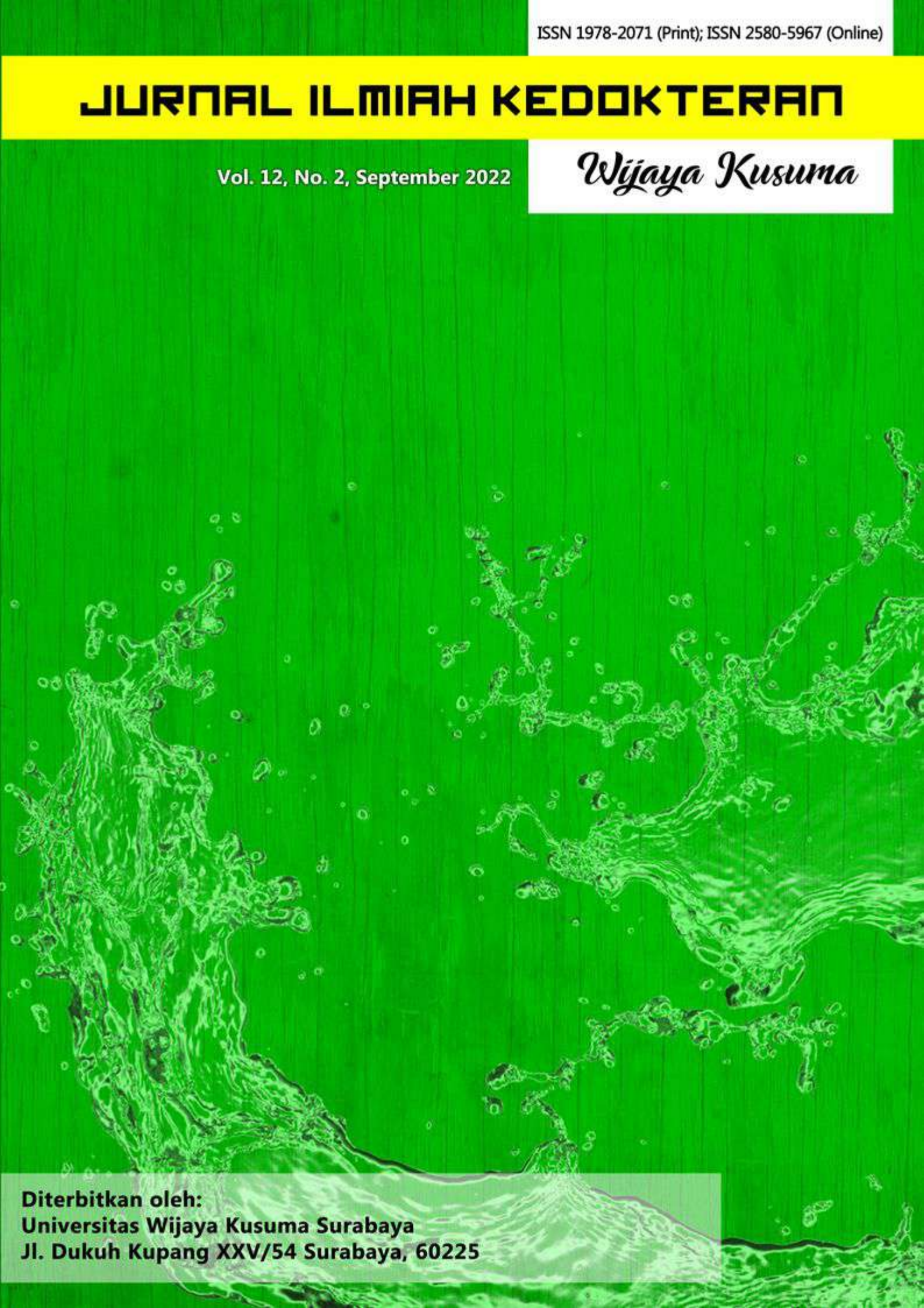
ISSN 1978-2071 (Print); ISSN 2580-5967 (Online)

JURNAL ILMIAH KEDOKTERAN

Vol. 12, No. 2, September 2022

Wijaya Kusuma



Diterbitkan oleh:
Universitas Wijaya Kusuma Surabaya
Jl. Dukuh Kupang XXV/54 Surabaya, 60225

ISSN 1978-2071 (Print); ISSN 2580-5967 (Online)

Jurnal Ilmiah Kedokteran Wijaya Kusuma

Vol. 11, No. 2, September 2022

Journal Ilmiah Kedokteran Wijaya Kusuma (JIKW) is a journal published twice a year which contains various articles/manuscripts in the following type of research results, literature reviews, case reports, and short communications in the medical field focused on Biomedical Sciences, Clinical Medicine, Public Health Sciences and Medical Education

Adress : Fakultas Kedokteran UWKS
Gedung C, Lantai 2 (R. 216)
Jl. Dukuh Kupang XXV Surabaya, 60225
Telp (Fax) 031 5686531
Email: jurnalkedokteranuwks@gmail.com
Website: http://journal.uwks.ac.id/index.php

ISSN 1978-2071 (Print); ISSN 2580-5967 (Online)
Jurnal Ilmiah Kedokteran Wijaya Kusuma 11(2): 105-197

PREFACE

Praise and gratitude that the Jurnal Ilmiah kedokteran Wijaya Kusuma (JIKW) Vol. 11, No. 2, September 2022 edition published. This issue contains articles that discuss aspects of Surgery, Pediatric, Neurology, Physiology, Biochemistry, Biomedical Sciences, Pharmacology, and Public Health Sciences, from Original research, Case Reports, as well as literature review.

