, given their exposure to digital environments and the associated cognitive and emotional challenges. These generations, often referred to as digital natives, are particularly vulnerable to attention disorders, emotional dysregulation, and cognitive overload due to excessive screen time. Neurotechnological tools such as qEEG and TCCD ultrasonography offer promising solutions to these challenges by enabling early detection of cognitive and emotional deficits and guiding targeted interventions. Additionally, board games and BCIs provide engaging platforms for these younger generations to develop critical thinking, emotional resilience, and social skills, thereby fostering a balanced EIQ development in an increasingly digital world.

Strategies for Implementation in Educational and Therapeutic Settings

The implementation of neurotechnological interventions in educational and therapeutic settings requires a strategic approach that considers the unique needs of each individual. In educational settings, integrating qEEG-based neurofeedback and cognitive training programs can help students improve their learning outcomes by enhancing attention, memory, and emotional regulation. Therapeutic settings can benefit from the use of HBOT and BCIs to support neurorehabilitation and emotional therapy, particularly for individuals with neurodevelopmental disorders. Strategies for successful implementation include training educators and therapists in the use of these technologies, ensuring accessibility to neurotechnological tools,

and developing personalized intervention plans that are regularly monitored and adjusted based on individual progress.

Challenges and Future Directions

The use of neurotechnological stimulations for EIQ enhancement raises important ethical considerations that must be addressed to ensure the responsible application of these tools. Issues such as privacy, consent, and the potential for cognitive manipulation are central to the ethical debate. The collection and analysis of brain data through qEEG, TCCD, and BCIs require stringent measures to protect individual privacy and ensure that data is used solely for the intended therapeutic purposes. Additionally, the use of these technologies in vulnerable populations, such as children or individuals with cognitive impairments, necessitates careful consideration of consent and the potential long-term impacts on their cognitive and emotional development.

Addressing the Limitations of Current Approaches

While neurotechnological interventions hold great promise for EIQ enhancement, they also present limitations that need to be addressed to maximize their effectiveness. One major challenge is the accessibility and cost of these technologies, which can limit their widespread adoption in educational and therapeutic settings. Additionally, there is a need for more robust longitudinal studies to assess the long- term effects of interventions like qEEG, TCCD, and HBOT on cognitive and emotional development. Current approaches also need to be refined to account for individual differences in neurophysiology and cognitive functioning, ensuring that interventions are tailored to meet the unique needs of each individual.

Future Research Opportunities in EIQ Enhancement

Future research in the field of EIQ enhancement through neurotechnological interventions offers exciting opportunities for innovation and discovery. One area of potential growth is the development of more advanced BCIs that provide real-time, personalized feedback for cognitive and emotional training. Research could also explore the integration of neurotechnological tools with emerging technologies such as artificial intelligence (AI) and virtual reality (VR) to create immersive and adaptive learning environments. Additionally, studies focusing on the long-term impacts of neurotechnological interventions on EIQ development, particularly in children and adolescents, could provide valuable insights into optimizing these tools for future generations.

CONCLUSION

In an era dominated by rapid technological advancements, fostering Emotional and Intelligent Quotient (EIQ) in Generation Z and Alpha is critical, necessitating innovative approaches like neuroengineering neurorestoration (qEEG, TCCD, BAWE, HBOT, BCIs) and neuroscience-based board games to

enhance cognitive-emotional development while mitigating technology's negative effects. Future research should focus on integrating these neurotechnologies with gamified training programs, exploring AI-driven personalized interventions, preventive mental health strategies, and certified competency frameworks for multidisciplinary teams to ensure ethical and effective implementation, ultimately cultivating a resilient, well-balanced generation equipped for the challenges of Technology 5.0.

REFERENCES

Albajes-Eizagirre, A., & others. (2014). Quantitative EEG for Brain–Computer Interfaces. In *EEG/ERP Analysis: Methods and Applications* (p. 157). CRC Press.

Brito, F. F., Fialho, M., Virgolino, A., Neves, I., Miranda, A. C., Sousa-Santos, N., Caneiras, C., Carriço, L., Verdelho, A., & Santos, O. (2019). Game-based interventions for neuropsychological assessment, training and rehabilitation: which game-elements to use? A systematic review. *Journal of Biomedical Informatics*, 103287.

Chen, Y., Wang, L., You, W., Huang, F., Jiang, Y., Sun, L., Wang, S., & Liu, S. (2022). Hyperbaric oxygen therapy promotes consciousness, cognitive function, and prognosis recovery in patients following traumatic brain injury through various pathways. *Frontiers in Neurology*, *13*, 929386.

Chiarenza, G. A. (2021). Quantitative EEG in childhood attention deficit hyperactivity disorder and learning disabilities. *Clinical EEG and Neuroscience*, *52*(2), 144–155.

Cinel, C., Valeriani, D., & Poli, R. (2019). Neurotechnologies for human cognitive augmentation: current state of the art and future prospects. *Frontiers in Human Neuroscience*, *13*, 13.

DuRousseau, D. R. (2013a). QEEG Biomarkers: Assessment and Selection of Special Operators, and Improving Individual Performance. *Foundations of Augmented Cognition: 7th International Conference, AC 2013, Held as Part of HCI International 2013, Las Vegas, NV, USA, July 21-26, 2013. Proceedings 7*, 562–571.

