

Substances with hormone-like activity in mineral water from PET bottles

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In a recently published study on mineral waters from various manufacturers, scientists at Johann Wolfgang Goethe University Frankfurt established that some of the samples examined in an *in vitro* test system revealed the presence of not otherwise specified substances with hormone-like activity. The scientists noted that this effect was determined more particularly in samples taken from mineral water in bottles made of the plastic PET. Amongst the public at large this prompted questions about the potential health impact of drinking mineral water from PET bottles. The Federal Institute for Risk Assessment (BfR) has undertaken an initial, provisional assessment of the study findings.

In its initial review of the study, BfR determined that the study indicates the presence of contamination of oestrogen-like activity in some of the samples examined. However, it was not examined which substances caused this activity. The effect was confirmed through an artificial *in vitro* system with genetically changed yeast cells (YES-test). The yeast cells contain parts of the abundance of human hormone signals and react very sensitively to the hormone 17 β -estradiol and similarly effective substances. The authors interpreted their results to reveal the presence of substances of an effective oestrogenic concentration. Nonetheless, it should be noted that the effect of known xenoestrogens is significantly weaker in the testing system used here. For example, the effect of nonylphenol is weaker than the natural hormone 17 β -estradiol by a factor of about 10,000. The concentrations of substances must thus be adequately high, which does not appear plausible.

Samples of different brands of mineral water showed considerable differences in the assays used. Yet these data allow no deduction on differences in packaging (glass versus PET). The possibility that these substances stem from the PET plastic as discussed by the authors is rather doubtful since comparable activity was detected in water samples from glass bottles as well as water samples from PET bottles of the same brand of mineral water in the assay used. Differences were especially apparent for water of different origin. It would be useful to have comparative data with mineral water samples that come directly from the source.

A snail model was used in a second experiment. Snails were kept in standard glass and PET bottles with special added water as nutrient solution (no mineral water). After 54 days, the number of embryos produced by the snails was counted. The reproductive rate of animals kept in glass or PET bottles was compared with the reproductive rate of animals that were kept in water enriched with oestrogen. It appeared that the reproductive rate of animals kept in PET bottles and that of animals kept in oestrogen-enriched water was comparable. The reproductive rate of animals kept in glass bottles was comparably lower. Whether this testing system permits relevant conclusions concerning consumer health risk is rather doubtful.

BfR is not aware of any substances used in PET production that migrate into the mineral water and that could be responsible for the oestrogen-like activity detected in samples from PET bottles. It is known that certain plasticisers are used, for example, in plastics such as PVC that have been proven to act as endocrine modulators. Yet such plasticisers are not used in PET production. The results of the study thus rather raise questions concerning the effective substances themselves and their origin. However, these cannot be answered on the basis of existing data from the study at hand.

One possible explanation for the contamination of the mineral waters examined could be the cap seals. In the past, these caused problems with nonylphenol, a chemical with an oestrogen-like effect. Yet no nonylphenol findings from examinations of caps (cap screening) have been reported in recent years. In addition, it should be noted that different caps are used for different glass and PET bottles. The water samples from glass and PET bottles should therefore not have similarly high oestrogen activity as it was detected in the YES-test.

Unprocessed mineral water directly from the source has never thus far been known to have oestrogen-like activity. Mineral water is pumped up from deep layers and can therefore not come into contact with oestrogenically active environmental contaminants, though the entry of such active substances through materials during the production and filling process cannot be ruled out.

In general, BfR considers oestrogen-like effects of mineral water as problematic. From BfR's view, however, the available test results require verification. Furthermore, a rational assessment of the observed effects would particularly require the identification of the active contaminants and the analytical ascertainment of existing concentrations. BfR also considers it important to determine potential pathways. Yet an assessment of consumer health risk would entail additional studies *in vivo* with consideration of vigorous limits.

From BfR's view, the results of the study do not require consumers to switch from mineral water in PET bottles to products available in glass bottles.