Jurnal Ilmiah Kedokteran Wijaya Kusuma (JIKW) receive scientific articles from original research, reports or case studies, studies or literature reviews, as well as medical science, which are oriented to updating information in medical science and technology. It expected be the sources of scientific information and contributing in overcoming medical problems.

The editors invite various scientists from various higher education and research institutions to provide scientific contributions, both in the form of research results and scientific studies on various topics of Health and Medical Science. We welcoming for critics, inputs from readers, medical professionals, or those related to publishing, for the sake of increasing the quality of the journal as we all hope.

The editor hopes that the scientific articles published in the Jurnal Ilmiah Kedokteran Wijaya Kusuma (JIKW) will be useful for academics, researchers and professionals working in the medical world and network building for researchers.

Editor in Chief

ISSN 1978-2071 (Print); ISSN 2580-5967 (Online)

Jurnal Ilmiah Kedokteran Wijaya Kusuma

Vol. 11, No. 2, September 2021

DAFTAR ISI **Halaman**

Acknowledgement to Reviewers

The editors of Jurnal Ilmiah Kedokteran Wijaya Kusuma (JIKW) would like to sincerely thank the peer reviewers/Bestari Partners who have reviewed the articles published in the Wijaya Kusuma Medical Scientific Journal Vol. 11, No. 2, September 2022. The following Bestari partners include:

1. Fitri Handayani, dr., M.Kes (Biokimia/ FK Universitas Hang Tuah Surabaya)
2. Brahmaputra Marjadi, Ph.D., dr., MPH FK Universitas Wijaya Kusuma Surabaya; School of Medicine, Western Sydney University, Australia)
3. Dr. dr. Basuki Supartono, Sp.OT., FICS, MARS (Fakultas Kedokteran UPN Veteran Jakarta, Indonesia)
4. Pratika Yuhyi Hernanda, dr., M.Sc., Ph.D (Biomedik/ FK UWKS)
5. Ferry Efendi, Ph.D., S.Kep., Ns., M.Sc (Fakultas Keperawatan/ Universitas Airlangga)
6. Prof. Win Darmanto, PhD., M.Si (Biologi/ FST Universitas Airlangga)
7. Dr. Willy Sandhika, dr., M.Si., Sp.PA (K) (Patologi Anatomi/ FK Universitas Airlangga)
8. Dr. H. Artha Budi Susila Duarsa, dr., M.Kes
9. Joko Gunawan, Ph.D (Fakultas Keperawatan/ Chulalongkorn University, Bangkok)
10. Prof. Dr. dr. Suhartati, MS (Biokimia/ FK Universitas Wijaya Kusuma Surabaya)
11. Prof. H. Didik Sarudji, M.Sc (IKM/ FK Universitas Wijaya Kusuma Surabaya)
12. Dr. Drs. Eko Suhartono, M.Si (Biokimia/ FK Universitas Lambung Mangkurat, Banjarmasin)

pISSN 1978-2071
eISSN 2580-5967
Jurnal Ilmiah Kedokteran Wijaya Kusuma (JIKW)
Volume 11, No. 2 September 2022

AUTHOR'S AFFILIATIONS
Medical Faculty of Wijaya Kusuma Surabaya University[1,3]
Pediatric Resident Medical Faculty, Lambung Mangkurat University, Banjarmasin[2]

CORRESPONDING AUTHOR
Erny
Medical Faculty of Wijaya Kusuma University Surabaya
E-mail: drernyspa@gmail.com

Received: 14 July 2022;
Accepted: 06 September 2022;
Published: 30 September 2022

The Impact of Using Gadgets at Early Age on The Brain Development of Infants and Children (Literature Review Article)

Erny[1]*, Okky Prasetyo[2], Ayly Soekanto[3]

Abstract

The use of gadgets is currently very evenly distributed in almost all age groups with screen times that are increasingly worrying, especially in infants and children. The influence of these devices can cause many problems not only social problems but especially health problems that have a long-term impact. Neuropsychiatric disorders caused by early use of gadgets in infants and children should be prevented by parents' understanding of the effects of using these devices. The purpose of writing this review article describes health problems that may arise due to the use of gadgets in children in an uncontrolled time. This literature review article was analyzed from 25 journals with topics of infant and toddler brain development, gadgets, electromagnetic waves and their impact on infant and toddler brain development. Search using pubmed central, google scholar, article in journals indexes Scopus Q1-4 and Sinta 1-4 from year 2002-2022. 25 journals were obtained and overall showed the impact of gadgets in the brain development.

Keywords: Brain development, Early age, Gadgets.

