Irrigation as a Source of Drinking Water: Is Safe Use Possible?

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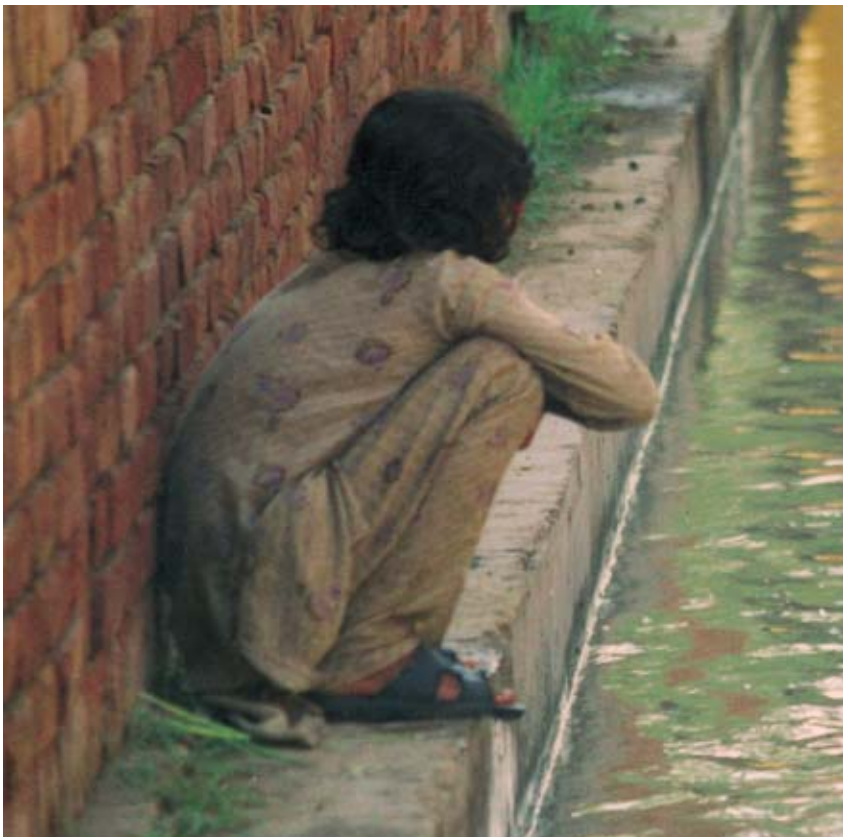
In arid and semiarid countries there are often large areas where groundwater is brackish and where people have to rely on irrigation water for all uses, including domestic uses.

An alternative to drawing drinking water directly from irrigation canals or village water reservoirs is to use the water that has seeped from the irrigation canals and irrigated fields. This water forms a small layer of freshwater on top of the brackish groundwater. The objective of the IWMI study was to assess whether the use of irrigation seepage water for drinking results in less diarrhea than direct use of irrigation water and how irrigation water management would impact on health. The study was conducted in an irrigated area in the southern Punjab, Pakistan.

In large areas of Pakistan where groundwater is too saline for human use, villagers divert canal irrigation water into small community reservoirs—called *diggis*—to meet their domestic needs. This water is carried home by hand or is supplied to the household by means of PVC pipes and manual or motor-driven pumps. In addition to using water directly from these reservoirs, people tap small pockets of potable groundwater formed by seepage from canals and fields. In this case, the sandy soils act as a filter—removing fecal contaminants.



Availability of this cleaner water depends on how much and how often irrigation water is released into the canals. For a period of four to eight weeks, during the annual canal closure, people rely on water stored in the local *diggi* or in household storage tanks. Several villages in the study area

have piped water-supply schemes, but the sand filters that the schemes rely on for water treatment are dysfunctional due to lack of funds for maintenance and, in effect, the villagers are being supplied with untreated irrigation water.

The year-long study recorded drinking water sources used and diarrhea episodes for each day for all individuals of 200 households in 10 villages. Surveys collected information on hygiene behavior, sanitary facilities and socioeconomic status.

The study found that seepage water was of much better quality than surface water but that this did not translate into less diarrhea. This could only be partially explained by the generally poor quality of water in the in-house storage vessels—reflecting considerable in-house contamination of drinking water. Risk factors for diarrhea were absence of a water connection and water storage facility, lack of a toilet, low standard of hygiene and low socioeconomic status. The association between water quality and diarrhea varied by the level of water availability and the presence or absence of a toilet.

Among people having a high quantity of water available and a toilet, the rate of incidence of diarrhoea was higher when surface water was used for drinking than when seepage water was used (relative risk 1.68; 95% CI 1.31-2.15). For people with less water available the direction of the association between water quality and diarrhea was different (relative risk 0.80; 95% CI 0.69-0.93). This indicates that good-quality drinking water provides additional health benefits only when sufficient quantities of water and a toilet are available. In a multivariate analysis no association was found between water quality and diarrhea but there was a significant effect of water quantity on diarrhea that was, to a large extent, mediated through sanitation and hygiene behavior.

Increasing the availability of water in the house by having a household connection and a storage facility is the most important factor associated with reduced diarrhea in this area. Safe use of canal irrigation water seems possible if households can pump seepage water to a large storage tank in their house and have a continuous water supply for sanitation and hygiene. Clearly, irrigation water management has an impact on health and on bridging the gap between the irrigation and drinking water supply sectors, which could provide important health benefits by considering the domestic water availability when managing irrigation water.

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