



Gregor Dürrenberger, Jürg Fröhlich, Hans Kastenholz

Mobilfunk – ein Risiko?

Supplement 1
Verwendete Literatur



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Das vorliegende Dokument stellt die in der Broschüre «Mobilfunk – ein Risiko?» verwendete Literatur nach gesundheitlichen Endpunkten dar. Aus Gründen der Übersichtlichkeit wurde die Literatur im Haupttext nicht explizit gelistet.

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Mobilfunk – ein Risiko?

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8092 Zürich

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Zur Darstellungsart der Literatur

Alle wissenschaftlichen Publikationen, die in die Tabellen im Haupttext eingeflossen sind, werden in diesem Supplement aufgelistet. Zu allen im Text behandelten gesundheitlichen Effekten (Endpunkte) werden die ausgewählten Artikel in einer Übersichtstabelle und unterhalb der Tabelle in einer bibliographischen Liste festgehalten. Leserinnen und Leser sehen auf einen Blick ob, wieviel und welche Literatur es zu einem Endpunkt im Bereich Zellforschung (in-vitro Studien), Tierforschung (in-vivo Arbeiten), sowie Humanstudien gibt. Letztere werden unterschieden in Studien zu physiologischen, zu akuten und zu chronischen Gesundheitseffekten.

Die Literatur ist gemäss den im Methodenteil beschriebenen Evidenzkategorien geordnet, das heisst: Studien, welche (aus Sicht der Autoren) klare Hinweise auf einen Effekt geben, sind unter der Kategorie ‚Effekt ausreichend‘ zu finden, Literatur, die zwar Hinweise gefunden hat, diese aber als unsicher einstuft, ist unter der Kategorie ‚Effekt inadäquat‘ zu finden. Sinngemässes gilt für die weiteren Kategorien. Die genauen Definitionen finden sich im Methodenteil des Haupttexts.

Methodisch nicht überzeugende Studien sind *kursiv* gesetzt (Details ebenfalls im Methodenteil).

Einzelstudien aus Synthese- oder Forschungsprogrammbereichen sind mit dem Kürzel der Institution bezeichnet (z.B. BfS, ANSES etc.). Diese Berichte verweisen meist auf mehrere Studien, die innerhalb der jeweiligen Programme durchgeführt wurden. Deshalb können diese Berichte in verschiedenen Tabellen und auch innerhalb einer Tabelle mehrmals vorkommen. Es ist aus diesem Grunde auch möglich, dass in einer bestimmten Zelle in einer Tabelle im Haupttext mehr Studien angegeben sind als in der entsprechenden Literaturliste in diesem Supplement zu finden sind. Beispiel: In einer Tabelle im Haupttext werden 5 Studien angegeben. Sucht man diese in der detaillierten Tabelle, findet man möglicherweise nur drei Publikationen, darunter könnte auch BfS (2008) sein. Das hiesse dann, dass im Bericht BfS (2008) Evidenzen aus drei verschiedenen Studien berücksichtigt worden sind.

Reviewberichte und Metaanalysen, welche publizierte Ergebnisse zum Gegenstand haben und nicht als Primärforschung angesehen werden können, sind unterstrichen. Diese Arbeiten können ebenfalls in mehreren Tabellen und auch innerhalb einer Tabelle mehrmals vorkommen.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
					Hardell und Carlberg (2015), Hardell et al. (2013)
					Coureau et al. (2014), Moon et al. (2014), Barchana et al. (2012) Yang et al. (2017), ANSES (2013), Sienkiewicz et al. (2012)
					Aydin et al. (2011), Frei et al. (2011), Sato et al (2011), BFS (2008), Takebayashi et al. (2008) ANSES (2016a)
					Carlberg und Hardell (2015), Benson et al. (2014), Petterson et al. (2014), Hsu et al (2013), Little et al. (2012), Boice et al. (2011), Cardis et al. (2011), Ding et al. (2011), Cardis et al. (2010), Inskip et al (2010), BFS (2008) Röösli et al. (2019), SSM (2019), ICNIRP (2018), SCENIHR (2015) Schoemaker und Sverdlöv (2009)

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- ANSES (2016a). Exposition aux radiofréquences et santé des enfants. Avis de l'Anses. Rapport d'expertise collective. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- Aydin, D., M. Feychting, J. Schüz, T. Tynes, T.V. Andersen, L. Samsø Schmidt, A.H. Poulsen, C. Johansen, M. Prochazka, B. Lannering, L. Klæboe, T. Eggen, D. Jenni, M. Grotzer, N. von der Weid, C.E. Kuehni, Röösli, M. (2011). Mobile phone use and risk of brain tumours in children and adolescents: a multicenter case-control study (CEFALO). *Journal of the National Cancer Institute*, 103: 1264-1276.
- Barchana, M., M. Margaliot, Liphshitz, I. (2012). Changes in brain glioma incidence and laterality correlates with use of mobile phones--a nationwide population based study in Israel. *Asian Pac J Cancer Prev* 13(11): 5857-5863.
- Benson, V.S., K. Pirie, J. Schüz, G.K. Reeves, V. Beral, Green, J. (2014). Authors' response to: the case of acoustic neuroma: comment on mobile phone use and risk of brain neoplasms and other cancers. *Int. J. Epidemiol.* 43: 275.
- BFS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.
- Boice, J. D. Jr., Tarone, R.E. (2011). Cell phones, cancer, and children. *J Natl Cancer Inst* 103(16): 1211-1213.
- Cardis E. et al. (2011). Acoustic neuroma risk in relation to mobile telephone use: results of the INTERPHONE international case-control study. *Cancer Epidemiol.* 35: 453-64.
- Cardis E. et al. (2010). Brain tumour risk in relation to mobile telephone use: results of the INTERPHONE international case-control study. *Int. J. Epidemiol.* 39: 675-94.
- Carlberg, M., Hardell, L. (2015). Pooled analysis of Swedish case-control studies during 1997–2003 and 2007–2009 on meningioma risk associated with the use of mobile and cordless phones. *Oncol. Rep.* 33: 3093-98.
- Coureau, G, G. Bouvier, P. Lebaillly, P. Fabbro-Peray, Gruber, A., et al. (2014). Mobile phone use and brain tumours in the CERENAT case-control study. *Occup. Environ. Med.* 71: 514-22.
- Ding, L. X., Wang, X.Y. (2011). Increasing incidence of brain and nervous tumours in urban Shanghai, China, 1983-2007. *Asian Pac J Cancer Prev* 12(12): 3319-3322.
- Frei, P., A.H. Poulsen, C. Johansen, J.H. Olsen, M. Steding-Jessen, Schüz, J. (2011). Use of mobile phones and risk of brain tumours: update of Danish cohort study. *BMJ* 343: d6387.
- Hardell, L., Carlberg, M. (2015). Mobile phone and cordless phone use and the risk for glioma—analysis of pooled case-control studies in Sweden, 1997–2003 and 2007–2009. *Pathophysiology* 22: 1-13.
- Hardell, L., M. Carlberg, F. Söderqvist, Mild, K.H. (2013). Pooled analysis of case-control studies on acoustic neuroma diagnosed 1997–2003 and 2007–2009 and use of mobile and cordless phones. *Int. J. Oncol.* 43: 1036-44.
- Hsu, M.H., S. Syed-Abdul, J. Scholl, W.S. Jian, P. Lee, U. Iqbal, Li, Y.C. (2013). The incidence rate and mortality of malignant brain tumors after 10 years of intensive cell phone use in Taiwan. *Eur J Cancer Prev* 22(6): 596-598.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Inskip, P.D., R.N. Hoover, Devesa, S.S. (2010). Brain cancer incidence trends in relation to cellular telephone use in the United States. *Neuro Oncol* 12(11): 1147-1151.
- Little, M.P., P. Rajaraman, R.E. Curtis, S.S. Devesa, P.D. Inskip, D.P. Check, Linet, M.S. (2012). Mobile phone use and glioma risk: comparison of epidemiological study results with incidence trends in the United States. *Bmj* 344: e1147.
- Moon, I.S., B.G. Kim, J. Kim, J.D. Lee, Lee, W.S. (2014). Association between vestibular schwannomas and mobile phone use. *Tumour Biol* 35(1): 581-587.
- Petterson, D., T. Mathiesen, M. Prochazka, T. Bergenheim, Florentzson, R., et al. (2014). Long-term mobile phone use and acoustic neuroma risk. *Epidemiology* 25: 233-41.

- Rööslj, M., S. Lagorio, M. Schoemaker, J. Schüz, Feychting, M. (2019). Brain and Salivary Gland Tumors and Mobile Phone Use: Evaluating the Evidence from Various Epidemiological Study Designs. *Annual Review of Public Health*, 40: 25.1–25.18.
- Sato, Y., S. Akiba, O. Kubo, Yamaguchi, N. (2011). A case-case study of mobile phone use and acoustic neuroma risk in Japan. *Bioelectromagnetics* 32(2): 85-93.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- Schoemaker, M.J., Swerdlow, A.J. (2009). Risk of pituitary tumors in cellular phone users: a case-control study. *Epidemiology* 20(3): 348-354.
- Sienkiewicz, Z., J. Schüz, A.H. Poulsen, Cardis, E. (2012). Risk analysis of human exposure to electromagnetic fields. (revised). EFHRAN, European Commission. Brussels.
- SSM (2019). Recent Research on EMF and Health Risk – Thirteenth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- Takebayashi, T., N. Varsier, Y. Kikuchi, K. Wake, M. Taki, S. Watanabe, S. Akiba, Yamaguchi, N. (2008). Mobile phone use, exposure to radiofrequency electromagnetic field, and brain tumour: a case-control study. *Br J Cancer* 98(3): 652-659.
- Yang, M. et al. (2017). Mobile phone use and glioma risk: A systematic review and meta-analysis. *PlosOne*. · <https://doi.org/10.1371/journal.pone.0175136>.

Krebs

Andere Tumore, Koexposition, Krebs allgemein

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
	<i>Ozgur et al. (2014), Zhu et al. (2014)</i>	Lerchl (2018), Tillmann et al. (2010)			Li et al. (2012), Dode et al. (2011)
		Falcioni et al. (2018), Wyde et al. (2018a) SSM (2019)		<i>Elliott et al. (2010)</i>	
	Seawind (2013), ICNIRP (2018), SCENIHR (2015), ANSES (2013)	Wyde et al. (2018b), Seawind (2013), Paulraj und Behari (2011), ICNIRP (2018), ANSES (2013)			Petterson et al. (2014), Sun et al. (2013) ANSES (2013), Sienkiewicz et al.(2012), SSK (2011)
	Moquet et al. (2008)	Klose und Lerchl (2013), Lee et al. (2011), BfS (2008) SSM (2017), SCENIHR (2015).			ICNIRP (2018), SSM (2017), SCENIHR (2015), Kheifets et al. (2008) Atzmon et al. (2012)

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.
- Atzmon, I., S. Linn, E. Richter, Portnov, B.A. (2012). Cancer risks in the Druze Isifya Village: Reasons and RF/MW antennas. Pathophysiology 19(1): 21-28.
- Dode, A.C., M.M. Leao, A. Tejo Fde, A.C. Gomes, D.C. Dode, M.C. Dode, C.W. Moreira, V.A. Condessa, C. Albinatti, W.T. Caiaffa, W. (2011). Mortality by neoplasia and cellular telephone base stations in the Belo Horizonte municipality, Minas Gerais state, Brazil. Sci Total Environ 409(19): 3649-3665.
- Elliott, P., M.B. Toledano, J. Bennett, L. Beale, K. de Hoogh, N. Best, Briggs, D.J. (2010). Mobile phone base stations and early childhood cancers: case-control study. Bmj 340: c3077.
- Falcioni, L., I. Bua, E. Tibaldi, M. Lauriola, L. De Angelis, F. Gnudi, D. Mandrioli, M. Manservigi, F. Manservigi, I. Manzoli, I. Menghetti, R. Montella, S. Panzacchi, D. Sgargi, V. Strollo, A. Vornoli, Belpoggi, F. (2018). Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission. Environmental Research, doi.org/10.1016/j.envres.2018.01.037.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Kheifets, L., J. Monroe, X. Vergara, G. Mezei, Afifi, A.A. (2008). Occupational electromagnetic fields and leukemia and brain cancer: an update to two meta-analyses. J Occup Environ Med 50(6): 677-688.
- Klose, M., Lerchl, A. (2013). Altersabhängige Wirkungen hochfrequenter elektromagnetischer Felder des Mobilfunks auf Entwicklungs- und Differenzierungsprozesse des Zentralnervensystems in juvenilen Labornagern - Vorhaben FM 8848. BfS, Salzgitter.
- Lee, H.J., Y.B. Jin, J.S. Lee, S.Y. Choi, T.H. Kim, J.K. Pack, H.D. Choi, N. Kim, Lee, Y.S. (2011). Lymphoma development of simultaneously combined exposure to two radiofrequency signals in AKR/J mice. Bioelectromagnetics 32(6): 485-492.
- Lerchl, A. (2018). Synergistische Wirkungen hochfrequenter elektromagnetischer Felder in Kombination mit kanzerogenen Substanzen – Kokanzerogenität oder Tumorpromotion? Vorhaben 3615S82431
- Li, C. Y., C.C. Liu, Y.H. Chang, L.P. Chou, Ko, M.C. (2012). A population-based case-control study of radiofrequency exposure in relation to childhood neoplasm. Sci Total Environ 435-436: 472-478.
- Moquet, J., E. Ainsbury, S. Bouffler, Lloyd, D. (2008). Exposure to low level GSM 935 MHz radiofrequency fields does not induce apoptosis in proliferating or differentiated murine neuroblastoma cells. Radiat Prot Dosimetry 131(3): 287-296.
- Ozgur, E., G. Guler, G. Kismali, Seyhan, N. (2014). Mobile phone radiation alters proliferation of hepatocarcinoma cells. Cell Biochem Biophys 70(2): 983-991.
- Paulraj, R., Behari, J. (2011). Effects of low level microwave radiation on carcinogenesis in Swiss Albino mice. Molecular and cellular biochemistry 348(1-2): 191-197
- Petterson, D., T. Mathiesen, M. Prochazka, T. Bergenheim, R. Florentzson, H. Harder, G. Nyberg, P. Siesjo, Feychting, M. (2014). Long-term mobile phone use and acoustic neuroma risk. Epidemiology 25(2): 233-241.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- Seawind (2013). Sound Exposure & Risk Assessment of Wireless Network Devices (SEAWIND). FP7-ENV-2009-1 Final Summary Report. Research Report: 1-44.
- Sienkiewicz, Z., J. Schüz, A.H. Poulsen, Cardis, E. (2012). Risk analysis of human exposure to electromagnetic fields. (revised). EFHRAN, European Commission. Brussels.
- SSK (2011). Biologische Auswirkungen des Mobilfunks, Gesamtschau. Bonn, Strahlenschutzkommission.
- SSM (2019). Recent Research on EMF and Health Risk – Thirteenth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- SSM (2017). Recent Research on EMF and Health Risk – Eleventh report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.

- Sun, J.W., X.R. Li, H.Y. Gao, J.Y. Yin, Q. Qin, S.F. Nie, Wei, S. (2013). Electromagnetic field exposure and male breast cancer risk: a meta-analysis of 18 studies. *Asian Pac J Cancer Prev* 14(1): 523-528.
- Tillmann T, H. Ernst, J. Streckert, Y. Zhou, F. Taugner, V. Hansen, Dasenbrock, C. (2010). Indication of cocarcinogenic potential of chronic UMTS-modulated radiofrequency exposure in an ethylnitrosourea mouse model. *Int J Radiat Biol* 86(7): 529-541.
- Wyde, M.E. et al. (2018a). Report on the Toxicology and Carcinogenesis Studies in Hsd:Sprague Dawley SD Rats Exposed to Whole-Body Radio Frequency Radiation at a Frequency (900MHz) and Modulations (GSM and CDMA) Used by Cell Phones. NTP TR 595. NIH.
- Wyde, M.E. et al. (2018b). Report on the Toxicology and Carcinogenesis Studies in B6C3F1/N Mice Exposed to Whole-Body Radio Frequency Radiation at a Frequency (900MHz) and Modulations (GSM and CDMA) Used by Cell Phones. NTP TR 596. NIH.
- Zhu, W., W. Zhang, H. Wang, J. Xu, Y. Li, Lv, S. (2014). Apoptosis induced by microwave radiation in pancreatic cancer JF305 cells. *Can J Physiol Pharmacol* 92(4): 324-329.