Review Article

Dampak Penggunaan Gawai pada Anak Usia Dini pada Perkembangan Otak Bayi dan Anak

Abstrak

Penggunaan gadget saat ini sangat merata di hampir semua kelompok umur dengan screen time yang semakin mengkhawatirkan, terutama pada bayi dan anak-anak. Pengaruh perangkat ini dapat menyebabkan banyak masalah tidak hanya masalah sosial tetapi terutama masalah kesehatan yang memiliki dampak jangka panjang. Gangguan neuropsikiatri yang disebabkan oleh penggunaan awal gadget pada bayi dan anak-anak harus dicegah oleh pemahaman orang tua tentang efek penggunaan perangkat ini. Tujuan penulisan artikel ulasan ini menjelaskan masalah kesehatan yang mungkin timbul akibat penggunaan gadget pada anak-anak dalam waktu yang tidak terkendali. Methods: this literature review article dengan mereview artikel dari jurnal kedokteran dengan topik perkembangan otak bayi dan balita, gadget, gelombang elektromagnetik dan dampaknya pada perkembangan otak bayi dan balita. Pencarian menggunakan pubmed central, google scholar pada jurnal kedokteran indeks Scopus Q1-4 dan Sinta 1-4 dari tahun 2002-2022. Hasil: didapatkan 25 jurnal dan menunjukkan dampak penggunaan gadget dalam perkembangan otak.

***Kata Kunci**: Perkembangan otak, usia dini, penggunaan gadget.*

INTRODUCTION

The development of the infant's brain is a continuous process from conception to reaching its peak in the first 1000 days after birth. This process is influenced by many factors both genetic and non-genetic for example CNS infection, head trauma, nutrition, radiation and last but not least are factors of stimulation and family parenting. If

all of the above factors are controlled and no specific genetic factors are found, basically the child must develop according to his age and potential to the maximum (Dahlia & Sekartini, 2017; Tierney & Nelson, 2009)

Nowadays in the digital era, many things have changed including game patterns and family parenting. Babies and toddlers are very much exposed to the use of gadgets, be it mobile phones or tablets. At first, the use of the device was intended to please babies and children by distracting them so as not to cry and make the little one calm down. The advantages of gadgets that contain elements of sound, image and motion are very attractive to babies and children. In the course of time, parents feel comfortable because the child becomes calm and not fussy so that parents can practically continue their work in peace or rest (Setianingsih, Amila Wahyuni Ardani, 2018). But behind this all a negative thing happens to babies and children because they will really enjoy gadgets indefinitely and several studies have proven the occurrence of a neuropsychiatric disorder known as Screen Dependency Disorder (SDD) which can interfere with the child's brain development process (Sharma, 2018; Sigman, 2014). The purpose of this paper is to review the effect of the use of gadgets on the brain development of babies and children in an effort to reduce or prevent the occurrence of elementary school and other health problems that have a long-term impact.

METHODS

This study is reviews articles from medical and health journals relevant to the title of the study. The journal was obtained from the search portal pubmed central, google scholar with keywords brain development of babies and toddlers, gadgets and its development, the impact of gadgets on the brain, speech disorders, cognitive and socialization. The journal used was published from 2002-2022. The inclusion criteria are journals from Indonesia and abroad must be able to be downloaded in full, medical journals with standards Q1-Q4 and Sinta 1-4 and accompanied by DOI and journal links that we enter with the mendeley system.

RESULTS

Literature searching related to the gadget using in brain development of infants and children was obtained 25 journals.

Table 1. Summary of the effects of Gadget and Internet in Infants and Children

Jurnal/artikel	Author, Co-author	Title	Result
Republika, 2014	Rezkisari	Pengguna smartphone Indonesia peringkat ke 5 dunia	There is a rapid increase in smartphone use in Indonesia
https://bpptik.kominfo.go.id/	Sumara 2016	Pertumbuhan digital di Indonesia	Growth of active internet users in Indonesia grew by 21% since March 2015
Jurnal Ilmiah Sekolah Dasar (2019) 3(4) 538	Syifa et al	Dampak Penggunaan Gadget terhadap Perkembangan Psikologi pada Anak Sekolah Dasar	The use of gadgets >2 hours / day in children causes changes in behavior, aspects of emotional growth and moral development.
https://kominfo.go.id/index.php/content/detail/3415/kominfo+%3A+Pengguna+internet+diindonesia+63+juta+orang/0/berita_satker	Kemenkominfo RI	Pengguna internet di Indonesia 63 juta orang	Indonesia is ranked 4th in the world in the use of social networks, but many of them are ineffective
IDAI, 2017	Dahlia, J. K., & Sekartini, R.	Pentingnya pemantauan tumbuh kembang 1000 hari pertama kehidupan anak	At the age of <2 years there is a very rapid brain development. This period is known as a critical period of brain development and must be monitored to detect deviations in the growth and development of children's

