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

Erny¹*, Okky Prasetyo², Ayly Soekanto³

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


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>
<thead>
<tr>
<th>Jurnal/artikel</th>
<th>Author, Co-author</th>
<th>Title</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Republika, 2014</td>
<td>Rezkisari</td>
<td>Pengguna smartphone Indonesia peringkat ke 5 dunia</td>
<td>There is a rapid increase in smartphone use in Indonesia</td>
</tr>
<tr>
<td><a href="https://bpptik.kominfo.go.id/">https://bpptik.kominfo.go.id/</a></td>
<td>Sumara 2016</td>
<td>Pertumbuhan digital di Indonesia</td>
<td>Growth of active internet users in Indonesia grew by 21% since March 2015</td>
</tr>
<tr>
<td><a href="https://kominfo.go.id/index.php/content/detail/3415/kominfo+%3A+Pengguna+internet+diIndonesia+63+juta+orang">https://kominfo.go.id/index.php/content/detail/3415/kominfo+%3A+Pengguna+internet+diIndonesia+63+juta+orang</a></td>
<td>Kemenkominfo RI</td>
<td>Pengguna internet di Indonesia 63 juta orang</td>
<td>Indonesia is ranked 4th in the world in the use of social networks, but many of them are ineffective</td>
</tr>
<tr>
<td>IDAI, 2017</td>
<td>Dahlia, J. K., &amp; Sekartini, R.</td>
<td>Pentingnya pemantauan tumbuh kembang 1000 hari pertama kehidupan anak</td>
<td>At the age of &lt;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</td>
</tr>
<tr>
<td>Title</td>
<td>Authors</td>
<td>Summary</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Majalah tehnologi elektro vol 8 no 1 2009 hal 106-109</td>
<td>IB Alit Swamardika</td>
<td>The degree of exposure of electromagnetic waves with varies frequency significantly adversely affects human physical and mental health.</td>
<td></td>
</tr>
<tr>
<td>J health Informatics in developing countries vol 4 no 1 tahun 2020 hal 1-13</td>
<td>Al Sagr, A. N., &amp; Al Sagr, N. A.</td>
<td>The effect of electronics on the growth and development of young children:A Narrative Review.</td>
<td></td>
</tr>
<tr>
<td>GEMA TEKNOLOGI Vol. 17 No. 4 Periode Oktober 2013 - April 2014</td>
<td>enny</td>
<td>Efek samping penggunaan ponsel.</td>
<td></td>
</tr>
</tbody>
</table>

**References:**
- Majalah tehnologi elektro vol 8 no 1 2009 hal 106-109
- Sari Pediatri, Vol. 14, No. 4, Desember 2012; p 230-234
- J health Informatics in developing countries vol 4 no 1 tahun 2020 hal 1-13
- J Agromed Unila, Volume 2 Nomor 4 November 2015 hal 236-240
- Biomol Ther 27(3), 265-275 (2019)
- GEMA TEKNOLOGI Vol. 17 No. 4 Periode Oktober 2013 - April 2014
- Adv Practice Nurs 2015, 1:1pp 1-7
<table>
<thead>
<tr>
<th>Journal/Magazine</th>
<th>Title</th>
<th>Authors</th>
<th>Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intractable and Rare Diseases Research, 7(1), 69–71. <a href="https://doi.org/10.5582/irdr.2018.01007">https://doi.org/10.5582/irdr.2018.01007</a></td>
<td>Early electronic screen exposure and autistic-like symptoms.</td>
<td>Hermawati, D., Rahmadi, F. A., Sumekar, T. A., &amp; Winarni, T. I</td>
<td>The increase in the prevalence of autism is currently widely associated with the use of gadgets at an early age &lt;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.</td>
</tr>
<tr>
<td>Global Journal of Addiction &amp; Rehabilitation Medicine (2018) 6(1) DOI: 10.19080/gjarm.2018.06.555677</td>
<td>Screen Dependency Disorders (SDD): An Innovative Contest for Brain of Children</td>
<td>Sharna S</td>
<td>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.</td>
</tr>
<tr>
<td>British Journal of General Practice,</td>
<td>Editorials: Virtually addicted: Why general practice must</td>
<td>Sigman</td>
<td>Found a connection between addiction game on gadgets with</td>
</tr>
</tbody>
</table>


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 electromagnetic fields, radiation, head trauma and last but not least the honing, compassion and foster care of parents or caregivers (Deki PEM., 2015).

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

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 electrotal 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).

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.

REFERENCES