Neurodegeneration, neuronale Erkrankungen

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
		Kim et al. (2017) Motawi et al. (2014), Saikhedkar et al. (2014), Aboul et al. (2013), Aldad et al. (2012), Celikozlu et al. (2012), Jing et al. (2012), Karaca et al. (2012), Chaturvedi et al. (2011)	Lv et al. (2014)		
	Chen et al. (2014), Hirose et al. (2010) Yang et al. (2012)	Lameth et al. (2017), Barthelemy et al. (2016), Jeong et al. (2015), Masuda et al. (2015), Narayanan et al. (2015), Maskey et al. (2014), Bouji et al. (2012), Noor et al. (2011), Maskey et al. (2010), Haghani et al. (2013)			
	Dasdag et al. (2015a), Dasdag et al. (2015b), Lu et al. (2014), Moretti et al. (2013), Liu et al. (2012), Maskey et al. (2012) SCENIHR (2015), ANSES (2013) He et al. (2014)	ANSES (2017a, 2017b), ANSES (2016b), Sahin et al. (2015), Fragopoulou et al. (2012), Jorge-Mora et al. (2011), ICNIRP (2018), SCENIHR (2015), ANSES (2013) Kokturk et al. (2013), Umur et al. (2013), Liu et al. (2011), Imge et al. (2010)			Luna et al. (2019), Harbo Poulsen et al. (2012) ICNIRP (2018), SCENIHR (2015), ANSES (2013), Sienkiewicz et al. (2012) Milham und Stetzer (2013)
		Bouji et al. (2016), Petitdant et al. (2016), Jani et al. (2014), Ait-Aissa et al. (2013), Ait-Aissa et al. (2010), Finnie et al. (2009), Masuda et al. (2009) Arendash et al. (2010), Ragbetli et al. (2009)			

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- Aboul Ezz, H.S., Y.A. Khadrawy, N.A. Ahmed, N.M. Radwan, El Bakry, M.M. (2013). The effect of pulsed electromagnetic radiation from mobile phone on the levels of monoamine neurotransmitters in four different areas of rat brain. *Eur Rev Med Pharmacol Sci* 17(13): 1782-1788.
- Ait-Aissa, S., F.P. de Gannes, M. Taxile, B. Billaudel, A. Hurtier, E. Haro, G. Ruffie, A. Athane, B. Veyret, Lagroye, I. (2013). In situ expression of heat-shock proteins and 3-nitrotyrosine in brains of young rats exposed to a WiFi signal in utero and in early life. *Radiat Res* 179(6): 707-716
- Ait-Aïssa, S., B. Billaudel, F.P. De Gannes, A. Hurtier, E. Haro, M. Taxile, G. Ruffie, A. Athane, B. Veyret, Lagroye, I. (2010). In situ detection of gliosis and apoptosis in the brains of young rats exposed in utero to a Wi-Fi signal. *Comptes Rendus Physique* 11(9): 592-601.
- Aldad, T.S., G. Gan, X. B. Gao, Taylor, H.S. (2012). Fetal radiofrequency radiation exposure from 800-1900 mhz-rated cellular telephones affects neurodevelopment and behavior in mice. *Sci Rep* 2: 312.
- ANSES (2017a). Radiofréquences et santé - Comprendre où en est la recherche. Maisons-Alfort, Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail.
- ANSES (2017b). Radiofréquences & santé. Maisons-Alfort, Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail.
- ANSES (2016b). Regards sur dix ans de recherche - Le PNR EST, de 2006 à 2015. Maisons-Alfort, Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail.
- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- Arendash, G.W., J. Sanchez-Ramos, T. Mori, M. Mamcarz, X. Lin, M. Runfeldt, L. Wang, G. Zhang, V. Sava, J. Tan, Cao, C. (2010). Electromagnetic field treatment protects against and reverses cognitive impairment in Alzheimer's disease mice. *J Alzheimers Dis* 19(1): 191-210.
- Barthelemy, A., A. Mouchard, M. Bouji, K. Blazy, R. Puigsegur, Villegier, A.S. (2016). Glial markers and emotional memory in rats following acute cerebral radiofrequency exposures. *Environ Sci Pollut Res Int* 23(24): 25343-25355.
- Bouji, M., A. Lecomte, C. Gamez, K. Blazy, Villegier, A.S. (2016). Neurobiological effects of repeated radiofrequency exposures in male senescent rats. *Biogerontology* 17(5-6): 841-857.
- Bouji, M., A. Lecomte, Y. Hode, R. de Seze, Villégier, A.S. (2012). Effects of 900MHz radiofrequency on corticosterone, emotional memory and neuroinflammation in middle-aged rats. *Experimental Gerontology* 47(6): 444-451.
- Celikozlu, S.D., M. S. Ozyurt, A. Cimbiz, M.Y. Yardimoglu, M.K. Cayci, Ozay, Y. (2012). The effects of long-term exposure of magnetic field via 900-MHz GSM radiation on some biochemical parameters and brain histology in rats. *Electromagn Biol Med* 31(4): 344-355.

- Chaturvedi, C.M., V.P. Singh, P. Singh, P. Basu, M. Singaravel, R.K. Shukla, A. Dhawan, A.K. Pati, R.K. Gangwar, Singh, P. (2011). 2.45 GHz (CW) microwave irradiation alters circadian organization, spatial memory, DNA structure in the brain cells and blood cell counts of male mice, *Mus musculus*. *Progr Electromagn Res B* 29: 23-42.
- Chen, C., Q. Ma, C. Liu, P. Deng, G. Zhu, L. Zhang, M. He, Y. Lu, W. Duan, L. Pei, M. Li, Z. Yu, Zhou, Z. (2014). Exposure to 1800 MHz radiofrequency radiation impairs neurite outgrowth of embryonic neural stem cells. *Sci Rep* 4: 5103.
- Dasdag, S., M.Z. Akdag, M.E. Erdal, N. Erdal, O.I. Ay, M.E. Ay, S.G. Yilmaz, B. Tasdelen, Yegin, K. (2015a). Effects of 2.4 GHz radiofrequency radiation emitted from Wi-Fi equipment on microRNA expression in brain tissue. *Int J Radiat Biol* 91(7): 555-561.
- Dasdag, S., M.Z. Akdag, M.E. Erdal, N. Erdal, O. I. Ay, M.E. Ay, S.G. Yilmaz, B. Tasdelen, Yegin, K. (2015b). Long term and excessive use of 900 MHz radiofrequency radiation alter microRNA expression in brain. *Int J Radiat Biol* 91(4): 306-311.
- Finnie, J.W., Z. Cai, J. Manavis, S. Helps, Blumbergs, P.C. (2010). Microglial activation as a measure of stress in mouse brains exposed acutely (60 minutes) and long-term (2 years) to mobile telephone radiofrequency fields. *Pathology* 42(2): 151-154.
- Fragopoulou, A.F., A. Samara, M.H. Antonelou, A. Xanthopoulou, A. Papadopoulou, K. Vougas, E. Koutsogiannopoulou, E. Anastasiadou, D.J. Stravopodis, G.T. Tsangaris, Margaritis, L.H. (2012). Brain proteome response following whole body exposure of mice to mobile phone or wireless DECT base radiation. *Electromagn Biol Med* 31(4): 250-274.
- Haghani, M., M. Shabani, Moazzami, K. (2013). Maternal mobile phone exposure adversely affects the electrophysiological properties of Purkinje neurons in rat offspring. *Neuroscience* 250: 588-598.
- Harbo Poulsen, A., E. Stenager, C. Johansen, J. Bentzen, S. Friis, Schüz, J. (2012). Mobile phones and multiple sclerosis--a nationwide cohort study in Denmark. *PLoS One*, 7(4): e34453.
- He, G.L., Y. Liu, M. Li, C.H. Chen, P. Gao, Z.P. Yu, Yang, X.S. (2014). The amelioration of phagocytic ability in microglial cells by curcumin through the inhibition of EMF-induced pro-inflammatory responses. *J Neuroinflammation* 11: 49.
- Hirose, H., A. Sasaki, N. Ishii, M. Sekijima, T. Iyama, T. Nojima, Ugawa, Y. (2010). 1950 MHz IMT-2000 field does not activate microglial cells in vitro. *Bioelectromagnetics* 31(2): 104-112.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Imge, E.B., B. Kilicoglu, E. Devrim, R. Cetin, Durak, I. (2010). Effects of mobile phone use on brain tissue from the rat and a possible protective role of vitamin C - a preliminary study. *Int J Radiat Biol* 86(12): 1044-1049.
- Jing, J., Z. Yuhua, Y. Xiao-Qian, J. Rongping, G. Dong-Mei, Xi, C. (2012). The influence of microwave radiation from cellular phone on fetal rat brain. *Electromagnetic biology and medicine* 31(1): 57-66.
- Jany, M., J. Enderlin, F. Poulliet de Gannes, E. Haro, Hurtier, A. et al.. Neurogenesis and neuroinflammation after mobile phone exposure. BIOEM2014 conference, Jun 2014, Cape Town, South Africa.
- Jeong, Y.J., G.Y. Kang, J.H. Kwon, H.D. Choi, J.K. Pack, N. Kim, Y.S. Lee, Lee, H.J. (2015). 1950 MHz Electromagnetic Fields Ameliorate Abeta Pathology in Alzheimer's Disease Mice. *Curr Alzheimer Res* 12(5): 481-492.
- Jorge-Mora, T., M.J. Misa-Agustino, J.A. Rodriguez-Gonzalez, F.J. Jorge-Barreiro, F.J. Ares-Pena, Lopez-Martin, E. (2011). The effects of single and repeated exposure to 2.45 GHz radiofrequency fields on c-Fos protein expression in the paraventricular nucleus of rat hypothalamus. *Neurochem Res* 36(12): 2322-2332.
- Karaca, E., B. Durmaz, H. Altug, T. Yildiz, C. Guducu, M. Irgi, M.G.C. Koksall, F. Ozkinay, C. Gunduz, Cogulu, O. (2012). The genotoxic effect of radiofrequency waves on mouse brain. *Journal of neuro-oncology* 106(1): 53-58.
- Kim, J.H., D.H. Yu, Y.H. Huh, E.H. Lee, H.G. Kim, Kim, H.R. (2017). Long-term exposure to 835 MHz RF-EMF induces hyperactivity, autophagy and demyelination in the cortical neurons of mice. *Sci Rep*. 2017.
- Kokturk, S., M. Yardimoglu, S.D. Celikozlu, E.G. Dolanbay, Cimbiz, A. (2013). Effect of Lycopersicon esculentum extract on apoptosis in the rat cerebellum, following prenatal and postnatal exposure to an electromagnetic field. *Exp Ther Med* 6(1): 52-56.
- Lameth, J., A. Gervais, C. Colin, P. Lévêque, T.M. Jay, J.M. Edeline, Mallat, M. (2017). Acute Neuroinflammation Promotes Cell Responses to 1800 MHz GSM Electromagnetic Fields in the Rat Cerebral Cortex. *Neurotox Res*. 32(3): 444-459.
- Liu, M.-L., J.-Q. Wen, Fan, Y.-B. (2011). Potential protection of green tea polyphenols against 1800 MHz electromagnetic radiation-induced injury on rat cortical neurons. *Neurotoxicity research* 20(3): 270-276.
- Liu, Y.X., J.L. Tai, G.Q. Li, Z.W. Zhang, J.H. Xue, H.S. Liu, H. Zhu, J.D. Cheng, Y.L. Liu, A.M. Li, Zhang, Y. (2012). Exposure to 1950-MHz TD-SCDMA electromagnetic fields affects the apoptosis of astrocytes via caspase-3-dependent pathway. *PLoS One* 7(8): e42332.
- Lu, Y., M. He, Y. Zhang, S. Xu, L. Zhang, Y. He, C. Chen, C. Liu, H. Pi, Z. Yu, Zhou, Z. (2014). Differential pro-inflammatory responses of astrocytes and microglia involve STAT3 activation in response to 1800 MHz radiofrequency fields. *PLoS One* 9(9): e108318.
- Luna, J., J.P. Leleu, P.M. Preux, P. Corcia, P. Couratier, B. Marin, Boumediene, F. (Fralim Consortium) (2019). Residential exposure to ultra high frequency electromagnetic fields emitted by Global System for Mobile (GSM) antennas and amyotrophic lateral sclerosis incidence: A geo-epidemiological population-based study. *Environ Res*. 176:108525. doi: 10.1016/j.envres.2019.108525.
- Lv, B., Z. Chen, T. Wu, Q. Shao, D. Yan, L. Ma, K. Lu, Xie, Y. (2014). The alteration of spontaneous low frequency oscillations caused by acute electromagnetic fields exposure. *Clin Neurophysiol* 125(2): 277-286.
- Maskey, D., H.G. Kim, M.W. Suh, G.S. Roh, Kim, M.J. (2014). Alteration of glycine receptor immunoreactivity in the auditory brainstem of mice following three months of exposure to radiofrequency radiation at SAR 4.0 W/kg. *Int J Mol Med* 34(2): 409-419.
- Maskey, D., H.J. Kim, H.G. Kim, Kim, M.J. (2012). Calcium-binding proteins and GFAP immunoreactivity alterations in murine hippocampus after 1 month of exposure to 835 MHz radiofrequency at SAR values of 1.6 and 4.0 W/kg. *Neurosci Lett* 506(2): 292-296.

- Maskey, D., J. Pradhan, B. Aryal, C.M. Lee, I.Y. Choi, K.S. Park, S.B. Kim, H.G. Kim, Kim, M.J. (2010). Chronic 835-MHz radiofrequency exposure to mice hippocampus alters the distribution of calbindin and GFAP immunoreactivity. *Brain Res* 1346: 237-246.
- Masuda, H., S. Hirota, A. Ushiyama, A. Hirata, T. Arima, H. Kawai, K. Wake, S. Watanabe, M. Taki, A. Nagai, Ohkubo, C. (2015). No Dynamic Changes in Inflammation-related Microcirculatory Parameters in Developing Rats During Local Cortex Exposure to Microwaves. *In Vivo* 29(5): 561-567.
- Masuda, H., A. Ushiyama, M. Takahashi, J. Wang, O. Fujiwara, T. Hikage, T. Nojima, K. Fujita, M. Kudo, Ohkubo, C. (2009). Effects of 915 MHz electromagnetic-field radiation in TEM cell on the blood-brain barrier and neurons in the rat brain. *Radiat Res* 172(1): 66-73.
- Milham, S., Stetzer, D. (2013). Dirty electricity, chronic stress, neurotransmitters and disease. Electromagn Biol Med* 32(4): 500-507.
- Moretti, D., A. Garenne, E. Haro, F. Poullétiér de Gannes, I. Lagroye, P. Leveque, B. Veyret, Lewis, N. (2013). In-vitro exposure of neuronal networks to the GSM-1800 signal. *Bioelectromagnetics* 34(8): 571-578.
- Motawi, T.K., H.A. Darwish, Y.M. Moustafa, Labib, M.M. (2014).** Biochemical modifications and neuronal damage in brain of young and adult rats after long-term exposure to mobile phone radiations. *Cell Biochem Biophys* 70(2): 845-855.
- Narayanan, S.N., R.S. Kumar, K.M. Karun, S.B. Nayak, Bhat, P.G. (2015). Possible cause for altered spatial cognition of prepubescent rats exposed to chronic radiofrequency electromagnetic radiation. *Metab Brain Dis* 30(5): 1193-1206.
- Noor, N.A., H.S. Mohammed, N.A. Ahmed, Radwan, N.M. (2011). Variations in amino acid neurotransmitters in some brain areas of adult and young male albino rats due to exposure to mobile phone radiation. *Eur Rev Med Pharmacol Sci* 15(7): 729-742.
- Petitdant, N., A. Lecomte, F. Robidel, C. Gamez, K. Blazy, Villegier, A.S. (2016). Cerebral radiofrequency exposures during adolescence: Impact on astrocytes and brain functions in healthy and pathologic rat models. *Bioelectromagnetics* 37(5): 338-350.
- Ragbetli, M.C., A. Aydinlioglu, N. Koyun, C. Ragbetli, Karayel, M. (2009).* Effect of prenatal exposure to mobile phone on pyramidal cell numbers in the mouse hippocampus: a stereological study. *Int J Neurosci* 119(7): 1031-1041.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- Sahin, A., A. Aslan, O. Bas, A. İkinci, C. Ozyilmaz, O. F. Sonmez, S. Colakoglu, Odaci, E. (2015). Deleterious impacts of a 900-MHz electromagnetic field on hippocampal pyramidal neurons of 8-week-old Sprague Dawley male rats. *Brain Res* 1624: 232-238.
- Saikhedkar, N., M. Bhatnagar, A. Jain, P. Sukhwal, C. Sharma, Jaiswal, N. (2014).* Effects of mobile phone radiation (900 MHz radiofrequency) on structure and functions of rat brain. *Neurol Res* 36(12): 1072-1079.
- Umur, A. S., C. Yaldiz, A. Bursali, N. Umur, B. Kara, M. Barutcuoglu, S. Vatanserver, D. Selcuki, Selcuki, M. (2013).* Evaluation of the effects of mobile phones on the neural tube development of chick embryos. *Turkish neurosurgery* 23(6): 742-752.
- Yang, L., D. Hao, M. Wang, Y. Zeng, S. Wu, Zeng, Y. (2012).* Cellular neoplastic transformation induced by 916 MHz microwave radiation. *Cell Mol Neurobiol* 32(6): 1039-1046.