			cognition, mental and emotional
Neuropsychol Rev (2010) 20:327–348	Stiles, J., & Jernigan, T. L	The basic of brain development	basic stages and mechanisms of mammalian brain development. Studies elucidating the neurobiology of brain development span the levels of neural organization from the macroanatomic, to the cellular, to the molecular.
Majalah tehnologi elektro vol 8 no 1 2009 hal 106-109	IB Alit Swamardika	Pengaruh gelombang elektromagnetik terhadap kesehatan manusia	The degree of exposure of electromagnetic waves with varies frequency significantly adversely affects human physical and mental health
Int J Community Med Public Health. 2020 May;7(5):1884-1888	V., R., B. S., S., & Karinagannanavar, A.	Exposure to electronic gadgets and its impact on developmental milestones among preschool children	Children in general use gadged 1-2 hours / day and start using gadgets at the age of 13-24 months. There is a meaningful relationship between gadget use and personal and social development disorders.
Sari Pediatri, Vol. 14, No. 4, Desember 2012; p 230-234	Dewanti, A., Widjaja, J. A., Tjandrajani, A., & Burhany, A. A	Karakteristik keterlambatan bicara di klinik khusus tumbuh kembang RS anak dan harapan bunda tahun 2008-2009	Almost 70% of patients with speech delay at the age of 13-36 months has a history and normal health status and the cause of speech disorders is suspected to be due to a lack of speech stimulation factors.
J health Informatics in developing countries vol 4 no 1 tahun 2020 hal 1-13	Al Sagr, A. N., & Al Sagr, N. A.	The effect of electronics on the growth and development of young children:A Narrative Review	Gadgets are getting more interesting and addictive to users. Prolonged use can cause adverse effects, especially in young children.
J Agromed Unila, Volume 2 Nomor 4 November 2015 hal 236-240	Imelda puspita	Pengaruh Paparan Gelombang Elektromagnetik Handphone Periode Kronik Terhadap Kadar SGOT dan SGPT	the impact of exposure to electromagnetic waves to public health in particular on changes in the levels of SGOT and SGPT which associated with liver damage
Biomol Ther 27(3), 265-275 (2019)	Kim, J. H., Lee, J. K., Kim, H. G., Kim, K. B., & Kim, H. R	Possible Effects of Radiofrequency Electromagnetic Field Exposure on Central Nerve System	RF-EMF can induce changes in central nerve cells including the process of apoptosis of neuron cells, changes in the function of nerve myelin and ion canals and RF-EMF can act as a source of stress.
GEMA TEKNOLOGI Vol. 17 No. 4 Periode Oktober 2013 - April 2014	enny	Efek samping penggunaan ponsel	The impact of gadgets (mobile phones) causes vertigo health problems to trigger cancer
Adv Practice Nurs 2015, 1:1pp 1-7	Pem, D.	Factors Affecting Early Childhood Growth and Development: Golden 1000 Days	Cognitive and social impairment in children aged <5 years is found due to poverty, poor parenting and lack of health facilities.

Dialogues in clinical neuroscience, vol 22 no 2,2020; 179-187	Small, G. W., Lee, J., Kaufman, A., Jalil, J., Siddarth, P., Gaddipati, H., Moody, T. D., & Bookheimer, S. Y	Brain health consequences of digital technology use	Research assessing the consequences of using digital technology shows how the effects that damage brain function occurs. Symptoms of ADHD, emotional and social disorders trigger addictive behaviors, increased social isolation, brain development and impaired sleep quality.
Sari Pediatri 2011;12(6):386-90.	Hartanto, F., Selina, H., H, Z., & Fitra, S	Pengaruh Perkembangan Bahasa Terhadap Perkembangan Kognitif Anak Usia 1-3 Tahun	There is an influence of language development on cognitive development in children of age 1-3 years.
Intractable and Rare Diseases Research, *7*(1), 69–71. https://doi.org/10.5582/irdr.2018.01007	Hermawati, D., Rahmadi, F. A., Sumekar, T. A., & Winarni, T. I	Early electronic screen exposure and autistic-like symptoms.	The increase in the prevalence of autism is currently widely associated with the use of gadgets at an early age <2 years due to stimulation of melanopsin-expressing neurons and a decrease in GABA resulting in behavioral disorders, cognitive decline and language development. Exposure to gadgets ≤ 3 hours / day causes language delays, while if ≥ 3 hours / day will experience speech delays, decreased attention and hyperactivity.
Bioelectromagnetic, 33(3):187-206	MH, R., A, L., M, R., Z, S., A, A., J, B., G, D., P, E., P, F., S, H., & I, L	Systematic review of wireless phone use and brain cancer and other head tumors	Epidemiological meta-analysis research ≥10 years showed no significant increase in the risk of brain cancer in adults due to cell phone use. Assessments using Hill's criteria do not support a causal relationship between cell phone use and the incidence of brain cancer in the adult population.
Journal of Sleep Research (2012) 21(1) 50-58	Schmid, M. R., Loughran, S. P., Regel, S. J., Murbach, M., Grunauer, A. B., Rusterholz, T., Bersagliere, A., Kuster, N., & Achermann, P.	Sleep EEG alterations: Effects of different pulse-modulated radio frequency electromagnetic fields	RF EMF affects brain physiology although almost all studies state the influence is strongly influenced by RF EMF exposure time and frequency modulation.
Global Journal of Addiction & Rehabilitation Medicine (2018) 6(1) DOI: 10.19080/gjarm.2018.06.555677	Sharna S	Screen Dependency Disorders (SDD): An Innovative Contest for Brain of Children	Neurological development in children is influenced, one of which is from initial involvement and environmental factors will cause changes in gene expression and affect long-term neurological development.
British Journal of General Practice,	Sigman	Editorials: Virtually addicted: Why general practice must	Found a connection between adiction game on gadgets with