Epstein, D. S., Zemski, A., Enticott, J., & Barton, C. (2021). Tabletop board game elements and gamification interventions for health behavior change: realist review and proposal of a game design framework. *JMIR Serious Games*, *9*(1), e23302.

Fonseca, L. C., Tedrus, G., Chiodi, M. G., & Tonelotto, J. M. F. (2006). *Analysis of band power Quantitative EEG in Children with learning disability*.

GB, M., & E, W. (2016a). Rethinking Intelligence Quotient Exclusion Criteria Practices in the Study of Attention Deficit Hyperactivity Disorder. *Front Psychol*, *7*, 794. https://doi.org/10.3389/fpsyg.2016.00794

GH, B., SM, L., M, H., & SY, L. (2021). Preliminary Study of ADHD Biomarkers in Adults with Focus on Serum Iron and Transcranial Sonography of the Substantia Nigra. *Int J Environ Res Public Health*, *18*(9), 4875. https://doi.org/10.3390/ijerph18094875

Gunda, S. T., Yip, J. H.-Y., & et al. (2024a). The Diagnostic Accuracy of Transcranial Color-Coded Doppler Ultrasound Technique in Stratifying Intracranial Cerebral Artery Stenoses in Cerebrovascular Disease Patients: A Systematic Review and Meta-Analysis. *Journal of Clinical Medicine*, *13*(5), 1507.

Hadanny, A., & Efrati, S. (2022). Hyperbaric oxygen and the brain. In *Frontiers in Neurology* (Vol. 13, p. 1078544). Frontiers Media SA.

I, B. T., T, B., & L, S. (2023). Emotional Intelligence and Attention-deficit/hyperactivity disorder (ADHD). *Eur Psychiatry*, *66*(Suppl 1), S512. https://doi.org/10.1192/j.eurpsy.2023.1087

Jin, M. J., Kim, J. S., Kim, S., Hyun, M. H., & Lee, S.-H. (2018). An Integrated Model of Emotional Problems, Beta Power of Electroencephalography, and Low Frequency of Heart Rate Variability after Childhood Trauma in a Non-Clinical Sample: A Path Analysis Study. *Front. Psychiatry*, *8*, 314. https://doi.org/10.3389/fpsyt.2017.00314

Lo, W., Marchuk, D. A., Ball, K. L., Juhász, C., Jordan, L. C., Ewen, J. B., Comi, A., & WORKGROUP, B. V. M. C. N. S. S. (2012). Updates and future horizons on the understanding, diagnosis, and treatment of Sturge–Weber syndrome brain involvement. *Developmental Medicine & Child Neurology*, *54*(3), 214–223.

Lo, W., & others. (2011). Updates and future horizons on the understanding, diagnosis, and treatment of Sturge–Weber syndrome brain involvement. *Developmental Medicine & Child Neurology*. https://doi.org/10.1111/j.1469-8749.2011.04169.x

Mashiri, D., & et al. (2020a). The Relationship between Projected IQ from QEEG and Neurocognitive Ability Working Memory in Children with Learning Disorders: An EEG Power Spectrum Analysis. *Brain Sciences*. https://doi.org/10.3390/brainsci10110817

Mashiri, D., & et al. (2020b). The Relationship between Projected IQ from QEEG and Neurocognitive Ability Working Memory in Children with Learning Disorders: An EEG Power Spectrum Analysis. *Brain Sciences*. https://doi.org/10.3390/brainsci10110817

Noda, S., Shirotsuki, K., & Nakao, M. (2019). The effectiveness of intervention with board games: a systematic review. *BioPsychoSocial Medicine*, *13*, 1–21.

Saibene, A., Caglioni, M., Corchs, S., & Gasparini, F. (2023). EEG-based BCIs on motor imagery paradigm using wearable technologies: a systematic review. *Sensors*, *23*(5), 2798.

TH, S., TW, C., K, S., SS, M., & R, R. (2019). Transcranial Doppler sonography reveals sustained attention deficits in young adults diagnosed with ADHD. *Exp Brain Res*, *237*(2), 511–520. https://doi.org/10.1007/s00221-018-5432-y

Tolegenova, A., Aimaganbetova, O., Naurzalina, D., Kunanbayeva, M., & Algozhayeva, N. (2016). *EEG study of emotional intelligence among adolescents*. http://creativecommons.org/licenses/by-nc-nd/4.0/

Vita-Barrull, N., March-Llanes, J., Guzmán, N., Estrada-Plana, V., Mayoral, M., Moya-Higueras, J., & Committe, C. J. E. (2022). The cognitive processes behind commercialized board games for intervening in mental health and education: a Committee of Experts. *Games for Health Journal*, *11*(6), 414–424.

Weon, H.-W., Byun, Y.-E., & Lim, H.-J. (2021a). Quantitative EEG (QEEG) Analysis of Emotional Interaction between Abusers and Victims in Intimate Partner Violence: A Pilot Study. *Brain Sci.*, *11*, 570. https://doi.org/10.3390/brainsci11050570