Fertilität

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
		Falzone et al. (2011) Odaci und Ozyilmaz (2015), Shahin et al. (2014), Atasoy et al. (2013), Al-Damegh (2012), Kesari und Behari (2012), Kesari et al. (2011a), Kesari et al. (2011b), Kesari und Behari (2010), Kesari et al. (2010)	Gorpinchenko et al. (2014)		Zhou et al. (2017), Dasdag et al. (2015), Mahmoudabadi et al. (2015)
		Otitoloju et al. (2010)			Zilberlicht et al. (2015)
		Bakacak et al. (2015), Imai et al. (2011) ICNIRP (2018), SSM (2018), ANSES (2013) Karaca et al. (2012), Panagopoulos (2012)	SCENIHR (2015), ANSES (2013) Kumar et al. (2014), Lukac et al. (2011)		ICNIRP (2018), SSM (2018), Sienkiewicz et al. (2012) Jurewicz et al. (2014), Barazani et al. (2014), Dama und Bhat (2013)
		Lee et al. (2009), BfS (2008), SCENIHR (2015)	BfS (2008)		Mortazavi et al. (2013), SSK (2011)

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- Al-Damegh, M.A. (2012). Rat testicular impairment induced by electromagnetic radiation from a conventional cellular telephone and the protective effects of the antioxidants vitamins C and E. *Clinics (Sao Paulo)* 67(7): 785-792.
- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- Atasoy, H.I., M.Y. Gunal, P. Atasoy, S. Elgun, Bugdayci, G. (2013). Immunohistopathologic demonstration of deleterious effects on growing rat testes of radiofrequency waves emitted from conventional Wi-Fi devices. *J Pediatr Urol* 9(2): 223-229.
- Bakacak, M., M.S. Bostanci, R. Attar, O.K. Yildirim, G. Yildirim, Z. Bakacak, H. Sayar, Han, A. (2015). The effects of electromagnetic fields on the number of ovarian primordial follicles: An experimental study. *Kaohsiung J Med Sci* 31(6): 287-292.
- Barazani, Y., B.F. Katz, H.M. Nagler, Stember, D.S. (2014). Lifestyle, environment, and male reproductive health. *Urol Clin North Am* 41(1): 55-66.
- BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.
- Dama, M.S., Bhat, M.N. (2013). Mobile phones affect multiple sperm quality traits: a meta-analysis. *F1000Res* 2: 40.
- Dasdag, S., M. Tas, M.Z. Akdag Yegin, K. (2015). Effect of long-term exposure of 2.4 GHz radiofrequency radiation emitted from Wi-Fi equipment on testes functions. *Electromagn Biol Med* 34(1): 37-42.
- Falzone, N., C. Huyser, P. Becker, D. Leszczynski, Franken, D.R. (2011). The effect of pulsed 900-MHz GSM mobile phone radiation on the acrosome reaction, head morphology and zona binding of human spermatozoa. *Int J Androl* 34(1): 20-26.
- Gorpinchenko, I., O. Nikitin, O. Banyra, Shulyak, A. (2014). The influence of direct mobile phone radiation on sperm quality. *Cent European J Urol* 67(1): 65-71.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Imai, N., M. Kawabe, T. Hikage, T. Nojima, S. Takahashi, Shirai, T. (2011). Effects on rat testis of 1.95-GHz W-CDMA for IMT-2000 cellular phones. *Syst Biol Reprod Med* 57(4): 204-209.
- Jurewicz, J., M. Radwan, W. Sobala, D. Ligocka, P. Radwan, M. Bochenek, Hanke, W. (2014). Lifestyle and semen quality: role of modifiable risk factors. *Syst Biol Reprod Med* 60(1): 43-51.
- Karaca, E., B. Durmaz, H. Altug, T. Yildiz, C. Guducu, M. Irgi, M. G.C. Koksai, F. Ozkinay, C. Gunduz, Cogulu, O. (2012). The genotoxic effect of radiofrequency waves on mouse brain. *Journal of neuro-oncology* 106(1): 53-58.
- Kesari, K.K., Behari, J. (2012). Evidence for mobile phone radiation exposure effects on reproductive pattern of male rats: role of ROS. *Electromagn Biol Med* 31(3): 213-222.
- Kesari, K.K., S. Kumar, Behari, J. (2011a). 900-MHz microwave radiation promotes oxidation in rat brain. *Electromagn Biol Med* 30(4): 219-234.
- Kesari, K.K., S. Kumar, Behari, J. (2011b). Effects of radiofrequency electromagnetic wave exposure from cellular phones on the reproductive pattern in male Wistar rats. *Appl Biochem Biotechnol* 164(4): 546-559.
- Kesari, K.K., Behari, J. (2010). Microwave exposure affecting reproductive system in male rats. *Appl Biochem Biotechnol* 162(2): 416-428.
- Kesari, K.K., S. Kumar, Behari, J. (2010). Mobile phone usage and male infertility in Wistar rats. *Indian J Exp Biol* 48(10): 987-992.
- Kumar, S., S. Murarka, V.V. Mishra, Gautam, A.K. (2014). Environmental & lifestyle factors in deterioration of male reproductive health. *Indian J Med Res* 140 Suppl: S29-35.

- Lee, H.J., J.S. Lee, J.K. Park, H. Choi, N. Kim, S.H. Kim, Lee, Y.S. (2009). Lack of teratogenicity after combined exposure of pregnant mice to CDMA and WCDMA radio-frequency electromagnetic fields. *Radiat Res* 172(5): 648-652.
- Lukac, N., P. Massanyi, S. Roychoudhury, M. Capcarova, E. Tvrda, Z. Knazicka, A. Kolesarova, Danko, J. (2011). In vitro effects of radiofrequency electromagnetic waves on bovine spermatozoa motility. *Journal of Environmental Science and Health, Part A* 46(12): 1417-1423.
- Mahmoudabadi, F. S., S. Ziaei, M. Firoozabadi, Kazemnejad, A. (2015). Use of mobile phone during pregnancy and the risk of spontaneous abortion. *J Environ Health Sci Eng* 13: 34.
- Mortazavi, S.M., K.R. Shirazi, Mortazavi, G. (2013). The study of the effects of ionizing and non-ionizing radiations on birth weight of newborns to exposed mothers. *J Nat Sci Biol Med* 4(1): 213-217.
- Odaci, E., Ozyilmaz, C. (2015). Exposure to a 900 MHz electromagnetic field for 1 hour a day over 30 days does change the histopathology and biochemistry of the rat testis. *Int J Radiat Biol* 91(7): 547-554.
- Otitoloju, A.A., I. A. Obe, O.A. Adewale, O.A. Otubanjo, Osunkalu, V.O. (2010). Preliminary study on the induction of sperm head abnormalities in mice, *Mus musculus*, exposed to radiofrequency radiations from global system for mobile communication base stations. *Bull Environ Contam Toxicol* 84(1): 51-54.
- Panagopoulos, D.J. (2012). Effect of microwave exposure on the ovarian development of *Drosophila melanogaster*. *Cell biochemistry and biophysics* 63(2): 121-132.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- Shahin, S., V. Mishra, S.P. Singh, Chaturvedi, C.M. (2014). 2.45-GHz microwave irradiation adversely affects reproductive function in male mouse, *Mus musculus* by inducing oxidative and nitrosative stress. *Free Radic Res* 48(5): 511-525.
- Sienkiewicz, Z., J. Schüz, A.H. Poulsen, Cardis, E. (2012). Risk analysis of human exposure to electromagnetic fields. (revised). EFHRAN, European Commission. Brussels.
- SSK (2011). Biologische Auswirkungen des Mobilfunks, Gesamtschau. Bonn, Strahlenschutzkommission.
- SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- Zhou, L.Y., H.X. Zhang, Y.L. Lan, Y. Li, Y. Liang, L. Yu, Y.M. Ma, C.W. Jia, Wang, S.Y. (2017). Epidemiological investigation of risk factors of the pregnant women with early spontaneous abortion in Beijing. *Chin J Integr Med* 23(5): 345-349.
- Zilberlicht, A., Z. Wiener-Megnazi, Y. Sheinfeld, B. Grach, S. Lahav-Baratz, Dirnfeld, M. (2015). Habits of cell phone usage and sperm quality - does it warrant attention? *Reprod Biomed Online* 31(3): 421-426.

Entwicklung

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
		Grigoriev et al. (2010), Gul et al. (2009) Hanci et al. (2015), Sehitoglu et al. (2015)			Col-Araz (2013)
		Ozorak et al. (2013), ICNIRP (2018), SSM (2018) Kumar et al. (2012)			SSM (2019), ANSES (2013), Sienkiewicz et al. (2012) Zarei et al. (2015), Saravi (2011)
		Woelders et al. (2017), Technopolis (2015), Shirai et al. (2014), Takahashi et al. (2010), Ait-Aïssa et al. (2010), BFS (2008), ANSES (2016a), SCENIHR (2015) Tumkaya et al. (2016), Guler et al. (2010)			ICNIRP (2018), SCENIHR (2015), SSK (2011)

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- Ait-Aïssa, S., B. Billaudel, F.P. De Gannes, A. Hurtier, E. Haro, M. Taxile, G. Ruffie, A. Athane, B. Veyret, Lagroye, I. (2010). In situ detection of gliosis and apoptosis in the brains of young rats exposed in utero to a Wi-Fi signal. *Comptes Rendus Physique* 11(9): 592-601.
- ANSES (2016a). Exposition aux radiofréquences et santé des enfants. Avis de l'Anses. Rapport d'expertise collective. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- BFS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.
- Col-Araz, N. (2013). Evaluation of factors affecting birth weight and preterm birth in southern Turkey. *J Pak Med Assoc* 63(4): 459-462.
- Grigoriev, Y.G., O.A. Grigoriev, A.A. Ivanov, A.M. Lyaginskaya, A.V. Merkulov, N.B. Shagina, V.N. Maltsev, P. Leveque, A.M. Ulanova, V.A. Osipov, Shafirkin, A.V. (2010). Confirmation studies of Soviet research on immunological effects of microwaves: Russian immunology results. *Bioelectromagnetics* 31(8): 589-602.
- Gul, A., H. Celebi, Ugras, S. (2009). The effects of microwave emitted by cellular phones on ovarian follicles in rats. *Arch Gynecol Obstet* 280(5): 729-733.
- Guler, G., A. Tomruk, E. Ozgur, Seyhan, N. (2010). The effect of radiofrequency radiation on DNA and lipid damage in non-pregnant and pregnant rabbits and their newborns. *Gen Physiol Biophys* 29(1): 59-66.
- Hanci, H., S. Turedi, Z. Topal, T. Mercantepe, I. Bozkurt, H. Kaya, S. Ersoz, B. Unal, Odaci, E. (2015). Can prenatal exposure to a 900 MHz electromagnetic field affect the morphology of the spleen and thymus, and alter biomarkers of oxidative damage in 21-day-old male rats? *Biotech Histochem* 90(7): 535-543.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Kumar, S., J. Behari, Sisodia, R. (2012). Impact of Microwave at X-Band in the aetiology of male infertility. *Electromagnetic biology and medicine* 31(3): 223-232.
- Ozorak, A., M. Naziroglu, O. Celik, M. Yuksel, D. Ozcelik, M.O. Ozkaya, H. Cetin, M.C. Kahya, Kose, S.A. (2013). Wi-Fi (2.45 GHz)- and mobile phone (900 and 1800 MHz)-induced risks on oxidative stress and elements in kidney and testis of rats during pregnancy and the development of offspring. *Biol Trace Elem Res* 156(1-3): 221-229.
- Saravi, F. D. (2011). Asymmetries in hip mineralization in mobile cellular phone users. *J Craniofac Surg* 22(2): 706-710.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- Sehitoglu, I., L. Tumkaya, Y. Kalkan, R. Bedir, M.C. Cure, O.U. Zorba, E. Cure, Yuçe, S. (2015). Biochemical and histopathological effects on the rat testis after exposure to electromagnetic field during fetal period. *Arch Esp Urol* 68(6): 562-568.
- Shirai, T., N. Imai, J. Wang, S. Takahashi, M. Kawabe, K. Wake, H. Kawai, S. Watanabe, F. Furukawa, Fujiwara, O. (2014). Multigenerational effects of whole body exposure to 2.14 GHz W-CDMA cellular phone signals on brain function in rats. *Bioelectromagnetics* 35(7): 497-511.
- Sienkiewicz, Z., J. Schüz, A.H. Poulsen, Cardis, E. (2012). Risk analysis of human exposure to electromagnetic fields. (revised). EFHRAN, European Commission. Brussels.
- SSK (2011). Biologische Auswirkungen des Mobilfunks, Gesamtschau. Bonn, Strahlenschutzkommission.
- SSM (2019). Recent Research on EMF and Health Risk – Thirteenth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- Takahashi, S., N. Imai, K. Nabae, K. Wake, H. Kawai, J. Wang, S. Watanabe, M. Kawabe, O. Fujiwara, K. Ogawa, S. Tamano, Shirai, T. (2010). Lack of adverse effects of whole-body exposure to a mobile telecommunication electromagnetic field on the rat fetus. *Radiat Res* 173(3): 362-372.
- Tumkaya, L., Y. Kalkan, O. Bas, Yilmaz, A. (2016). Mobile phone radiation during pubertal development has no effect on testicular histology in rats. *Toxicol Ind Health* 32(2): 328-336.

- Woelders, H., A. de Wit, A. Lourens, N. Stockhofe, B. Engel, I. Hulsegge, D. Schokker, P. van Heijningen, S. Vossen, D. Bekers, Zwamborn, P. (2017). Study of potential health effects of electromagnetic fields of telephony and Wi-Fi, using chicken embryo development as animal model. *Bioelectromagnetics* 38(3): 186-203.
- Technopolis (2015). Programme evaluation Electromagnetic Fields & Health (EMF&H). Amsterdam, Technopolis Group.
- Zarei, S., S.M. Mortazavi, A.R. Mehdizadeh, M. Jalalipour, S. Borzou, S. Taeb, M. Haghani, S.A. Mortazavi, M.B. Shojaei-Fard, S. Nematollahi, N. Alighanbari, Jarideh, S. (2015). A Challenging Issue in the Etiology of Speech Problems: The Effect of Maternal Exposure to Electromagnetic Fields on Speech Problems in the Offspring. *J Biomed Phys Eng* 5(3): 151-154.