2014,64(629), 610–611.		now confront screen dependency.	impaired neural function and even nervous tissue abnormalities
Zero to Three, 2009, *30*(2), 9–13.	Tierney, A. L., & Nelson, C. A	Brain Development and the Role of Experience in the Early Years	Elaboration of prenatal to postnatal phases of brain development and evaluation of the development of brain function and how the experience mediates the process, especially in speech ability. And research getting the first year of life is the most important time that has an effect on brain development.
Drug Invention Today, 2019,*12*(3), 559–561.	Sarojini, K., Gayathri, R., & Vishnu Priya, V.	Awareness of screen dependency disorder among information technology professionals – A survey.	SDD is closely related to internet addiction and shows some clinical symptoms.
Gaster, 2018, *XVI*(2), 191–205. https://doi.org/10.30787/gaster.v16i2.297	Setianingsih, Amila Wahyuni Ardani, F. N. K.	**Dampak penggunaan gadget pada anak usia prasekolah**	Gadget addiction can affect the development of the child's brain because excessive production of the hormone dopamine interferes with the maturity of the prefrontal functions of the cortex, namely emotional control, self-control, responsibility, decision making and other moral values.
Bioelectromagnetics (2000) 21(1) 52-56	Wang, B., & Lai, H.	Acute exposure to pulsed 2450-MHz microwaves affects water-maze performance of rats	Experimental study on 3 groups of mice presented with 2450-MHz microwaves for 1 hour, group 2 sham-exposes and control groups in cages. The results of group 1 appeared to be slower than groups 2 and 3, There was no significant difference in swimming speed which showed differences in understanding were not influenced by differences in motor function or motivation.

DISCUSSION

The Development of Gadget and The Internet in Indonesia

The history of the internet in Indonesia started around 1990 and has grown very rapidly until now. Nowadays, it may be rare to find Indonesians who do not have a device with specifications ranging from very simple to very sophisticated. Even 1 person may have more than 1 device for various reasons of usefulness. Along with the advancement of gadgets, the use of the internet has also increased to surf in cyberspace and social media.

Figure 1. Digital growth in Indonesia (quoted from (Sumara, 2016)

Currently from the population report, Indonesia's population growth from 2018 to 2019 is around 1%, but the growth of internet use is recorded at 13%, social media is 15% and mobile social media is 8.3% and it seems that this figure will increase further in the following years (kemenkominfo RI, 2013; Puspita, 2015; Rezkisari, 2014).

Brain Development of Infant and Children

Children are born with the readiness to learn all the things found in their lives both positive and negative. Factors affecting the development of the child's brain are divided into endogenous and exogenous factors. Endogenous factors here are more about the involvement of chromosomal disorders or genetically inherited diseases. While exogenous factors are exposure to infections, intoxication, certain nutritional deficit, exposure to electromegnetic fields, radiation, head trauma and last but not least the honing, compassion and foster care of parents or caregivers (Deki PEM., 2015).

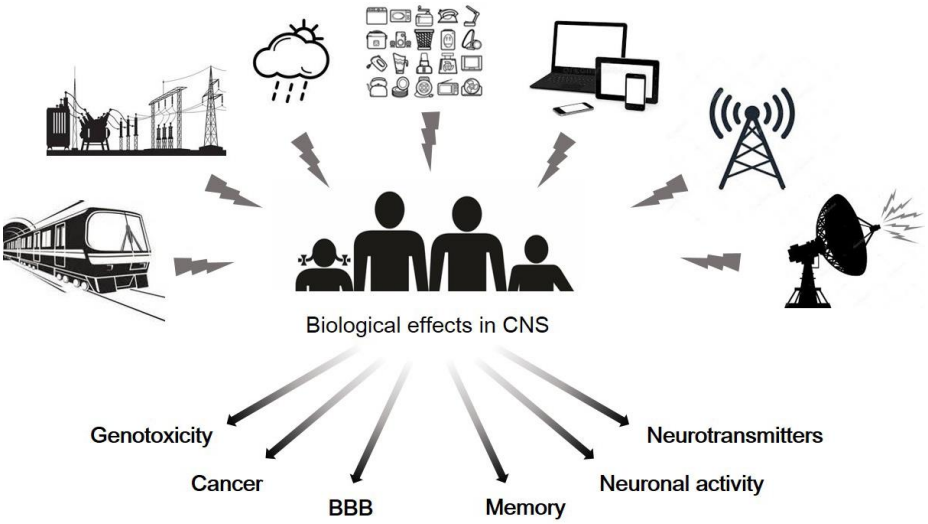


Figure 2. Schematic resume of possible biological effects due to exposure to electromagnetic fields (quoted from (Kim et al., 2019).

An important period in a person's life is the golden period of brain development of a child that occurs from the time the baby is born to the first 1000 days of life. It is at that time that there is a rapid growth of the brain both cellular and all its components, this golden age will continue regardless of the condition and will not recur in the following ages (Dahlia & Sekartini, 2017; Hartanto et al., 2016; Stiles & Jernigan, 2010).

