

Spotlight on EMF Research

Spotlight on “Mobile phone specific radiation disturbs cytokinesis and causes cell death but not acute chromosomal damage in buccal cells: Results of a controlled human intervention study” by Kundi et al. in Environmental Research (2024)

Category [radiofrequency, human study]

Spotlight - Sep/2024 no.5 (Eng)

Competence Centre Electromagnetic Fields (KEMF)

1 Putting the paper into context by the BfS

Currently, radiofrequency electromagnetic fields (RF-EMF) are classified by the International Agency for Research on Cancer (IARC) into Group 2B "possibly carcinogenic" on the IARC scale. The classification is based on limited evidence from epidemiological studies on humans and on limited evidence from laboratory tests on animals. However, a carcinogenic potential of RF-EMF is not supported by recent epidemiological findings [2]. There are also no established molecular mechanisms which could lead to neoplastic transformation of cells by RF-EMF, but the research is still ongoing and the results of many studies are controversial, and their reliability strongly depends on study quality [3]. The present study aimed to investigate potential genotoxic and cytotoxic effects of RF-EMF exposure in cells from human oral cavity [1].

2 Results and conclusions from the authors' perspective

The study [1] investigated the effects of exposure to a generic UMTS-like RF-EMF signal on buccal cells (i.e., cells from the inside of the cheek) in the human oral cavity. The researchers conducted a controlled intervention study under laboratory conditions.

Twenty-one participants were randomly allocated to the low-exposure group: one did not complete the study, nine were exposed on the left side, and eleven were exposed on the right side. Twenty-one

participants were allocated to the high-exposure group, ten were exposed on the left side and eleven on the right side. There were 21 males and 20 females, evenly distributed between the groups.

The exposure of the cheek region was achieved by antennas placed in special headsets worn by the participants. The participants were exposed to the UMTS signal for 2 hours per day for 5 consecutive days inside a shielded cabin with walls covered by RF-absorbing material. The specific absorption rate (SAR) spatially averaged over the whole mucosa was 0.1 W/kg and 1.6 W/kg in the low and high exposure group, respectively. The exposure set-up was validated by measurements in a homogeneous phantom and by numerical simulations in three different anatomical models. There was a sufficient exposure contrast between the two exposure levels, and the exposure was applied in a double-blind fashion. The exposure of the participants due to regular use of mobile phones was assessed by questionnaires. All participants were asked to use hands-free devices three weeks before and during the intervention period, as well as three weeks after the last exposure.

Buccal cells were collected from both cheeks immediately before and three weeks after the end of the exposure. 2000 cells per sample were examined for various nuclear anomalies indicative of genotoxic and cytotoxic effects according to the recommendations of international guidelines [4]. Nuclear anomalies were statistically evaluated by generalized models with the factors exposure group, exposure side, and time (before and after exposure). Age, sex, smoking, and mobile phone use without a hands-free device were included as covariates.

The authors observed no evidence of induction of micronuclei and nuclear buds, which are indicative of genetic instability and chromosomal aberrations.

The number of karyorrhectic and binucleated cells was statistically significantly increased after exposure to the higher RF-EMF level. After exposure to the higher RF-EMF level, the frequency of karyorrhectic cells and cells with condensed chromatin was statistically significantly higher on the exposed side. For binucleated cells, the difference did not reach statistical significance.

The authors interpret these results as an indication that exposure to the UMTS-like RF-EMF signals causes acute cytotoxic effects and disturbed cytokinesis.

3 Comments by the BfS

The present study found evidence for increased cellular damage (cytotoxicity) in the buccal cells of study participants three weeks after exposure to a generic UMTS signal. Markers of genetic damage (genotoxicity), such as micronuclei, were not increased. Compared to 21 previous cross-sectional studies investigating induction of micronuclei in buccal cells of subjects exposed to cell phone radiation by their daily use ([1], Supplementary Table 1), of which some found increases in micronuclei, the present study used improved methods:

- For the first, time a defined, dosimetrically characterized exposure set-up was applied instead of using questionnaires for exposure assessment. Thus, exposure misclassification could be avoided.
- Exposure was allocated randomly in a double-blind fashion; bias due to subjective expectations of the scientific staff was avoided.
- Specific staining methods and sufficient number of cells as recommended in [4] were used to avoid artefacts. In fact, contrary to previous studies, no micronuclei or chromosomal aberrations were found.

However, there are some aspects that limit generalizability of the findings and the relevance of the results for risk assessment:

- Weekly sampling of buccal cells from 7 to 21 days is recommended [4], but in the present paper, only one sample was taken 21 days after the end of exposure. The recommended number of



evaluation time points is important to improve the evidence, reduce the effect of random short-term variations and to account for variability in the buccal mucosa renewal rate.

- In the present study, there was no unexposed or sham-exposed parallel group. Thomas et al. [4] recommend establishing a normal range of values for the different buccal cytome biomarkers in healthy control subjects to help to distinguish time trends and normal biological variability from exposure effects.

The present study represents a considerable qualitative improvement over previous studies ([1] Supplementary Table 1). It shows the absence of chromosomal damage three weeks after UMTS exposure. The shortcomings mentioned above reduce the scientific validity of the study. The observed cytotoxic effects need to be independently replicated and their biological relevance, if any, confirmed.



References

- [1] Kundi M, Nersesyan A, Schmid G, et al. Mobile phone specific radiation disturbs cytokinesis and causes cell death but not acute chromosomal damage in buccal cells: Results of a controlled human intervention study. *Environ Res*. Published online March 6, 2024. doi:10.1016/j.envres.2024.118634
- [2] Feychting M, Schüz J, Toledano MB, et al. Mobile phone use and brain tumour risk - COSMOS, a prospective cohort study. *Environ Int*. 2024;185:108552. doi:10.1016/j.envint.2024.108552
- [3] Vijayalaxmi, Prihoda TJ. Comprehensive Review of Quality of Publications and Meta-analysis of Genetic Damage in Mammalian Cells Exposed to Non-Ionizing Radiofrequency Fields. *Radiat Res*. 2019;191(1):20-30. doi:10.1667/RR15117.1
- [4] Thomas P, Holland N, Bolognesi C, et al. Buccal micronucleus cytome assay. *Nat Protoc*. 2009;4(6):825-837. doi:10.1038/nprot.2009.53



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