Herz-Kreislauf-System

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
	Lu et al. (2012)	Eris et al. (2015), El-Bediwi et al. (2013), Meo und Rubeaan (2013), Chaturvedi et al. (2011)	Huber et al. (2005)		
				Volkow et al. (2011)	Suresh et al. (2011)
		ANSES (2013), Ozgur, et al. (2013), Sirav und Seyhan (2011)	Kwon et al. (2011), Negovetic und Regel (2011), ANSES (2013)	Negovetic und Regel (2011), Sinkiewicz et al. (2012)	Sienkiewicz et al. (2012)
	Gläser (2017)	Meral et al. (2014), Vanderwaal et al. (2006), ICNIRP (2018), Colak et al. (2012)	Andrianome et al. (2017), Wolf et al. (2006)	Negovetic und Regel (2011), ICNIRP (2018)	Chen et al. (2013)

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- Andrianome, S., J. Gobert, L. Hugueville, E. Stephan-Blanchard, F. Telliez, Selmaoui, B. (2017). An assessment of the autonomic nervous system in the electrohypersensitive population: a heart rate variability and skin conductance study. *J Appl Physiol* (1985): jap.00229.02017.
- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- Chaturvedi, C.M., V.P. Singh, P. Singh, P. Basu, M. Singaravel, R.K. Shukla, A. Dhawan, A.K. Pati, R.K. Gangwar, Singh, S.P. (2011). 2.45 GHz (CW) microwave irradiation alters circadian organization, spatial memory, DNA structure in the brain cells and blood cell counts of male mice, *Mus musculus*. *Progr Electromagn Res B* 29: 23-42.
- Chen, Q., G. Xu, L. Lang, A. Yang, S. Li, L. Yang, C. Li, H. Huang, Li, T. (2013). ECG changes in factory workers exposed to 27.2 MHz radiofrequency radiation. *Bioelectromagnetics* 34(4): 285-290.
- Colak, C., H. Parlakpınar, N. Ermis, M.E. Tagluk, C. Colak, E. Sarihan, O. F. Dilek, B. Turan, S. Bakir, Acet, A. (2012). Effects of electromagnetic radiation from 3G mobile phone on heart rate, blood pressure and ECG parameters in rats. *Toxicol Ind Health* 28(7): 629-638.
- El-Bediwi, A.B., M. Saad, A.F. El-kott, Eid, E. (2013). Influence of electromagnetic radiation produced by mobile phone on some biophysical blood properties in rats. *Cell Biochem Biophys* 65(3): 297-300.
- Eris, A.H., H.S. Kiziltan, I. Meral, H. Genc, M. Trabzon, H. Seyithanoglu, B. Yagci, Uysal, O. (2015). Effect of Short-term 900 MHz low level electromagnetic radiation exposure on blood serotonin and glutamate levels. *Bratisl Lek Listy* 116(2): 101-103.
- Gläser, K. (2017). Einfluss hochfrequenter Felder des Mobilfunks auf das blutbildende System in vitro. Diss Uni Würzburg.
- Huber, R., V. Treyer, J. Schuderer, A. Buck, N. Kuster, H.P. Landolt, Achermann, P. (2005). Exposure to pulse-modulated radio frequency electromagnetic fields affects regional cerebral blood flow. *European Journal of Neuroscience*, 21: 1000-1006.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Kwon, M.S., V. Vorobyev, S. Kännälä, M. Laine, J.O. Rinne, T. Toivonen, J. Johansson, M. Teräs, H. Lindholm, Alanko, T. (2011). GSM mobile phone radiation suppresses brain glucose. *J Cereb Blood Flow Metab* 31 (12): 2293-2301.
- Lu, Y.S., B.T. Huang, Huang, Y.X. (2012). Reactive oxygen species formation and apoptosis in human peripheral blood mononuclear cell induced by 900 MHz mobile phone radiation. *Oxidative medicine and cellular longevity* 2012. Article ID 740280, 8 pages.
- Meo, S.A., Al Rubeaan, K. (2013). Effects of exposure to electromagnetic field radiation (EMFR) generated by activated mobile phones on fasting blood glucose. *Int J Occup Med Environ Health* 26(2): 235-241.
- Meral, I., Y. Tekintangac, Demir, H. (2014). Effects of 900 MHz electromagnetic field emitted by cellular phones on electrocardiograms of guinea pigs. *Hum Exp Toxicol* 33(2): 164-169.
- Negovetic, S., Regel, S. (2011). Nichtionisierende Strahlung - Umwelt und Gesundheit. Schweizerischer Nationalfonds, Bern.
- Ozgur, E., G. Kismali, G. Guler, A. Akcay, G. Ozkurt, T. Sel, Seyhan, N. (2013). Effects of prenatal and postnatal exposure to gsm-like radiofrequency on blood chemistry and oxidative stress in infant rabbits, an experimental study. *Cell biochemistry and biophysics* 67(2): 743-751.
- Sienkiewicz, Z., J. Schüz, A.H. Poulsen, Cardis, E. (2012). Risk analysis of human exposure to electromagnetic fields. (revised). EFHRAN, European Commission. Brussels.
- Sirav, B., Seyhan, N. (2011). Effects of radiofrequency radiation exposure on blood-brain barrier permeability in male and female rats. *Electromagn Biol Med* 30(4): 253-260.
- Suresh, S., C. Sabanayagam, S. Kalidindi, Shankar, A. (2011). Cell-phone use and self-reported hypertension: national health interview survey 2008. *Int J Hypertens* 2011: 360415.
- Vanderwaal, R.P., B. Cha, E.G. Moros, Roti Roti, J.L. (2006). HSP27 phosphorylation increases after 45 degrees C or 41 degrees C heat shocks but not after non-thermal TDMA or GSM exposures. *Int J Hyperthermia* 22(6): 507-519.

- Volkow, N.D., D. Tomasi, G.J. Wang, P. Vaska, J.S. Fowler, F. Telang, D. Alexoff, J. Logan, Wong, C. (2011). Effects of cell phone radiofrequency signal exposure on brain glucose metabolism. *Jama* 305(8): 808-813.
- Wolf, M., Haensse, D., Morren, G., Froehlich, J. (2006). Do GSM 900MHz signals affect cerebral blood circulation? A near-infrared spectrophotometry study, in: *Optics Express*, 14: 6128-6141.

EEG

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
			Negovetic und Regel (2011), Carrubba et al. (2010), Regel et al. (2007), Huber (2003), ICNIRP (2018), ANSES (2013), Sienkiewicz et al. (2012)		
			Sauter et al. (2015), Perentos et al. (2013), Croft et al. (2010), de Tommaso et al. (2009), BfS (2008), Croft et al (2008) SSM (2017), Sauter et al. (2014), Sienkiewicz et al. (2012)		
			SSM (2018) Vecchio et al. (2012)	SCENIHR (2015), Sienkiewicz et al. (2012)	
				Sauter et al. (2015), BfS (2008), ICNIRP (2018)	Negovetic und Regel (2011)

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.
- Carrubba, S., C. Frilot, 2nd, A.L. Chesson, Jr., Marino, A.A. (2010). Mobile-phone pulse triggers evoked potentials. *Neurosci Lett* 469(1): 164-168.
- Croft, R.J., S. Leung, R.J. McKenzie, S.P. Loughran, S. Iskra, D.L. Hamblin, Cooper, N.R. (2010). Effects of 2G and 3G mobile phones on human alpha rhythms: Resting EEG in adolescents, young adults, and the elderly. *Bioelectromagnetics* 31(6): 434-444.
- Croft, R. J., D.L. Hamblin, J. Spong, A.W. Wood, R.J. McKenzie, Stough, C. (2008). The effect of mobile phone electromagnetic fields on the alpha rhythm of human electroencephalogram. *Bioelectromagnetics* 29(1): 1-10.
- de Tommaso, M., P. Rossi, R. Falsaperla, V. Francesco Vde, R. Santoro, Federici, A. (2009). Mobile phones exposure induces changes of contingent negative variation in humans. *Neurosci Lett* 464(2): 79-83.
- Huber, R., J. Schuderer, T. Graf, K. Jütz, A.A. Borbély, N. Kuster, N., Achermann, P. (2003) Radiofrequency electromagnetic field exposure in humans: estimation of SAR distribution in the brain, effects on sleep and heart rate, in: *Bioelectromagnetics*, 24(4): 262-276.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature,
- Negovetic, S., Regel, S. (2011). Nichtionisierende Strahlung - Umwelt und Gesundheit. Schweizerischer Nationalfonds, Bern.
- Perentos, N., R.J. Croft, R.J. McKenzie, Cosic, I. (2013). The alpha band of the resting electroencephalogram under pulsed and continuous radio frequency exposures. *IEEE Trans Biomed Eng* 60(6): 1702-1710.
- Regel, S.J., G. Tinguely, J. Schuderer, M. Adam, N. Kuster, H.P. Landolt, Achermann, P. (2007). Pulsed radio-frequency electromagnetic fields: dose-dependent effects on sleep, the sleep EEG and cognitive performance. *Journal of Sleep Research*, 16(3): 253-258.
- Sauter, C., T. Eggert, H. Dorn, G. Schmid, T. Bolz, A. Marasanov, V.W. Hansen, A. Peter, Danker-Hopfe, H. (2015). Do signals of a hand-held TETRA transmitter affect cognitive performance, well-being, mood or somatic complaints in healthy young men? Results of a randomized double-blind cross-over provocation study. *Environ Res.*, 140: 85-94.
- Sauter, C., T. Eggert, H. Dorn, Danker-Hopfe, H. (2014). Literaturübersicht im Rahmen des Projekts: Einfluss hochfrequenter elektromagnetischer Felder auf Gehirnaktivität, Schlaf und kognitive Leistungsfähigkeit älterer Personen beider Geschlechter - Vorhaben 3613S30012. BfS-RESFOR 99/14. BfS, Salzgitter.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- Sienkiewicz, Z., J. Schüz, A.H. Poulsen, Cardis, E. (2012). Risk analysis of human exposure to electromagnetic fields. (revised). EFHRAN, European Commission. Brussels.
- SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- SSM (2017). Recent Research on EMF and Health Risk – Eleventh report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- Vecchio, F., P. Buffo, S. Sergio, D. Iacoviello, P.M. Rossini, Babiloni, C. (2012). Mobile phone emission modulates event-related desynchronization of alpha rhythms and cognitive-motor performance in healthy humans. *Clinical Neurophysiology* 123(1): 121-128.

Kognition

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
		<u>ANSES (2013)</u> <i>Hao et al. (2013)</i>	Movahedi et al. (2014), Lustenberger et al. (2013), Mortazavi et al (2012), Leung et al. (2011), Luria et al. (2009) <u>ANSES (2016a)</u>		Foerster et al. (2018)
		<u>SSM (2018), SCENIHR (2015)</u> <i>Ntzouni et al. (2011)</i>	Guxens et al. (2016), Sauter et al. (2015), Negovetic und Regel (2011), BfS (2008), Regel et al. (2007) <u>Sauter et al. (2014), ANSES (2013)</u>		<u>SSM (2018)</u>
		Klose und Lerchl (2013), BfS (2008)	Regel et al. (2006), BfS (2008) <u>ICNIRP (2018), SCENIHR (2015)</u>	Malek et al. (2015), Sauter et al. (2015), Negovetic und Regel (2011), BfS (2008) <u>ICNIRP (2018), SSM (2017), Sienkiewicz et al. (2012)</u>	Ng et al. (2012)

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- ANSES (2016a). Exposition aux radiofréquences et santé des enfants. Avis de l'Anses. Rapport d'expertise collective. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.
- Foerster M, A. Thielens, W. Joseph, M. Eeftens, Rösli, M. (2018). A prospective cohort study of adolescents' memory performance and individual brain dose of microwave radiation from wireless communication. *Environ Health Perspect.* 126(7): 077007, 1-13.
- Guxens, M., R. Vermeulen, M. van Eijsden, J. Beekhuizen, T. G. Vrijkotte, R. T. van Strien, H. Kromhout, Huss, A. (2016). Outdoor and indoor sources of residential radio-frequency electromagnetic fields, personal cell phone and cordless phone use, and cognitive function in 5-6 years old children. *Environ Res* 150: 364-374.
- Hao, D., L. Yang, S. Chen, J. Tong, Y. Tian, B. Su, S. Wu, Zeng, Y. (2013)*. Effects of long-term electromagnetic field exposure on spatial learning and memory in rats. *Neuro Sci* 34(2): 157-164.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Klose, M., Lerchl, A. (2013). Altersabhängige Wirkungen hochfrequenter elektromagnetischer Felder des Mobilfunks auf Entwicklungs- und Differenzierungsprozesse des Zentralnervensystems in juvenilen Labornagern - Vorhaben FM 8848. BfS, Salzgitter.
- Leung, S., R.J. Croft, R.J. McKenzie, S. Iskra, B. Silber, N.R. Cooper, B. O'Neill, V. Cropley, A. Diaz-Trujillo, D. Hamblin, Simpson, D. (2011). Effects of 2G and 3G mobile phones on performance and electrophysiology in adolescents, young adults and older adults. *Clinical Neurophysiology* 122(11): 2203-2216.
- Luria, R., I. Eliyahu, R. Hareuveny, M. Margaliot, Meiran, N. (2009). Cognitive effects of radiation emitted by cellular phones: the influence of exposure side and time. *Bioelectromagnetics* 30(3): 198-204.
- Lustenberger, C., M. Murbach, R. Durr, M. R. Schmid, N. Kuster, P. Achermann, Huber, R. (2013). Stimulation of the brain with radiofrequency electromagnetic field pulses affects sleep-dependent performance improvement. *Brain Stimul* 6(5): 805-811.
- Malek, F., K.A. Rani, H.A. Rahim, Omar, M.H. (2015). Effect of Short-Term Mobile Phone Base Station Exposure on Cognitive Performance, Body Temperature, Heart Rate and Blood Pressure of Malaysians. *Sci Rep* 5: 13206.
- Mortazavi, S.M., M.S. Rouintan, S. Taeb, N. Dehghan, A.A. Ghaffarpanah, Z. Sadeghi, Ghafouri, F. (2012). Human short-term exposure to electromagnetic fields emitted by mobile phones decreases computer-assisted visual reaction time. *Acta Neurol Belg* 112(2): 171-175.
- Movahedi, M.M., A. Tavakkoli-Golpayegani, S.A. Mortazavi, M. Haghani, Z. Razi, M.B. Shojaie-Fard, M. Zare, E. Mina, L. Mansourabadi, J. Nazari, A. Safari, N. Shokrpour, Mortazavi, S.M. (2014). Does exposure to GSM 900 MHz mobile phone radiation affect short-term memory of elementary school students? *J Pediatr Neurosci* 9(2): 121-124.
- Negovetic, S., Regel, S. (2011). Nichtionisierende Strahlung - Umwelt und Gesundheit. Schweizerischer Nationalfonds, Bern.
- Ng, T.P., M.L. Lim, M. Niti, Collinson, S. (2012). Long-term digital mobile phone use and cognitive decline in the elderly. *Bioelectromagnetics* 33(2): 176-185.
- Ntzouni, M., A. Stamatakis, F. Stylianopoulou, Margaritis, L. (2011)*. Short-term memory in mice is affected by mobile phone radiation. *Pathophysiology* 18(3): 193-199.
- Regel, S.J., G. Tinguely, J. Schuderer, M. Adam, N. Kuster, H.P. Landolt, Achermann, P. (2007). Pulsed radio-frequency electromagnetic fields: dose-dependent effects on sleep, the sleep EEG and cognitive performance. *Journal of Sleep Research*, 16(3): 253-258.
- Regel, S.J., S. Negovetic, M. Roosli, V. Berdinas, J. Schuderer, A. Huss, U. Lott, N. Kuster, Achermann, P. (2006). UMTS base station-like exposure, well-being, and cognitive performance. *Environ Health Perspect* 114(8): 1270-1275.

- Sauter, C., T. Eggert, H. Dorn, G. Schmid, T. Bolz, A. Marasanov, V.W. Hansen, A. Peter, Danker-Hopfe, H. (2015). Do signals of a hand-held TETRA transmitter affect cognitive performance, well-being, mood or somatic complaints in healthy young men? Results of a randomized double-blind cross-over provocation study. *Environ Res.*, 140: 85-94.
- Sauter, C., T. Eggert, H. Dorn, Danker-Hopfe, H. (2014). Literaturübersicht im Rahmen des Projekts: Einfluss hochfrequenter elektromagnetischer Felder auf Gehirnaktivität, Schlaf und kognitive Leistungsfähigkeit älterer Personen beider Geschlechter - Vorhaben 3613S30012. BfS-RESFOR 99/14. BfS, Salzgitter.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- Sienkiewicz, Z., J. Schüz, A.H. Poulsen, Cardis, E. (2012). Risk analysis of human exposure to electromagnetic fields. (revised). EFHRAN, European Commission. Brussels.
- SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- SSM (2017). Recent Research on EMF and Health Risk – Eleventh report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.