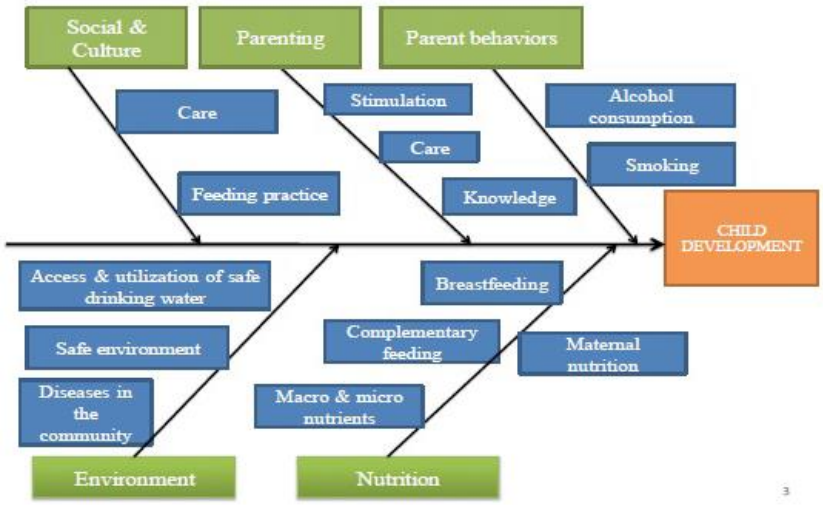


Figure 3. Factors affecting the development of the child (Quoted from (Pem, 2016)

Impact of Gadget

The impact of using gadgets can be viewed from various aspects, social aspects, health and neurological and psychiatric disorders. Social development is very important to prepare the child to be adaptive in all the environments he will face and be able to solve problems that arise as a result of his social interactions. The use of gadgets does have 2 sides of impact. The impact consists of positive and negative, on the one hand with the improvement of internet capabilities And gadgets can help a lot in work, communication and data search effectively but the negative effect is the reduced ability and opportunity in carrying out verbal communication, socialization and cultivating individualistic traits especially if introduced at that age the child is not yet able to think logically and has not been able to self-control from the use of gadgets which further makes addiction increasingly difficult to control (Dewanti et al., 2016)

The impact on health is very diverse, problems in vision, obesity, sleep disorders and neurological disorders. From the research that has been done, it can be established that many neurological impacts occur due to exposure to electromagnetic fields in the CNS. The complaints caused are headaches, changes in sleep patterns, changes in EEG, changes in behavior and changes in blood pressure. Other neurological disorders are tremors, frequent complaints of dizziness, loss of concentration and memory (Sarojini et al., 2019; Schmid et al., 2012; Syifa et al., 2019).

From research, it is known that electromagnetic waves of high wavelength and low-frequency devices with a frequency band of 800 - 3000 MHz. until now in Indonesia there are 2 networks, namely the Global System for Mobile Communication (GSM) and the Code Division Multiple Access (CDMA) system (Swamardika, 2013). Electromagnetic radiation is generated from exposure to radio waves that fluctuate through the air. This exposure has been widely studied for its impact on health. In brain development the biggest influence is due to electential hypersensitivity due to exposure to electromagnetic fields that are widely known as triassic Anies which consists of headaches, dizziness and chronic fatigue and research also causes an increase in blood pressure of 5-10% if used for more than 35 minutes (Enny, 2015; V. et al., 2020).

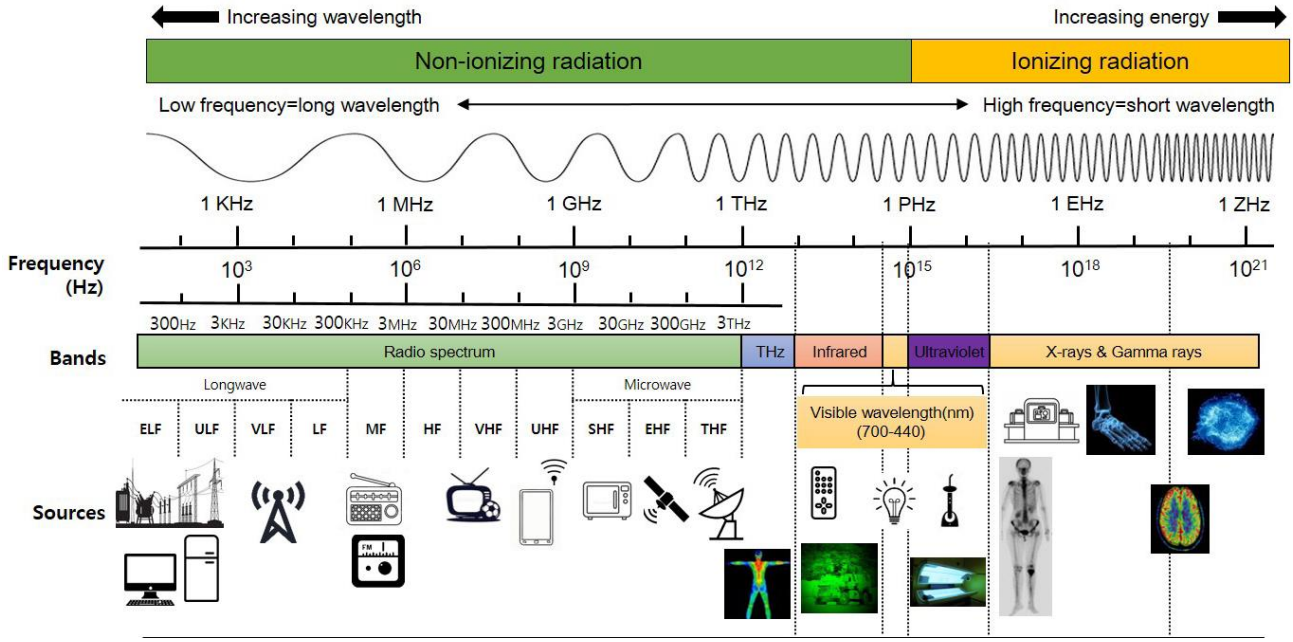


Figure 4. Schematic illustration of the spectrum of electromagnetic fields in an environment (quoted from (Wang & Lai, 2000).

Exposure to light electromagnetic fields within a reasonable time in a relatively harmless environment to human health (Hermawati et al., 2018; MH et al., 2012). But with increased exposure in intensity and time this meaningfully affects behavior, learning processes and memory (Al Sagr & Al Sagr, 2020). This has been proven by experimental animal studies with exposure to 2,450 MHz will reduce learning and memory ability (Wang & Lai, 2000). This study is indeed in

experimental animals which may not be entirely certain to occur in humans but nowadays many clinical manifestations are beginning to be found in society.

The mechanism of occurrence of abnormalities in the CNS is still not fully explained. Studies that have been carried out on animals have tried to find several points of capture of abnormalities, including the impact of electromagnetic waves on the blood brain barrier, myelin sheaths, changes in ion canals and autophagic activity in neurons which will certainly greatly affect infants and children who are still in the process of CNS development (Kim et al., 2019; Small et al., 2020).

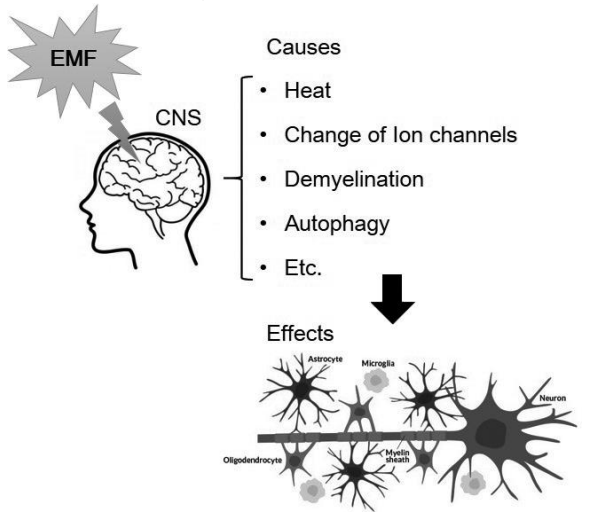


Figure 5. Scheme of possible mechanisms of exposure to electromagnetic-radiofrequency fields on the Central Nervous System (quoted from (Kim et al., 2019).

CONCLUSION

Until now, the use of gadgets is inevitable in everyday life. In wise use, it certainly does not cause long-term health problems, especially in children who are still in the rapid period of brain growth. Clinical symptoms should be recognized immediately and the use of gadgets should be in accordance with screen times whose needs vary according to the age of the child.

REFFERENCES

Al Sagr, A. N., & Al Sagr, N. A. (2020). The effect of electronics on the growth and development of young children: A Narrative Review. *Journal of Health Informatics in Developing Countries*, *14*(1), 1–13.

Dahlia, J. K., & Sekartini, R. (2017). *Pentingnya pemantauan tumbuh kembang 1000 hari pertama kehidupan anak*. IDAI. https://www.idai.or.id/artikel/klinik/pengasuhan-anak/pentingnya-pemantauan-tumbuh-kembang-1000-hari-pertama-kehidupan-anak

Dewanti, A., Widjaja, J. A., Tjandrajani, A., & Burhany, A. A. (2016). Karakteristik Keterlambatan Bicara di Klinik Khusus Tumbuh Kembang Rumah Sakit Anak dan Bunda Harapan Kita Tahun 2008 - 2009. *Sari Pediatri*, *14*(4), 230. https://doi.org/10.14238/sp14.4.2012.230-4

Enny, E. (2015). Efek Samping Penggunaan Ponsel. *Gema Teknologi*, *17*(4), 178–183. https://doi.org/10.14710/gt.v17i4.8938

Hartanto, F., Selina, H., H, Z., & Fitra, S. (2016). Pengaruh Perkembangan Bahasa Terhadap Perkembangan Kognitif Anak Usia 1-3 Tahun. *Sari Pediatri*, *12*(6), 386. https://doi.org/10.14238/sp12.6.2011.386-90