Schlaf

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
			<i>Andrianome et al. (2016)</i>	Liu et al. (2014), Loughran et al. (2012)	Munezawa et al. (2011)
			<u>SCENIHR (2015)</u>	<u>SSM (2018)</u> , <u>ANSES (2016a)</u> , <u>ANSES (2013)</u>	
			Baliatsas et al. (2015), Huss et al. (2015), Negovetic und Regel (2011), BFS (2008), Regel et al. (2007)	Martens et al. (2017), Baliatsas et al. (2015), Huss et al. (2015), Negovetic und Regel (2011), Nakatani-Enomoto et al. (2013), BFS (2008) <u>SCENIHR (2015)</u> , <u>Sienkiewicz et al. (2012)</u> , <u>SSK (2011)</u>	Martens et al. (2017) <u>SSK (2011)</u>

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- Andrianome, S., L. Hugueville, R. de Seze, M. Hanot-Roy, K. Blazy, C. Gamez, Selmaoui, B. (2016)*. Disturbed sleep in individuals with Idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF): Melatonin assessment as a biological marker. *Bioelectromagnetics*, 37(3): 175-182.
- ANSES (2016a). Exposition aux radiofréquences et santé des enfants. Avis de l'Anses. Rapport d'expertise collective. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- Baliatsas, C., J. Bolte, J. Yzermans, G. Kelfkens, M. Hooiveld, E. Lebret, van Kamp, I. (2015). Actual and perceived exposure to electromagnetic fields and non-specific physical symptoms: an epidemiological study based on self-reported data and electronic medical records. *Int J Hyg Environ Health* 218(3): 331-344.
- BFS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.
- Huss, A., M. van Eijsden, M. Guxens, J. Beekhuizen, R. van Strien, H. Kromhout, T. Vrijkotte, Vermeulen, R. (2015). Environmental Radiofrequency Electromagnetic Fields Exposure at Home, Mobile and Cordless Phone Use, and Sleep Problems in 7-Year-Old Children. *PLoS One* 10(10): e0139869.
- Liu, H., G. Chen, Y. Pan, Z. Chen, W. Jin, C. Sun, C. Chen, X. Dong, K. Chen, Z. Xu, S. Zhang, Yu, Y. (2014). Occupational electromagnetic field exposures associated with sleep quality: a cross-sectional study. *PLoS One* 9(10): e110825.
- Loughran, S.P., R.J. McKenzie, M.L. Jackson, M.E. Howard, Croft, R.J. (2012). Individual differences in the effects of mobile phone exposure on human sleep: rethinking the problem. *Bioelectromagnetics* 33(1): 86-93.
- Martens, A.L., P. Slotje, D.R. Timmermans, H. Kromhout, M. Reedijk, R.C. Vermeulen, Smid, T. (2017). Modeled and Perceived Exposure to Radio-Frequency Electromagnetic Fields From Mobile-Phone Base Stations and the Development of Symptoms Over Time in a General Population Cohort. *Am J Epidemiol*, 186(2): 210-219.
- Munezawa, T., Y. Kaneita, Y. Osaki, H. Kanda, M. Minowa, K. Suzuki, S. Higuchi, J. Mori, R. Yamamoto, Ohida, T. (2011). The association between use of mobile phones after lights out and sleep disturbances among Japanese adolescents: a nationwide cross-sectional survey. *Sleep* 34(8): 1013-1020.
- Nakatani-Enomoto, S., T. Furubayashi, A. Ushiyama, S.J. Groiss, K. Ueshima, S. Sokejima, A.Y. Simba, K. Wake, S. Watanabe, M. Nishikawa, K. Miyawaki, M. Taki, Ugawa, Y. (2013). Effects of electromagnetic fields emitted from W-CDMA-like mobile phones on sleep in humans. *Bioelectromagnetics* 34(8): 589-598.
- Negovetic, S., Regel, S. (2011). Nichtionisierende Strahlung - Umwelt und Gesundheit. Schweizerischer Nationalfonds, Bern.
- Regel, S.J., G. Tinguely, J. Schuderer, M. Adam, N. Kuster, H.P. Landolt, Achermann, P. (2007). Pulsed radio-frequency electromagnetic fields: dose-dependent effects on sleep, the sleep EEG and cognitive performance. *Journal of Sleep Research*, 16(3): 253-258.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- Sienkiewicz, Z., J. Schüz, A.H. Poulsen, Cardis, E. (2012). Risk analysis of human exposure to electromagnetic fields. (revised). EFHRAN, European Commission. Brussels.
- SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- SSK (2011). Biologische Auswirkungen des Mobilfunks, Gesamtschau. Bonn, Strahlenschutzkommission.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
				McCarty et al. (2011)	ANSES (2016a)
				Baliatsas et al. (2016) ANSES (2018)	Meg et al. (2011), Negovetic und Regel (2011) ANSES (2018)
			Andrianome et al. (2017), Baliatsas et al. (2015), Sauter et al. (2015) SCENIHR (2015), Baliatsas et al. (2012)	Martens et al. (2017), Slotjje et al. (2017), van Wel et al. (2017), Baliatsas et al. (2015), Chu et al. (2011), McCarty et al. (2011), Mortazavi et al. (2011), Negoveic und Regel (2011), Furubayashi et al. (2009), BfS (2008), Regel et al. (2006) ICNIRP (2018), SSM (2018), Klaps et al. (2016), SCENIHR (2015), Baliatsas et al. (2012), Sienkiewicz et al. (2012), SSK (2011)	Baliatsas et al. (2016), Schoeni et al. (2016), Kato und Johansson (2012), Negovetic und Regel (2011), Nam et al. (2009) ICNIRP (2018), SSM (2018), SCENIHR (2015), Sienkiewicz et al. (2012), Augner et al. (2012), SSK (2011) Bortkiewicz et al. (2012)

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

ANSES (2018). Hypersensibilité électromagnétique ou intolérance environnementale idiopathique attribuée aux champs électromagnétiques. Avis de l'Anses. Rapport d'expertise collective. Maisons-Alfort, Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail.

ANSES (2016a). Exposition aux radiofréquences et santé des enfants. Avis de l'Anses. Rapport d'expertise collective. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.

Andrianome, S., J. Gobert, L. Hugueville, E. Stephan-Blanchard, F. Telliez, Selmaoui, B. (2017). An assessment of the autonomic nervous system in the electrohypersensitive population: a heart rate variability and skin conductance study. *J Appl Physiol* (1985): jap.00229.02017.

Augner, C., T. Gnams, R. Winker, Barth, A. (2012). Acute effects of electromagnetic fields emitted by GSM mobile phones on subjective well-being and physiological reactions: a meta-analysis. *Sci Total Environ* 424, May: 11-15.

Baliatsas, C., I. van Kamp, J. Bolte, G. Kelfkens, C. van Dijk, P. Spreuvenberg, M. Hooiveld, E. Lebret, Yzermans, J. (2016). Clinically defined non-specific symptoms in the vicinity of mobile phone base stations: A retrospective before-after study. *Sci Total Environ* 565, Sept.: 714-720.

Baliatsas, C., J. Bolte, J. Yzermans, G. Kelfkens, M. Hooiveld, E. Lebret, van Kamp, I. (2015). Actual and perceived exposure to electromagnetic fields and non-specific physical symptoms: an epidemiological study based on self-reported data and electronic medical records. *Int J Hyg Environ Health* 218(3): 331-344.

Baliatsas, C., I. van Kamp, J. Bolte, M. Schipper, J. Yzermans, Lebret, E. (2012). Non-specific physical symptoms and electromagnetic field exposure in the general population: can we get more specific? A systematic review. *Environ Int* 41, May: 15-28.

BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.

Bortkiewicz, A., E. Gadzicka, A. Szykowska, P. Poltanski, P. Mamrot, W. Szymczak, Zmyslony, M. (2012). Subjective complaints of people living near mobile phone base stations in Poland. *Int J Occup Med Environ Health* 25(1): 31-40.

Chu, M.K., H.G. Song, C. Kim, B. Lee, B.C. (2011). Clinical features of headache associated with mobile phone use: a cross-sectional study in university students. *BMC Neurol* 11, Sept: 115.

Furubayashi, T., A. Ushiyama, Y. Terao, Y. Mizuno, K. Shirasawa, P. Pongpaibool, A.Y. Simba, K. Wake, M. Nishikawa, K. Miyawaki, A. Yasuda, M. Uchiyama, H.K. Yamashita, H. Masuda, S. Hirota, M. Takahashi, T. Okano, S. Inomata-Terada, S. Sokejima, E. Maruyama, S. Watanabe, M. Taki, C. Ohkubo, Ugawa, Y. (2009). Effects of short-term W-CDMA mobile phone base station exposure on women with or without mobile phone related symptoms. *Bioelectromagnetics* 30(2): 100-113.

ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.

Kato, Y., Johansson, O. (2012). Reported functional impairments of electrohypersensitive Japanese: A questionnaire survey. *Pathophysiology* 19(2): 95-100.

Klaps, A., I. Ponocny, R. Winker, M. Kundi, F. Auersperg, Barth, A. (2016). Mobile phone base stations and well-being – A meta-analysis. *Science of the Total Environment*, 544, Feb: 24-30.

Martens, A.L., P. Slotjje, D.R. Timmermans, H. Kromhout, M. Reedijk, R.C. Vermeulen, Smid, T. (2017). Modeled and Perceived Exposure to Radio-Frequency Electromagnetic Fields From Mobile-Phone Base Stations and the Development of Symptoms Over Time in a General Population Cohort. *Am J Epidemiol*, 186(2): 210-219.

McCarty, D.E., S. Carrubba, A.L. Chesson, C. Frilot, E. Gonzalez-Toledo, Marino, A.A. (2011). Electromagnetic hypersensitivity: evidence for a novel neurological syndrome. *Int J Neurosci* 121(12): 670-676.

Meg Tseng, M.C., Y.P. Lin, Cheng, T.J. (2011). Prevalence and psychiatric comorbidity of self-reported electromagnetic field sensitivity in Taiwan: a population-based study. *J Formos Med Assoc* 110(10): 634-641.

Mortazavi, S.M., A. Mahbudi, M. Atefi, S. Bagheri, N. Bahaedini, Besharati, A. (2011). An old issue and a new look: electromagnetic hypersensitivity caused by radiations emitted by GSM mobile phones. *Technol Health Care* 19(6): 435-443.

- Nam, K.C., J.H. Lee, H.W. Noh, E.J. Cha, N.H. Kim, Kim, D.W. (2009). Hypersensitivity to RF fields emitted from CDMA cellular phones: a provocation study. *Bioelectromagnetics* 30(8): 641-650.
- Negovetic, S., Regel, S. (2011). *Nichtionisierende Strahlung - Umwelt und Gesundheit*. Schweizerischer Nationalfonds, Bern.
- Regel, S.J., S. Negovetic, M. Roosli, V. Berdinas, J. Schuderer, A. Huss, U. Lott, N. Kuster, Achermann, P. (2006). UMTS base station-like exposure, well-being, and cognitive performance. *Environ Health Perspect* 114(8): 1270-1275.
- Sauter, C., T. Eggert, H. Dorn, G. Schmid, T. Bolz, A. Marasanov, V.W. Hansen, A. Peter, Danker-Hopf, H. (2015). Do signals of a hand-held TETRA transmitter affect cognitive performance, well-being, mood or somatic complaints in healthy young men? Results of a randomized double-blind cross-over provocation study. *Environ Res.*, 140: 85-94.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- Schoeni, A., K. Roser, A. Bürgi, Rössli, M. (2016). Symptoms in Swiss adolescents in relation to exposure from fixed site transmitters: a prospective cohort study. *Environ Health*. 15(1): 77.
- Sienkiewicz, Z., J. Schüz, A.H. Poulsen, Cardis, E. (2012). Risk analysis of human exposure to electromagnetic fields. (revised). EFHRAN, European Commission. Brüssel.
- Slottje, P., I. van Moorselaar, R. van Strien, R. Vermeulen, H. Kromhout, Huss, A. (2017). Electromagnetic hypersensitivity (EHS) in occupational and primary health care: A nation-wide survey among general practitioners, occupational physicians and hygienists in the Netherlands. *Int J Hyg Environ Health* 220(2 Pt B): 395-400.
- SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- SSK (2011). Biologische Auswirkungen des Mobilfunks, Gesamtschau. Bonn, Strahlenschutzkommission.
- van Wel, L., A. Huss, P. Bachmann, M. Zahner, H. Kromhout, J. Frohlich, Vermeulen, R. (2017). Context-sensitive ecological momentary assessments; integrating real-time exposure measurements, data-analytics and health assessment using a smartphone application. *Environ Int* 103, June: 8-12.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
				BfS (2008) ICNIRP (2018), SSM (2018)	Martens et al. (2017) Klaps et al. (2016)
				Martens et al. (2017), van Moorselaar et al. (2017), Baliatsas et al. (2011) ANSES (2018), SCENIHR (2015), Baliatsas et al. (2012), Sienkiewicz et al. (2012)	
				Dieudonné (2019)	

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

ANSES (2018). Hypersensibilité électromagnétique ou intolérance environnementale idiopathique attribuée aux champs électromagnétiques. Avis de l’Anses. Rapport d’expertise collective. Maisons-Alfort, Agence nationale de sécurité sanitaire de l’alimentation, de l’environnement et du travail.

Baliatsas, C., I. Van Kamp, J. Bolte, M. Schipper, J. Yzermans, Lebre, E. (2012). Non-specific physical symptoms and electromagnetic field exposure in the general population: can we get more specific? A systematic review. *Environ Int* 41: 15-28.

Baliatsas, C., I. van Kamp, G. Kelfkens, M. Schipper, J. Bolte, J. Yzermans, Lebre, E. (2011). Non-specific physical symptoms in relation to actual and perceived proximity to mobile phone base stations and powerlines. *BMC Public Health* 11: 421.

BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.

Dieudonné, M. (2019). Becoming Electro-Hypersensitive: A Replication Study. *Bioelectromagnetics*, 40(3): 188-200.

Klaps, A., I. Ponocny, R. Winker, M. Kundi, F. Auersperg, Barth, A. (2016). Mobile phone base stations and well-being – A meta-analysis. *Science of the Total Environment*, 544, Feb: 24-30.

Martens, A.L., P. Slottje, D.R. Timmermans, H. Kromhout, M. Reedijk, R.C. Vermeulen, Smid, T. (2017). Modeled and Perceived Exposure to Radio-Frequency Electromagnetic Fields From Mobile-Phone Base Stations and the Development of Symptoms Over Time in a General Population Cohort. *Am J Epidemiol*, 186(2): 210-219.

Sienkiewicz, Z., J. Schüz, A.H. Poulsen, Cardis, E. (2012). Risk analysis of human exposure to electromagnetic fields. (revised). EFHRAN, European Commission. Brussels.

SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM’s Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.

van Moorselaar, I., P. Slottje, P. Heller, R. van Strien, H. Kromhout, M. Murbach, N. Kuster, R. Vermeulen, Huss, A. (2017). Effects of personalised exposure on self-rated electromagnetic hypersensitivity and sensibility - A double-blind randomised controlled trial. *Environ Int* 99: 255-262.

Hormone, Drüsen

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
					<i>Bhargava et al. (2012)</i>
	Sukhotina et al. (2006)	ANSES (2013)	ANSES (2013)		ICNIRP (2018)
		Jin et al. (2013), Ait-Aissa et al. (2012) ICNIRP (2018) <i>Aydogan et al. (2015)</i>	<i>Andrianome et al. (2016)</i>		

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- Ait-Aissa, S., B. Billaudel, F. Poullétiér de Gannes, G. Ruffie, S. Duleu, A. Hurtier, E. Haro, M. Taxile, A. Athane, M. Geffard, T. Wu, J. Wiart, D. Bodet, B. Veyret, Lagroye, I. (2012). In utero and early-life exposure of rats to a Wi-Fi signal: screening of immune markers in sera and gestational outcome. *Bioelectromagnetics* 33(5): 410-420.
- Andrianome, S., L. Hugueville, R. de Seze, M. Hanot-Roy, K. Blazy, C. Gamez, Selmaoui, B. (2016). Disturbed sleep in individuals with Idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF): Melatonin assessment as a biological marker. *Bioelectromagnetics* 37(3): 175-182.
- Aydogan, F., I. Unlu, E. Aydin, N. Yumusak, E. Devrim, E.E. Samim, E. Ozgur, V. Unsal, A. Tomruk, G.G. Ozturk, Seyhan, N. (2015). The effect of 2100 MHz radiofrequency radiation of a 3G mobile phone on the parotid gland of rats. *Am J Otolaryngol* 36(1): 39-46.
- Bhargava, S., M.B. Motwani, Patni, V.M. (2012). Effect of handheld mobile phone use on parotid gland salivary flow rate and volume. *Oral Surg Oral Med Oral Pathol Oral Radiol* 114(2): 200-206.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Jin, Y.B., D. Choi, B. C. Kim, J.K. Pack, N. Kim, Lee, Y.S. (2013). Effects of simultaneous combined exposure to CDMA and WCDMA electromagnetic fields on serum hormone levels in rats. *J Radiat Res* 54(3): 430-437.
- Sukhotina, I., J.R. Streckert, A.K. Bitz, V.W. Hansen, Lerchl, A. (2006). 1800 MHz electromagnetic field effects on melatonin release from isolated pineal glands, *J. Pineal Res.* 40: 86 – 91.