Hermawati, D., Rahmadi, F. A., Sumekar, T. A., & Winarni, T. I. (2018). Early electronic screen exposure and autistic-like symptoms. *Intractable and Rare Diseases Research*, *7*(1), 69–71. https://doi.org/10.5582/irdr.2018.01007

kemenkominfo RI. (2013). *penggunaan internet di indonesia*. https://kominfo.go.id/index.php/content/detail/3415/kominfo+%3A+Pengguna+internet+diindonesia+63+juta+orang/0/berita_satker

Kim, J. H., Lee, J. K., Kim, H. G., Kim, K. B., & Kim, H. R. (2019). Possible effects of radiofrequency electromagnetic field exposure on central nerve system. *Biomolecules and Therapeutics*, *27*(3), 265–275. https://doi.org/10.4062/biomolther.2018.152

MH, R., A, L., M, R., Z, S., A, A., J, B., G, D., P, E., P, F., S, H., & I, L. (2012). Systematic review of wireless phone use and brain cancer and other head tumors. *Bioelectromagnetics*, *33*(3), 187–206. https://doi.org/10.1002/bem.20716

Pem, D. (2016). Factors Affecting Early Childhood Growth and Development: Golden 1000 Days. *Advanced Practices in Nursing*, *01*(01), 1–4. https://doi.org/10.4172/2573-

0347.1000101

Puspita, I. (2015). Terhadap Kadar SGOT dan SGPT Imelda Puspita Effect of Electromagnetic Wave Mobile Exposure Chronic on SGOT and SGPT lev els. *Jurnal Agramed Unila*, *2*(4), 536–540.

Rezkisari, I. (2014). *Pengguna smartphone Indonesia peringkat kelima dunia*. https://www.republika.co.id/berita/neehfh/pengguna-smartphone-indonesia-peringkat-kelima-dunia

Sarojini, K., Gayathri, R., & Vishnu Priya, V. (2019). Awareness of screen dependency disorder among information technology professionals – A survey. *Drug Invention Today*, *12*(3), 559–561.

Schmid, M. R., Loughran, S. P., Regel, S. J., Murbach, M., Grunauer, A. B., Rusterholz, T., Bersagliere, A., Kuster, N., & Achermann, P. (2012). Sleep EEG alterations: effects of different pulse-modulated radio frequency electromagnetic fields. *J Sleep Res*, *21*(1), 50–58. https://doi.org/10.1111/j.1365-2869.2011.00918.x

Setianingsih, Amila Wahyuni Ardani, F. N. K. (2018). DAMPAK PENGGUNAAN GADGET PADA ANAK USIA PRASEKOLAH. *Gaster*, *XVI*(2), 191–205. https://doi.org/10.30787/gaster.v16i2.297

Sharma, S. K. (2018). Screen Dependency Disorders (SDD): An Innovative Contest for Brain of Children. *Global Journal of Addiction & Rehabilitation Medicine*, *6*(1), 5–6. https://doi.org/10.19080/gjarm.2018.06.555677

Sigman, A. (2014). Editorials: Virtually addicted: Why general practice must now confront screen dependency. *British Journal of General Practice*, *64*(629), 610–611. https://doi.org/10.3399/bjgp14X682597

Small, G. W., Lee, J., Kaufman, A., Jalil, J., Siddarth, P., Gaddipati, H., Moody, T. D., & Bookheimer, S. Y. (2020). Brain health consequences of digital technology use. *Dialogues in Clinical Neuroscience*, *22*(2), 179–187. https://doi.org/10.31887/DCNS.2020.22.2/gsmall

Stiles, J., & Jernigan, T. L. (2010). The basics of brain development. *Neuropsychology Review*, *20*(4), 327–348. https://doi.org/10.1007/s11065-010-9148-4

Sumara, A. R. (2016). *Pertumbuhan digital di Indonesia*. Https://Bpptik.Kominfo.Go.Id/. https://bpptik.kominfo.go.id/2016/09/13/2203/pertumbuhan-digital-indonesia

Swamardika, I. A. (2013). Pengaruh radiasi gelombang elektromagnetik terhadap kesehatan manusia. In *Majalah Ilmiah Teknologi Elektro* (Vol. 12, Issue 1).

Syifa, L., Setianingsih, E. S., & Sulianto, J. (2019). Dampak Penggunaan Gadget terhadap Perkembangan Psikologi pada Anak Sekolah Dasar. *Jurnal Ilmiah Sekolah Dasar*, *3*(4), 538. https://doi.org/10.23887/jisd.v3i4.22310

Tierney, A. L., & Nelson, C. A. (2009). Brain Development and the Role of Experience in the Early Years. *Zero to Three*, *30*(2), 9–13. http://www.ncbi.nlm.nih.gov/pubmed/23894221%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3722610

V., R., B. S., S., & Karinagannanavar, A. (2020). Exposure to electronic gadgets and its impact on developmental milestones among preschool children. *International Journal Of Community Medicine And Public Health*, *7*(5), 1884. https://doi.org/10.18203/2394-6040.ijcmph20202000

Wang, B., & Lai, H. (2000). Acute exposure to pulsed 2450-MHz microwaves affects water-maze performance of rats. *Bioelectromagnetics*, *21*(1), 52–56.