Blut-Hirn-Schranke

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
		<u>SSM (2018)</u>			
	BfS (2008)	Masuda et al. (2015), Klose und Lerchl (2013), McQuade et al. (2009), BfS (2008) ICNIRP (2018), SCENIHR (2015), ANSES (2013)	<u>ICNIRP (2018), SCENIHR (2015), ANSES (2013)</u>		<u>SSK (2011)</u>

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.
- BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Klose, M., Lerchl, A. (2013). Altersabhängige Wirkungen hochfrequenter elektromagnetischer Felder des Mobilfunks auf Entwicklungs- und Differenzierungsprozesse des Zentralnervensystems in juvenilen Labornagern - Vorhaben FM 8848. BfS, Salzgitter.
- Masuda, H., S. Hirota, A. Ushiyama, A. Hirata, T. Arima, H. Kawai, K. Wake, S. Watanabe, M. Taki, A. Nagai, Ohkubo, C. (2015). No Dynamic Changes in Inflammation-related Microcirculatory Parameters in Developing Rats During Local Cortex Exposure to Microwaves. *In Vivo* 29(5): 561-567.
- McQuade, J.M., J.H. Merritt, S.A. Miller, T. Scholin, M.C. Cook, A. Salazar, O.B. Rahimi, M.R. Murphy, Mason, P.A. (2009). Radiofrequency-radiation exposure does not induce detectable leakage of albumin across the blood-brain barrier. *Radiat Res* 171(5): 615-621.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- SSK (2011). Biologische Auswirkungen des Mobilfunks, Gesamtschau. Bonn, Strahlenschutzkommission.
- SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
		Deshmukh et al. (2013), Khirazova et al. (2012), Narayanan et al. (2010), Narayanan et al. (2009)		Okano et al. (2010)	Ikeda und Nakamura (2014)
		ANSES (2017a) ICNIRP (2018), SSM (2018), SCENIHR (2015) Daniels et al. (2009)			Thomas et al. (2010)
		BfS (2008), Klose und Lerchl (2013), Narayanan et al (2013) Salunke et al (2015)			

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- ANSES (2017a). Radiofréquences et santé - Comprendre où en est la recherche. Maisons-Alfort, Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail.
- BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.
- Daniels, W.M., I.L. Pitout, T.J. Afullo, Mabandla, M.V. (2009). The effect of electromagnetic radiation in the mobile phone range on the behaviour of the rat. *Metab Brain Dis* 24(4): 629-641.
- Deshmukh, P.S., B.D. Banerjee, M.P. Abegaonkar, K. Megha, R.S. Ahmed, A.K. Tripathi, Mediratta, P.K. (2013). Effect of low level microwave radiation exposure on cognitive function and oxidative stress in rats. *Indian J Biochem Biophys* 50(2): 114-119.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Ikeda, K., Nakamura, K. (2014). Association between mobile phone use and depressed mood in Japanese adolescents: a cross-sectional study. *Environ Health Prev Med* 19(3): 187-193.
- Khirazova, E.E., A.A. Baizhumanov, L.K. Trofimova, L.I. Deev, M.V. Maslova, N.A. Sokolova, Kudryashova, N.Y. (2012). Effects of GSM-Frequency Electromagnetic Radiation on Some Physiological and Biochemical Parameters in Rats. *Bull Exp Biol Med* 153(6): 816-819.
- Klose, M., Lerchl, A. (2013). Altersabhängige Wirkungen hochfrequenter elektromagnetischer Felder des Mobilfunks auf Entwicklungs- und Differenzierungsprozesse des Zentralnervensystems in juvenilen Labornagern - Vorhaben FM 8848. BfS, Salzgitter.
- Narayanan, S.N., R.S. Kumar, J. Paval, V. Kedage, M.S. Bhat, S. Nayak, Bhat, P.G. (2013). Analysis of emotionality and locomotion in radio-frequency electromagnetic radiation exposed rats. *Neurol Sci* 34(7): 1117-1124.
- Narayanan, S.N., R.S. Kumar, B.K. Potu, S. Nayak, P.G. Bhat, Mailankot, M. (2010). Effect of radio-frequency electromagnetic radiations (RF-EMR) on passive avoidance behaviour and hippocampal morphology in Wistar rats. *Ups J Med Sci* 115(2): 91-96.
- Narayanan, S.N., R.S. Kumar, B.K. Potu, S. Nayak, Mailankot, M. (2009). Spatial memory performance of Wistar rats exposed to mobile phone. *Clinics (Sao Paulo)* 64(3): 231-234.
- Okano, T., Y. Terao, T. Furubayashi, A. Yugeta, R. Hanajima, Ugawa, Y. (2010). The effect of electromagnetic field emitted by a mobile phone on the inhibitory control of saccades. *Clin Neurophysiol* 121(4): 603-611.
- Salunke, B.P., S.N. Umathe, Chavan, J.G. (2015). Behavioral in-effectiveness of high frequency electromagnetic field in mice. *Physiol Behav* 140, Mar: 32-37.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- Thomas, S., G. Benke, C. Dimitriadis, I. Inyang, M.R. Sim, R. Wolfe, R.J. Croft, Abramson, M.J. (2010). Use of mobile phones and changes in cognitive function in adolescents. *Occup Environ Med* 67(12): 861-866.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
					Zheng et al. (2015), Zheng et al. (2014)
			Birks, et al. (2017)		Birks et al. (2017), Chiu et al. (2015), Sudan et al. (2012), Divan et al. (2008) <u>SSM (2019), ICNIRP (2018), ANSES (2016a), SCENIHR (2015)</u> <i>Byun et al. (2013a), Byun et al. (2013b)</i>

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

ANSES (2016a). Exposition aux radiofréquences et santé des enfants. Avis de l'Anses. Rapport d'expertise collective. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.

Birks, L., M. Guxens, E. Papadopoulou, J. Alexander, F. Ballester, M. Estarlich, M. Gallastegi, M. Ha, M. Haugen, A. Huss, L. Kheifets, H. Lim, J. Olsen, L. Santa-Marina, M. Sudan, R. Vermeulen, T. Vrijkotte, E. Cardis, Vrijheid, M. (2017). Maternal cell phone use during pregnancy and child behavioral problems in five birth cohorts. *Environ Int*, 104, Jul: 122-131.

Byun, Y.H., M. Ha, H. J. Kwon, K.H. Choi, E. Burm, Y. Choi, M.H. Lim, S.J. Yoo, K.C. Paik, H.D. Choi, Kim, N. (2013a). Epidemiological characteristics of mobile phone ownership and use in Korean children and adolescents. *Environ Health Toxicol* 28: e2013018.

Byun, Y.H., M. Ha, H.J. Kwon, Y.C. Hong, J.H. Leem, J. Sakong, S.Y. Kim, C.G. Lee, D. Kang, H.D. Choi, Kim, N. (2013b). Mobile phone use, blood lead levels, and attention deficit hyperactivity symptoms in children: a longitudinal study. *PLoS One* 8(3): e59742.

Chiu, C.T., Y.H. Chang, C.C. Chen, M.C. Ko, Li, C.Y. (2015). Mobile phone use and health symptoms in children. *J Formos Med Assoc* 114(7): 598-604.

Divan, H.A., L. Kheifets, C. Obel, Olsen, J. (2008). Prenatal and postnatal exposure to cell phone use and behavioral problems in children. *Epidemiology* 19(4): 523-529.

ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.

SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.

Sudan, M., L. Kheifets, O. Arah, J. Olsen, Zeltzer, L. (2012). Prenatal and Postnatal Cell Phone Exposures and Headaches in Children. *Open Pediatr Med Journal* 6(2012): 46-52.

SSM (2019). Recent Research on EMF and Health Risk – Thirteenth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.

Zheng, F., P. Gao, M. He, M. Li, J. Tan, D. Chen, Z. Zhou, Z. Yu, Zhang, L. (2015). Association between mobile phone use and self-reported well-being in children: a questionnaire-based cross-sectional study in Chongqing, China. *BMJ open* 5(5): e007302.

Zheng, F., P. Gao, M. He, M. Li, C. Wang, Q. Zeng, Z. Zhou, Z. Yu, Zhang, L. (2014). Association between mobile phone use and inattention in 7102 Chinese adolescents: a population-based cross-sectional study. *BMC Public Health* 14: 1022.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
		<i>Deshmukh et al.(2015), Tang et al. (2015)</i>			
	Sun et al. (2016), Zuo et al (2015), Liu et al. (2013), Negovetic und Regel (2011), Zhijian et al. (2010) <i>Cam und Seyhan (2012)</i>	Trosic et al. (2011)			<i>Gandhi et al. (2015)</i>
	BfS (2008), Lehmann et al. (2003) <u>SSM (2018), ICNIRP (2018), SCENIHR (2015), ANSES (2013), SSK (2011)</u>	<i>Sekeroglu et al. (2012)</i>			
	Schuermann et al. (2017), Technopolis (2016), Layer et al. (2013), Seawind (2013), Speit et al. (2013), Vijayalaxmi et al. (2013), Zhijian et al. (2009), Schuermann et al. (2017) <i>Vijayalaxmi und Prihoda (2012, 2019)</i>	Seawind (2013) <u>SCENIHR (2015)</u>			Gulati et al. (2016)

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.

BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.

Cam, S.T., Seyhan, N. (2012). Single-strand DNA breaks in human hair root cells exposed to mobile phone radiation. Int J Radiat Biol 88(5): 420-424.

Deshmukh, P.S., N. Nasare, K. Megha, B.D. Banerjee, R.S. Ahmed, D. Singh, M.P. Abegaonkar, A.K. Tripathi, Mediratta, P.K. (2015). Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation. Int J Toxicol 34(3): 284-290.

Gandhi, G., G. Kaur, Nisar, U. (2015). A cross-sectional case control study on genetic damage in individuals residing in the vicinity of a mobile phone base station. Electromagn Biol Med 34(4): 344-354.

Gulati, S., A. Yadav, N. Kumar, Kanupriya, N.K. Aggarwal, R. Kumar, Gupta, R. (2016). Effect of GSTM1 and GSTT1 Polymorphisms on Genetic Damage in Humans Populations Exposed to Radiation From Mobile Towers. Arch Environ Contam Toxicol 70(3): 615-625.

ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.

Layer, P.G., A. Heselich, Waldmann, P. et al. (2013). Einfluss hochfrequenter Felder auf menschliche Fibroblasten (Genotoxizität). - Vorhaben 3607S04504. BfS-RES-FOR-80/13. BfS, Salzgitter.

Lehmann, H., M. Urech, Pickl, C. (2003). Tradescantia micronucleus bioassay for detecting mutagenicity of GSM-fields, in: 15th International Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility 2003, Zurich, February 18-20, 2003, 301-303.

Liu, C., W. Duan, S. Xu, C. Chen, M. He, L. Zhang, Z. Yu, Zhou, Z. (2013). Exposure to 1800 MHz radiofrequency electromagnetic radiation induces oxidative DNA base damage in a mouse spermatocyte-derived cell line. Toxicol Lett 218(1): 2-9.

Negovetic, S., Regel, S. (2011). Nichtionisierende Strahlung - Umwelt und Gesundheit. Schweizerischer Nationalfonds, Bern.

SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.

Schuermann, D., G.E. Beši, M. Manser, F. Focke, M.A. Sater, Z. Barekati, F. Noreen, Ch. Schmid, M. Murbach, J. Fröhlich, N. Kuster, Schär, P. (2017). Interaction Between Electromagnetic Fields and Cellular Mechanisms – What We Learned from Our Investigation of the Impact on Genome Integrity and Cell Proliferation. COST EMF-MED Workshop on Non-Thermal EMF Cancer Treatment. Warschau, 15.2.2017.

Seawind (2013). Sound Exposure & Risk Assessment of Wireless Network Devices (SEAWIND). FP7-ENV-2009-1 Final Summary Report. Research Report. Brussels.

ekero lu, V., A. Akar, ekero lu, Z.A. (2012). Cytotoxic and genotoxic effects of high-frequency electromagnetic fields (GSM 1800MHz) on immature and mature rats. Ecotoxicology and environmental safety 80: 140-144.

Speit, G., R. Gminski, Tauber, R. (2013). Genotoxic effects of exposure to radiofrequency electromagnetic fields (RF-EMF) in HL-60 cells are not reproducible. Mutat Res., 15, 755(2): 163-166.

SSK (2011). Biologische Auswirkungen des Mobilfunks, Gesamtschau. Bonn, Strahlenschutzkommission.

SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.

Sun, C., X. Wei, Y. Fei, L. Su, X. Zhao, G. Chen, Xu, Z. (2016). Mobile phone signal exposure triggers a hormesis-like effect in Atm+/+ and Atm-/- mouse embryonic fibroblasts. Sci Rep., Nov 18, 6: 37423.

Tang, J., Y. Zhang, L. Yang, Q. Chen, L. Tan, S. Zuo, H. Feng, Z. Chen, Zhu, G. (2015). Exposure to 900 MHz electromagnetic fields activates the mcp-1/ERK pathway and causes blood-brain barrier damage and cognitive impairment in rats. Brain Res 1601: 92-101.

- Technopolis (2015). Programme evaluation Electromagnetic Fields & Health (EMF&H). Technopolis Group, Amsterdam.
- Trosic, I., I. Pavicic, S. Milkovic-Kraus, M. Mladinic, Zeljezic, D. (2011). Effect of electromagnetic radiofrequency radiation on the rats' brain, liver and kidney cells measured by comet assay. *Coll Antropol* 35(4): 1259-1264.
- Vijayalaxmi, A.B. Reddy, R.J. McKenzie, R.L. McIntosh, T.J. Pihoda, Wood, A.W. (2013). Incidence of micronuclei in human peripheral blood lymphocytes exposed to modulated and unmodulated 2450 MHz radiofrequency fields. *Bioelectromagnetics* 34(7): 542-548.
- Vijayalaxmi, Pihoda, T.J. (2012). Genetic damage in human cells exposed to non-ionizing radiofrequency fields: a meta-analysis of the data from 88 publications (1990-2011). *Mutat Res* 749(1-2): 1-16.
- Vijayalaxmi, Pihoda, T.J. (2019). Comprehensive Review of Quality of Publications and Meta-analysis of Genetic Damage in Mammalian Cells Exposed to Non-Ionizing Radiofrequency Fields. *Radiation Research*, 191(1): 20-30.
- Zhijian, C., L. Xiaoxue, L. Yezhen, C. Shijie, J. Lifen, L. Jianlin, L. Deqiang, Jiliang, H. (2010). Impact of 1.8-GHz radiofrequency radiation (RFR) on DNA damage and repair induced by doxorubicin in human B-cell lymphoblastoid cells. *Mutat Res* 695(1-2): 16-21.
- Zhijian, C., L. Xiaoxue, L. Yezhen, L. Deqiang, C. Shijie, J. Lifen, L. Jianlin, Jiliang, H. (2009). Influence of 1.8-GHz (GSM) radiofrequency radiation (RFR) on DNA damage and repair induced by X-rays in human leukocytes in vitro. *Mutat Res* 677(1-2): 100-104.
- Zuo, H., T. Lin, D. Wang, R. Peng, S. Wang, Y. Gao, X. Xu, L. Zhao, S. Wang, Su, Z. (2015). RKIP Regulates Neural Cell Apoptosis Induced by Exposure to Microwave Radiation Partly Through the MEK/ERK/CREB Pathway. *Mol Neurobiol* 51(3): 1520-1529.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
	Kazemi et al. (2015), Burlaka et al. (2013), Dasdag et al. (2009)	Akbari et al. (2014) Cetin et al. (2014), Bilgici et al. (2013), Avci et al. (2012), Aydin und Akar (2011)			
	Hou et al. (2015), Wang et al. (2015), Ni et al. (2013) SSM (2018)	Jelodar et al. (2013), Megha et al. (2012), Esmekaya et al. (2011), Ozgur et al. (2010) SSM (2018) Cao et al (2015)			
	Xu et al. (2010), De Luliis et al. (2009) ICNIRP (2018), ANSES (2013)	SCENIHR (2015) Manta et al. (2014), Shahin et al. (2013)			
	Kang et al. (2014), Hong et al. (2012), BFS (2008)	Demirel et al. (2012), Lagroye (2007)			

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

Akbari, A., G. Jelodar, Nazifi, S. (2014). Vitamin C protects rat cerebellum and encephalon from oxidative stress following exposure to radiofrequency wave generated by a BTS antenna model. *Toxicol Mech Methods* 24(5): 347-352.

ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.

Avci, B., A. Akar, B. Bilgici, Tuncel, O.K. (2012). Oxidative stress induced by 1.8 GHz radio frequency electromagnetic radiation and effects of garlic extract in rats. *Int J Radiat Biol* 88(11): 799-805.

Aydin, B., Akar, A. (2011). Effects of a 900-MHz electromagnetic field on oxidative stress parameters in rat lymphoid organs, polymorphonuclear leukocytes and plasma. *Arch Med Res* 42(4): 261-267.

BFS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.

Bilgici, B., A. Akar, B. Avci, Tuncel, O.K. (2013). Effect of 900 MHz radiofrequency radiation on oxidative stress in rat brain and serum. *Electromagn Biol Med* 32(1): 20-29.

Burlaka, A., O. Tsybulin, E. Sidorik, S. Lukin, V. Polishuk, S. Tsehmistrenko, Yakymenko, I. (2013). Overproduction of free radical species in embryonal cells exposed to low intensity radiofrequency radiation. *Exp Oncol* 35(3): 219-225.

Cao, H., F. Qin, X. Liu, J. Wang, Y. Cao, J. Tong, Zhao, H. (2015). Circadian rhythmicity of antioxidant markers in rats exposed to 1.8 GHz radiofrequency fields. *Int J Environ Res Public Health* 12(2): 2071-2087.

Cetin, H., M. Naziroglu, O. Celik, M. Yuksel, N. Pastaci, Ozkaya, M.O. (2014). Liver antioxidant stores protect the brain from electromagnetic radiation (900 and 1800 MHz)-induced oxidative stress in rats during pregnancy and the development of offspring. *J Matern Fetal Neonatal Med* 27(18): 1915-1921.

Dasdag, S., M.Z. Akdag, E. Ulukaya, A.K. Uzunlar, Ocak, A.R. (2009). Effect of mobile phone exposure on apoptotic glial cells and status of oxidative stress in rat brain. *Electromagn Biol Med* 28(4): 342-354.

De Luliis, G.N., R.J. Newey, B.V. King, Aitken, R.J. (2009). Mobile phone radiation induces reactive oxygen species production and DNA damage in human spermatozoa in vitro. *PLoS One* 4(7): e6446.

Demirel, S., S. Doganay, Y. Turkoz, Z. Dogan, B. Turan, P. Firat, G. (2012). Effects of third generation mobile phone-emitted electromagnetic radiation on oxidative stress parameters in eye tissue and blood of rats. *Cutan Ocul Toxicol* 31(2): 89-94.

Esmekaya, M.A., C. Ozer, Seyhan, N. (2011). 900 MHz pulse-modulated radiofrequency radiation induces oxidative stress on heart, lung, testis and liver tissues. *Gen Physiol Biophys* 30(1): 84-89.

Hong, M.N., B.C. Kim, Y.G. Ko, Y.S. Lee, S.C. Hong, T. Kim, J.K. Pack, H.D. Choi, N. Kim, Lee, J.S. (2012). Effects of 837 and 1950 MHz radiofrequency radiation exposure alone or combined on oxidative stress in MCF10A cells. *Bioelectromagnetics* 33(7): 604-611.

Hou, Q., M. Wang, S. Wu, X. Ma, G. An, H. Liu, Xie, F. (2015). Oxidative changes and apoptosis induced by 1800-MHz electromagnetic radiation in NIH/3T3 cells. *Electromagn Biol Med* 34(1): 85-92.

ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.

Jelodar, G., A. Akbari, Nazifi, S. (2013). The prophylactic effect of vitamin C on oxidative stress indexes in rat eyes following exposure to radiofrequency wave generated by a BTS antenna model. *Int J Radiat Biol* 89(2): 128-131.

Kang, K.A., H.C. Lee, J.J. Lee, M.N. Hong, M.J. Park, Y.S. Lee, H.D. Choi, N. Kim, Y.G. Ko, Lee, J.S. (2014). Effects of combined radiofrequency radiation exposure on levels of reactive oxygen species in neuronal cells. *J Radiat Res* 55(2): 265-276.

Kazemi, E., S.M. Mortazavi, A. Ali-Ghanbari, S. Sharifzadeh, R. Ranjbaran, Z. Mostafavi-Pour, F. Zal, Haghani, M. (2015). Effect of 900 MHz Electromagnetic Radiation on the Induction of ROS in Human Peripheral Blood Mononuclear Cells. *J Biomed Phys Eng* 5(3): 105-114.

Lagroye, I., E. Haro, E. Ladevèze, C. Madelon, B. Billaudel, M. Taxile, Veyret, B. (2007). Effects of mobile telephony signals exposure on radical stress in the rat brain. in: Twenty-ninth Annual Technical Meeting of the Bioelectromagnetics Society, Kanazawa, Japan (Abstract book).

- Manta, A.K., D.J. Stravopodis, I.S. Papassideri, Margaritis, L.H. (2014). Reactive oxygen species elevation and recovery in Drosophila bodies and ovaries following short-term and long-term exposure to DECT base EMF. *Electromagnetic biology and medicine* 33(2): 118-131.
- Megha, K., P.S. Deshmukh, B.D. Banerjee, A.K. Tripathi, Abegaonkar, M.P. (2012). Microwave radiation induced oxidative stress, cognitive impairment and inflammation in brain of Fischer rats. *Indian J Exp Biol* 50(12): 889-896.
- Ni, S., Y. Yu, Y. Zhang, W. Wu, K. Lai, K. Yao, K. (2013). Study of oxidative stress in human lens epithelial cells exposed to 1.8 GHz radiofrequency fields. *PLoS One* 8(8): e72370.
- Ozgur, E., G. Guler, Seyhan, N. (2010). Mobile phone radiation-induced free radical damage in the liver is inhibited by the antioxidants N-acetyl cysteine and epigallocatechin-gallate. *Int J Radiat Biol* 86(11): 935-945.
- SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.
- Shahin, S., V.P. Singh, R.K. Shukla, A. Dhawan, R.K. Gangwar, S.P. Singh, Chaturvedi, C.M. (2013). 2.45 GHz microwave irradiation-induced oxidative stress affects implantation or pregnancy in mice, *Mus musculus*. *Applied biochemistry and biotechnology* 169(5): 1727-1751.
- SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.
- Wang, X., C. Liu, Q. Ma, W. Feng, L. Yang, Y. Lu, Z. Zhou, Z. Yu, W. Li, Zhang, L. (2015). 8-oxoG DNA glycosylase-1 inhibition sensitizes Neuro-2a cells to oxidative DNA base damage induced by 900 MHz radiofrequency electromagnetic radiation. *Cell Physiol Biochem* 37(3): 1075-1088.
- Xu, S., Z. Zhou, L. Zhang, Z. Yu, W. Zhang, Y. Wang, X. Wang, M. Li, Y. Chen, C. Chen, M. He, G. Zhang, Zhong, M. (2010). Exposure to 1800 MHz radiofrequency radiation induces oxidative damage to mitochondrial DNA in primary cultured neurons. *Brain Res* 1311, Jan: 189-196.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
					Balakrishnan et al. (2014)
	Zhijian et al. (2013), Chen et al. (2012), Maskey et al. (2010)				Mortazavi et al. (2012)
	ANSES (2015), Dasdag et al. (2012), ICNIRP (2018), SSM (2018), ANSES (2013) Soubere Mahamoud et al. (2016), Habauzit et al. (2014)	SCENIHR (2015)			
	Kuzniar et al. (2017), Haas et al. (2016), Kim et al. (2012), Ding et al. (2009), BFS (2008) ANSES (2013) Le Quement et al. (2014), Le Quement et al. (2012), Sekijima et al. (2010)	Dawe et al. (2009), Finnie et al. (2009) ANSES (2013)			

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Referenzen

ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.

ANSES (2015). Exposition aux agents physiques et aux nouvelles technologies : quels effets sanitaires ?, Agence nationale de sécurité sanitaire, alimentation, environnement, travail.

Balakrishnan, K., V. Murali, C. Rathika, T. Manikandan, R.P. Malini, R.A. Kumar, Krishnan, M. (2014). Hsp70 is an independent stress marker among frequent users of mobile phones. J Environ Pathol Toxicol Oncol 33(4): 339-347.

BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.

Chen, G., D. Lu, H. Chiang, D. Leszczynski, Xu, Z. (2012). Using model organism Saccharomyces cerevisiae to evaluate the effects of ELF-MF and RF-EMF exposure on global gene expression. Bioelectromagnetics 33(7): 550-560.

Dasdag, S., M.Z. Akdag, G. Kizil, M. Kizil, D.U. Cakir, Yokus, B. (2012). Effect of 900 MHz radio frequency radiation on beta amyloid protein, protein carbonyl, and malondialdehyde in the brain. Electromagn Biol Med 31(1): 67-74.

Dawe, A.S., R.K. Bodhicharla, N.S. Graham, S.T. May, T. Reader, B. Loader, A. Gregory, M. Swicord, G. Bit-Babik, de Pomerai, D.I. (2009). Low-intensity microwave irradiation does not substantially alter gene expression in late larval and adult Caenorhabditis elegans. Bioelectromagnetics 30(8): 602-612.

Ding, G.R., X.W. Wang, K.C. Li, L.B. Qiu, S.L. Xu, J. Tan and Guo, G.Z. (2009). Comparison of Hsps expression after radio-frequency field exposure in three human glioma cell lines. Biomed Environ Sci 22(5): 374-380.

Finnie, J.W., G. Chidlow, P.C. Blumbergs, J. Manavis, Cai, Z. (2009). Heat shock protein induction in fetal mouse brain as a measure of stress after whole of gestation exposure to mobile telephony radiofrequency fields. Pathology 41(3): 276-279.

Haas, A.J., Y. Le Page, M. Zhadobov, A. Boriskin, R. Sauleau, Le Drean, Y. (2016). Impact of 60-GHz millimeter waves on stress and pain-related protein expression in differentiating neuron-like cells. Bioelectromagnetics 37(7): 444-454.

Habauzit, D., C. Le Quement, M. Zhadobov, C. Martin, M. Aubry, R. Sauleau, Le Drean, Y. (2014). Transcriptome analysis reveals the contribution of thermal and the specific effects in cellular response to millimeter wave exposure. PLoS One 9(10): e109435.

ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.

Kim, H.N., N.K. Han, M.N. Hong, S.G. Chi, Y.S. Lee, T. Kim, J.K. Pack, H.D. Choi, N. Kim, Lee, J.S. (2012). Analysis of the cellular stress response in MCF10A cells exposed to combined radio frequency radiation. J Radiat Res 53(2): 176-183.

Kuzniar, A., C. Laffeber, B. Eppink, K. Bezstarosti, D. Dekkers, H. Woelders, A. P. Zwamborn, J. Demmers, J. H. Lebbink, Kanaar, R. (2017). Semi-quantitative proteomics of mammalian cells upon short-term exposure to non-ionizing electromagnetic fields. PLoS One 12(2): e0170762.

Le Quement, C., C.N. Nicolaz, D. Habauzit, M. Zhadobov, R. Sauleau, Le Drean, Y. (2014). Impact of 60-GHz millimeter waves and corresponding heat effect on endoplasmic reticulum stress sensor gene expression. Bioelectromagnetics 35(6): 444-451.

Le Quement, C., C. Nicolas Nicolaz, M. Zhadobov, F. Desmots, R. Sauleau, M. Aubry, D. Michel, Le Drean, Y. (2012). Whole-genome expression analysis in primary human keratinocyte cell cultures exposed to 60 GHz radiation. Bioelectromagnetics 33(2): 147-158.

Maskey, D., M. Kim, B. Aryal, J. Pradhan, I.Y. Choi, K.S. Park, T. Son, S.Y. Hong, S.B. Kim, H.G. Kim, Kim, M.J. (2010). Effect of 835 MHz radiofrequency radiation exposure on calcium binding proteins in the hippocampus of the mouse brain. Brain Res 1313: 232-241.

Mortazavi, S.M., S. Vazife-Doost, M. Yaghooti, S. Mehdizadeh, Rajae-Far, A. (2012). Occupational exposure of dentists to electromagnetic fields produced by magnetostrictive cavitrons alters the serum cortisol level. J Nat Sci Biol Med 3(1): 60-64.

SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.

Sekijima, M., H. Takeda, K. Yasunaga, N. Sakuma, H. Hirose, T. Nojima, Miyakoshi, J. (2010). 2-GHz band CW and W-CDMA modulated radiofrequency fields have no significant effect on cell proliferation and gene expression profile in human cells. J Radiat Res 51(3): 277-284.

Souberé Mahamoud, Y., M. Aite, C. Martin, M. Zhadobov, R. Sauleau, Y. Le Drian, Habauzit, D. (2016). Additive Effects of Millimeter Waves and 2-Deoxyglucose Co-Exposure on the Human Keratinocyte Transcriptome. PLoS One 11(8): e0160810.

SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.

Zhijian, C., L. Xiaoxue, Z. Wei, L. Yezhen, L. Jianlin, L. Deqiang, C. Shijie, J. Lifan, Jiliang, H. (2013). Studying the protein expression in human B lymphoblastoid cells exposed to 1.8-GHz (GSM) radiofrequency radiation (RFR) with protein microarray. *Biochem Biophys Res Commun* 433(1): 36-39.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
	BfS (2008)				
	Ertilav et al. (2018) Liu et al. (2014)				
	ANSES (2017b), Parham et al. (2016), Negovetic und Regel (2011) ICNIRP (2018), SSM (2018)	Negovetic und Regel (2011)			
	Beyer et al. (2014), Lee et al. (2011), Negovetic und Regel (2011) SCENIHR (2015)	Naziroglu et al. (2015)			

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

ANSES (2017b). Radiofréquences & santé. Maisons-Alfort, Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail.

Beyer, C., P. Christen, I. Jelesarov, Fröhlich, J. (2014). Real-time assessment of possible electromagnetic-field-induced changes in protein conformation and thermal stability. *Bioelectromagnetics* 35(7): 470-478.

BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.

Ertilav, K, F. Uslusoy, S. Ataizi, Naziro lu, M. (2018). Long term exposure to cell phone frequencies (900 and 1800 MHz) induces apoptosis, mitochondrial oxidative stress and TRPV1 channel activation in the hippocampus and dorsal root ganglion of rats. *Metab Brain*, 33(3): 753-763.

ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.

Naziroglu, M., F.F. Ozkan, S.R. Hapil, V. Ghazizadeh, Cig, B. (2015). Epilepsy but not mobile phone frequency (900 MHz) induces apoptosis and calcium entry in hippocampus of epileptic rat: involvement of TRPV1 channels. *J Membr Biol* 248(1): 83-91.

Negovetic, S., Regel, S. (2011). Nichtionisierende Strahlung - Umwelt und Gesundheit. Schweizerischer Nationalfonds, Bern.

Lee, K.Y., B.C. Kim, N.K. Han, Y.S. Lee, T. Kim, J.H. Yun, N. Kim, J.K. Pack, Lee, J.S. (2011). Effects of combined radiofrequency radiation exposure on the cell cycle and its regulatory proteins. *Bioelectromagnetics* 32(3): 169-178.

Liu, K., Y. Li, G. Zhang, J. Liu, J. Cao, L. Ao, Zhang, S. (2014). Association between mobile phone use and semen quality: a systemic review and meta-analysis. *Andrology* 2(4): 491-501.

Parham, F., C.J. Portier, X. Chang, M. Mevissen (2016). The Use of Signal-Transduction and Metabolic Pathways to Predict Human Disease Targets from Electric and Magnetic Fields Using in vitro Data in Human Cell Lines. *Frontiers in Public Health* 4: 193.

SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.

SSM (2018). Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
					Foerster et al. (2018) ANSES (2013)
				Negovetic und Regel (2011) ANSES (2016a)	Birks et al. (2017), Sudan et al. (2013), Negovetic und Regel (2011) ANSES (2016a)
			Christ et al. (2010a), Christ et al. (2010b)	SSK (2011)	Choi et al. (2014) SSK (2011)

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Referenzen

ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.

ANSES (2016a). Exposition aux radiofréquences et santé des enfants. Avis de l'Anses. Rapport d'expertise collective. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.

Birks, L., M. Guxens, E. Papadopoulou, J. Alexander, F. Ballester, M. Estarlich, M. Gallastegi, M. Ha, M. Haugen, A. Huss, L. Kheifets, H. Lim, J. Olsen, L. Santa-Marina, M. Sudan, R. Vermeulen, T. Vrijkotte, E. Cardis, Vrijheid, M. (2017). Maternal cell phone use during pregnancy and child behavioral problems in five birth cohorts. Environ Int., 104, Jul: 122-131.

Christ, A., M.C. Gosselin, M. Christopoulou, S. Kühn, Kuster, N. (2010a). Age dependent tissue-specific exposure of cell phone users, Physics in Medicine and Biology 55: 1767-1783.

Christ, A., M.C. Gosselin, S. Kühn, Kuster, N. (2010b). Impact of pinna compression on the RF Absorption in the heads of adult and juvenile cell phone users. Bioelectromagnetics 31(5): 406-412.

Choi, S.B., M.K. Kwon, J.W. Chung, J.S. Park, K. Chung, Kim, D.W. (2014). Effects of short-term radiation emitted by WCDMA mobile phones on teenagers and adults. BMC Public Health 14: 438.

Foerster M, A. Thielens, W. Joseph, M. Eeftens, Rösli, M. (2018). A prospective cohort study of adolescents' memory performance and individual brain dose of microwave radiation from wireless communication. Environ Health Perspect. 126(7): 077007, 1-13.

Negovetic, S. und S. Regel (2011). Nichtionisierende Strahlung - Umwelt und Gesundheit. Schweizerischer Nationalfonds, Bern.

SSK (2011). Biologische Auswirkungen des Mobilfunks, Gesamtschau. Bonn, Strahlenschutzkommission.

Sudan, M., L. Kheifets, O.A. Arah, Olsen, J. (2013). Cell phone exposures and hearing loss in children in the Danish National Birth Cohort. Paediatr Perinat Epidemiol 27(3): 247-257.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
			Sauter et al. (2014)	Negovetic und Regel (2011)	Negovetic und Regel (2011)

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keine Hinweise
 Evidenznachweis für Effekte

Referenzen

Negovetic, S., Regel, S. (2011). Nichtionisierende Strahlung - Umwelt und Gesundheit. Schweizerischer Nationalfonds, Bern.

Sauter, C., T. Eggert, H. Dorn, Danker-Hopfe, H. (2014). Literaturübersicht im Rahmen des Projekts: Einfluss hochfrequenter elektromagnetischer Felder auf Gehirnaktivität, Schlaf und kognitive Leistungsfähigkeit älterer Personen beider Geschlechter - Vorhaben 3613S30012. BfS-RESFOR 99/14. BfS, Salzgitter.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
		ANSES (2013)	ANSES (2013)		
	BfS (2008) ICNIRP (2018)	Ohtani et al. (2015), Technopolis (2015), BfS (2008)			SSK (2011)

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 Evidenznachweis für Effekte

Referenzen

ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.

BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.

ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.

Ohtani, S., A. Ushiyama, M. Maeda, Y. Ogasawara, J. Wang, N. Kunugita, Ishii, K. (2015). The effects of radio-frequency electromagnetic fields on T cell function during development. J Radiat Res 56(3): 467-474.

SSK (2011). Biologische Auswirkungen des Mobilfunks, Gesamtschau. Bonn, Strahlenschutzkommission.

Technopolis (2015). Programme evaluation Electromagnetic Fields & Health (EMF&H). Technopolis Group, Amsterdam.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
	Vojisavljevic et al. (2011)	BfS (2008) <i>Khalil, Gagaa et al. (2012)</i>			
		<i>Seyednour und Chekaniazar (2011)</i>			
		Technopolis (2015)			

ausreichend
limitiert
inadäquat
keine Hinweise
 Evidenznachweis für Effekte

Referenzen

BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.

Khalil, A.M., M.H. Gagaa, Alshamali, A.M. (2012). 8-Oxo-7, 8-dihydro-2'-deoxyguanosine as a biomarker of DNA damage by mobile phone radiation. Hum Exp Toxicol 31(7): 734-740.

Seyednour, R., Chekaniazar, V. (2011). Effects of Exposure to Cellular Phones 950 MHZ Electromagnetic Fields on Progesterone, Cortisol and Glucose Level in Female Hamsters (*Mesocricetus auratus*). Asian Journal of Animal and Veterinary Advances 6(11): 1084-1088.

Vojisavljevic, V., E. Pirogova, Cosic, I. (2011). Low intensity microwave radiation as modulator of the L-lactate dehydrogenase activity. Medical & biological engineering & computing 49(7): 793-799.

Technopolis (2015). Programme evaluation Electromagnetic Fields & Health (EMF&H). Technopolis Group, Amsterdam.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
		<i>Aydogan et al. (2015), Ozgur et al. (2015), Sekin et al. (2014)</i> <i>Budak et al. (2009a), Budak et al. (2009b), Budak et al. (2009c), Budak et al. (2009d)</i>	<u>ICNIRP (2018)</u>		
		<u>ICNIRP (2018), ANSES (2013)</u>	<u>ANSES (2013)</u>		<i>Gupta et al. (2015), Panda et al. (2011), Panda et al. (2010)</i>
		BfS (2008) <i>Kayabasoglu et al. (2011)</i>	<i>Adibzadeh et al. (2016)</i>		<u>ICNIRP (2018), SSK (2011)</u>

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

Adibzadeh, F., G.C. van Rhoon, G.M. Verduijn, N.C. Naus-Postema, Paulides, M.M. (2016). Absence of acute ocular damage in humans after prolonged exposure to intense RF EMF. *Phys Med Biol* 61(2): 488-503.

ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.

Aydogan, F., E. Aydin, G. Koca, E. Ozgur, P. Atilla, A. Tuzuner, S. Demirci, A. Tomruk, G.G. Ozturk, N. Seyhan, M. Korkmaz, S. Muftuoglu, Samim, E.E. (2015). The effects of 2100-MHz radiofrequency radiation on nasal mucosa and mucociliary clearance in rats. *Int Forum Allergy Rhinol* 5(7): 626-632.

BfS (2008). Ergebnisse des Deutschen Mobilfunk Forschungsprogramms. Bundesamt für Strahlenschutz, Salzgitter.

Budak, G.G., N.B. Muluk, B. Budak, G.G. Ozturk, A. Apan, Seyhan, N. (2009a). Effects of GSM-like radiofrequency on distortion product otoacoustic emissions of rabbits: comparison of infants versus adults. *Int J Pediatr Otorhinolaryngol* 73(8): 1143-1147.

Budak, G.G., N.B. Muluk, B. Budak, G.G. Ozturk, A. Apan, Seyhan, N. (2009b). Effects of intrauterine and extrauterine exposure to GSM-like radiofrequency on distortion product otoacoustic emissions in infant male rabbits. *Int J Pediatr Otorhinolaryngol* 73(3): 391-399.

Budak, G.G., N.B. Muluk, B. Budak, G.G. Ozturk, A. Apan, Seyhan, N. (2009c). Effects of Intrauterine and Extrauterine GSM-like Radiofrequency on Distortion Product Otoacoustic Emissions in Infant Female Rabbits. *Journal of International Advanced Otology* 5(2): 209-217.

Budak, G.G., N.B. Muluk, G.G. Ozturk, B. Budak, A. Apan, N. Seyhan, Sanli, C. (2009d). Effects of GSM-like radiofrequency on distortion product otoacoustic emissions in pregnant adult rabbits. *Clin Invest Med* 32(2): E112-116.

Gupta, N., D. Goyal, R. Sharma, Arora, K.S. (2015). Effect of Prolonged Use of Mobile Phone on Brainstem Auditory Evoked Potentials. *J Clin Diagn Res* 9(5): Cc07-09.

ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.

Kayabasoglu, G., O.S. Sezen, G. Eraslan, E. Aydin, T. Coskuner, Unver, S. (2011). Effect of chronic exposure to cellular telephone electromagnetic fields on hearing in rats. *J Laryngol Otol* 125(4): 348-353.

Ozgur, A., L. Tumkaya, S. Terzi, Y. Kalkan, O.C. Erdivanli, Dursun, E. (2015). Effects of chronic exposure to electromagnetic waves on the auditory system. *Acta Otolaryngol* 135(8): 765-770.

Panda, N.K., R. Jain, J. Bakshi, Munjal, S. (2010). Audiologic disturbances in long-term mobile phone users. *J Otolaryngol Head Neck Surg* 39(1): 5-11.

Panda, N.K., R. Modi, S. Munjal, Virk, R.S. (2011). Auditory changes in mobile users: is evidence forthcoming? *Otolaryngol Head Neck Surg* 144(4): 581-585.

Seckin, E., F. Suren Basar, S. Atmaca, F.F. Kaymaz, A. Suzer, A. Akar, E. Sunan, Koyuncu, M. (2014). The effect of radiofrequency radiation generated by a Global System for Mobile Communications source on cochlear development in a rat model. *J Laryngol Otol* 128(5): 400-405.

SSK (2011). Biologische Auswirkungen des Mobilfunks, Gesamtschau. Bonn, Strahlenschutzkommission.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
		<i>Ragy (2015), Yilmaz et al (2014), Kesari et al. (2012)</i>			
	<i>Sun et al. (2017)</i>	<i>Cam et al. (2014)</i>			
	<i>ICNIRP (2018), Mattsson et al. (2018) Ballardin et al. (2011)</i>	<i>Sieron-Stoltny et al. (2015)</i>			
	<i>ANSES (2017b), Canseven et al. (2015), Lee et al. (2014), Xu et al (2013) Simko et al. (2016)</i>				

ausreichend limitiert inadäquat keine Hinweise Evidenznachweis für Effekte

Referenzen

- ANSES (2017b). Radiofréquences & santé. Maisons-Alfort, Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail.
- Ballardin, M., I. Tusa, N. Fontana, A. Monorchio, C. Pelletti, A. Rogovich, R. Barale, Scarpato, R. (2011)*. Non-thermal effects of 2.45 GHz microwaves on spindle assembly, mitotic cells and viability of Chinese hamster V-79 cells. *Mutat Res* 716(1-2): 1-9.
- Cam, S.T., N. Seyhan, C. Kavakli, Celikbicak, O. (2014)*. Effects of 900 MHz radiofrequency radiation on skin hydroxyproline contents. *Cell Biochem Biophys* 70(1): 643-649.
- Canseven, A.G., M.A. Esmekaya, H. Kayhan, M.Z. Tuysuz, Seyhan, N. (2015)*. Effects of microwave exposure and Gemcitabine treatment on apoptotic activity in Burkitt's lymphoma (Raji) cells. *Electromagn Biol Med* 34(4): 322-326.
- ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.
- Kesari, K.K., S. Kumar, Behari, J. (2012)*. Pathophysiology of microwave radiation: effect on rat brain. *Appl Biochem Biotechnol* 166(2): 379-388.
- Lee, S.S., H.R. Kim, M.S. Kim, S. Park, E.S. Yoon, S.H. Park, Kim, D.W. (2014)*. Influence of smartphone Wi-Fi signals on adipose-derived stem cells. *J Craniofac Surg* 25(5): 1902-1907.
- Mattsson, M-O., O. Zeni, Simkó, M. (2018). Is there a Biological Basis for Therapeutic Applications of Millimetre Waves and THz Waves? *J Infrared Milli Terahz Waves*, doi.org/10.1007/s10762-018-0483-5
- Ragy, M.M. (2015)*. Effect of exposure and withdrawal of 900-MHz-electromagnetic waves on brain, kidney and liver oxidative stress and some biochemical parameters in male rats. *Electromagn Biol Med* 34(4): 279-284.
- Sieron-Stoltny, K., L. Teister, G. Cieslar, D. Sieron, Z. Sliwinski, M. Kucharzewski, Sieron, A. (2015)*. The influence of electromagnetic radiation generated by a mobile phone on the skeletal system of rats. *Biomed Res Int* 2015: 896019.
- Simko, M., D. Remondini, O. Zeni, Scarfi, R. (2016). Quality Matters: Systematic Analysis of Endpoints Related to Cellular Life in Vitro Data of Radiofrequency Electromagnetic Field Exposure. *Int J Environ Res Public Health*, 13(7): E701
- Sun, Y., Zong, L., Gao, Z., Zhu, S., Tong, J., Cao, Y. (2017)*. Mitochondrial DNA damage and oxidative damage in HL-60 cells exposed to 900MHz radiofrequency fields. *Mutat Res*, 797-799: 7-14.
- Xu, S., G. Chen, C. Chen, C. Sun, D. Zhang, M. Murbach, N. Kuster, Q. Zeng, Xu, Z. (2013)*. Cell type-dependent induction of DNA damage by 1800 MHz radiofrequency electromagnetic fields does not result in significant cellular dysfunctions. *PLoS One* 8(1): e54906
- Yilmaz, A., N. Yilmaz, Y. Serarslan, M. Aras, M. Altas, T. Ozgur, Sefil, F. (2014)*. The effects of mobile phones on apoptosis in cerebral tissue: eean experimental study on rats. *Eur Rev Med Pharmacol Sci* 18(7): 992-1000.

	Zellstudien	Tierstudien	Humanstudien		
			Physiologie	akut	chronisch
	He et al. (2017)				
	Sannino et al. (2014)	Zong et al. (2015), Li et al. (2014), Jiang et al. (2013), Jiang et al. (2012), Jin et al. (2012), Cao et al. (2011) <u>SSM (2019)</u>			
	Sannino et al. (2017) <u>SCENIHR (2015)</u>	<u>ICNIRP (2018)</u> , <u>SCENIHR (2015)</u> , <u>ANSES (2013)</u>			
		Lerchl (2018), Tillmann et al. (2010)			

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Referenzen

ANSES (2013). Update of the Radiofrequency electromagnetic fields and health" expert appraisal. Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail, Maisons-Alfort.

Cao, Y., Q. Xu, Z. D. Jin, Z. Zhou, J. H. Nie, Tong, J. (2011). Induction of adaptive response: pre-exposure of mice to 900 MHz radiofrequency fields reduces hematopoietic damage caused by subsequent exposure to ionising radiation. *Int J Radiat Biol* 87(7): 720-728.

He, Q., L. Zong, Y. Sun, Y., Vijayalaxmi, T.J. Prihoda, J. Tong, Cao, Y. (2017). Adaptive response in mouse bone marrow stromal cells exposed to 900MHz radiofrequency fields: Impact of poly (ADP-ribose) polymerase (PARP). *Mutat Res.*, 820, Aug: 19-25.

ICNIRP (2018). Draft - ICNIRP Guidelines: Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (100 kHz to 300 GHz): Appendix B: Health Risk Assessment Literature.

Jiang, B., J. Nie, Z. Zhou, J. Zhang, J. Tong, Cao, Y. (2012). Adaptive response in mice exposed to 900 MHz radiofrequency fields: primary DNA damage. *PLoS One* 7(2): e32040.

Jiang, B., C. Zong, H. Zhao, Y. Ji, J. Tong, Cao, Y. (2013). Induction of adaptive response in mice exposed to 900MHz radiofrequency fields: application of micronucleus assay. *Mutat Res* 751(2): 127-129.

Jin, Z., C. Zong, B. Jiang, Z. Zhou, J. Tong, Cao, Y. (2012). The effect of combined exposure of 900 MHz radiofrequency fields and doxorubicin in HL-60 cells. *PLoS One* 7(9): e46102.

Lerchl, A. (2018). Synergistische Wirkungen hochfrequenter elektromagnetischer Felder in Kombination mit kanzerogenen Substanzen – Kokanzerogenität oder Tumorpromotion? Vorhaben 3615S82431. BfS, Salzgitter.

Li, W.H., Y.Z. Li, D.D. Song, X.R. Wang, M. Liu, X.D. Wu, Liu, X.H. (2014). Calreticulin protects rat microvascular endothelial cells against microwave radiation-induced injury by attenuating endoplasmic reticulum stress. *Microcirculation* 21(6): 506-515.

Sannino A, O. Zeni, S. Romeo, R. Massa, G. Gialanella, G. Grossi, L. Manti, Vijayalaxmi, Scarfi, M.R. (2014). Adaptive response in human blood lymphocytes exposed to non-ionizing radiofrequency fields: resistance to ionizing radiation-induced damage. *J Radiat Res*, 55(2): 210-217.

Sannino A, O. Zeni, S. Romeo, R. Massa, Scarfi, M.R. (2017). Adverse and Beneficial Effects in Chinese Hamster Lung Fibroblast Cells Following Radiofrequency Exposure. *Bioelectromagnetics*, 38(4): 245-254.

SCENIHR (2015). Potential health effects of exposure to electromagnetic fields (EMF). Scientific Committee on Emerging and Newly Identified Health Risks, Brussels.

SSM (2019). Recent Research on EMF and Health Risk – Thirteenth report from SSM's Scientific Council on Electromagnetic Fields. Swedish Radiation Safety Authority, Stockholm.

Tillmann T, H. Ernst, J. Streckert, Y. Zhou, F. Taugner, V. Hansen V, Dasenbrock, C. (2010). Indication of cocarcinogenic potential of chronic UMTS-modulated radiofrequency exposure in an ethylnitrosourea mouse model. *Int J Radiat Biol* 86(7): 529-541.

Zong, C., Y. Ji, Q. He, S. Zhu, F. Qin, J. Tong, Cao, Y. (2015). Adaptive response in mice exposed to 900 MHz radiofrequency fields: bleomycin-induced DNA and oxidative damage/repair. *Int J Radiat Biol* 91(3): 270-276.



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FSM – Swiss Research Foundation for
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FSM – Forschungsstiftung Strom und Mobilkommunikation
c/o ETH Zürich
Institut für Elektromagnetische Felder (ETZ K89)
Gloriastr. 35
CH-8092 Zürich

Tel. +41 44 632 59 78
Fax +41 44 632 11 98
info@emf.ethz.ch
www.emf.ethz.ch