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Groundwater and nutritional health challenges- A case study from Indus river system in Pakistan

Abstract

Groundwater plays an important role in supporting the humanity by providing the basic needs of food, fiber and shelter and underpinning the livelihood especially in rural areas in Pakistan. Land and water and air are the essential natural resources to support the food security and human health. Groundwater plays important role in nutritional health as it supports about 100% drinking water requirements in Pakistan. Quality deterioration of groundwater is a big challenge in Indus Basin in Pakistan. Both natural and anthropogenic sources are creating threats for the quality of groundwater. Domestic, agricultural and industrial effluents are sources of pollution of groundwater resources. More than 80% diseases are the waterborne. Unsafe drinking water is a source of many diseases including typhoid, intestinal worms, and hepatitis etc. Globally 780 million and in Pakistan 100 million people are exposed to unsafe water. Groundwater is a major player in nutrition value addition and ensuring food-security. Punjab province of Pakistan is major user of groundwater (more than 80% extraction), where groundwater contamination is posing severe health problems. Over extraction of groundwater is resulting in mixing of fresh-brackish groundwater layers. Use of wastewater in peripheries of the urban cities by the irrigators for growing vegetables is also a major concern for human health.[1] Groundwater management, protection of its quality by putting in and implementation in true sense leading to sustainable use of groundwater can yield positive results for health and nutrition.

Keywords: ground water, human-health, nutrition, Punjab, Indus-river-basin, Pakistan

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Background

Pakistan is the 8th largest food producing country and ranks 5th in list of countries by population. Current population of Pakistan is 220 million with annual increasing rate of about 2%.[2,3] To feed this tremendously increasing population we need to grow more food for which both horizontal and vertical expansion of irrigated agriculture is imperative for Pakistan. An increase of 50% in food, 40% in energy and 30% in water is needed to by 2030 to feed the growing population and support the required economic development in A study on says under-nutrition is the largest killer of under-five children and is responsible for the death of 3.1 million children each year. Globally approximately 162 million children under the age of 5 years are stunted. At 43.7 percent, Pakistan has the third highest rate of stunting in the world. Pakistan accounts for up to 12 million of this total represent the highest in South Asia.[4] Unsafe drinking water is a source of many diseases including typhoid, intestinal worms, and hepatitis etc. Globally 780 million and in Pakistan 100 million people are exposed to unsafe water.[4] According to WHO report, 3.4 million people (out of which 90% are children) die annually round the globe particularly from developing countries due to diarrheal diseases like cholera, typhoid, dysentery which are associated with ingestion of unsafe water.[5,6] As per current estimates about 80% people in Pakistan do not have access to clean drinking water, and water pollution is causing about 80% of all disease and 30% deaths.[7] Quality of groundwater is deteriorating due to domestic, industrial and agricultural effluents.[8,9] As groundwater quality is deteriorating, and groundwater is source of drinking water, therefore there is direct link between groundwater and the malnutrition.

Study area

Under this paper results of different research studies conducted by Irrigation Research Institute (IRI) in Punjab province of Pakistan have been presented. Punjab is the largest province of Pakistan with respect to irrigated agriculture, having largest part of Indus River Irrigation System, food production and groundwater user. It is food basket for the country. At present groundwater is contribution about 40-50% of irrigation water requirements, almost all drinking water needs and about more than 90% of industrial water demands. Thus, groundwater has attained a significant role in meeting food security and thus have a vital impact of human health and nutrition. Results from about 3000 farmers tubewell regarding groundwater quality have been discussed in this short article.

Results and discussions

Agricultural runoff polluted with fertilizers and pesticides used for crop production, is another source of contamination of groundwater. These effluents are diverted to surface drainage network which ultimately flow to the rivers. On the way, drainage system pollutes land and water and leaching down contaminates the groundwater.

River Indus and its tributaries are major source of recharge to the aquifer lying under the Indus Basin. As the rivers originate from the mountainous regions and pass through the salt range, a huge quantity of salts is carried down by the river water which is ultimately transferred to the aquifer. Agriculture in Indus River Basin (IRB) in Pakistan mainly depends on irrigation where 90% of food grains and almost 100% of cash crops (mainly fruits, vegetables, sugarcane, cotton and rice) are produced from irrigated lands.[11] Even then, about forty seven percent of the population of Pakistan is food insecure as well as the access to food is uneven and malnutrition is widespread in the country.[12,13] We -need to study the water-food-energy nexus and devise the new ways and means to meet the future challenges.[14] River Indus- 2900 km long- is the lifeline for economy of the country as its – along with five tributaries-supports livelihood and food security by providing about 171 km3 of water annually for irrigated agriculture

in the basin.[11] Schematic diagram of Indus Basin Irrigation System is shown in Figure 2.[15] The area affected with salts in different districts of Punjab is shown in Figure 3.

Many studies have indicated that over 1 billion people in developing countries lack access to safe drinking water.[16] Climate threats like droughts, floods, global warming, sea water intrusion, glacier melting, over depletion of aquifer are the greatest challenges being faced by the mankind on the planet, and we need to fight against these threats for our survival.[17,18]

Groundwater has been identified as one of the major drivers for bringing green-revolution through irrigated agriculture. But groundwater resources are under sever threat due to unplanned excessive pumping, complexity in defining rights and entitlements, capacity and awareness issues, and lack of implementation of effective and holistic regulation. Quality of groundwater is under threat due to natural and anthropogenic activities which puts irrigated agriculture under threat resulting health and nutrition challenges through food-chain. When groundwater is polluted and it used for irrigation, livestock and drinking, it has direct and indirect implications for human health and nutrition. Food nutrition means sufficient quantity of food and good quality food. Groundwater plays a vital role in food security and nutrition being a major component of our food-chain. In Punjab province government is monitoring quality of groundwater from around 3000 framers tube wells, generally for irrigation uses and specifically for drinking purposes.[19–22] A map of groundwater suitability for irrigation is shown in Figure 4.[23] This figure indicates that in most of the areas in the Punjab groundwater quality is not fit for irrigation purposes and thus not for drinking purposes. Quality of groundwater along the rivers is comparatively better. Also, it can be observed that groundwater quality deteriorates downward along the Indus Irrigation System, which is transportation of accumulation of salts along with irrigation water.

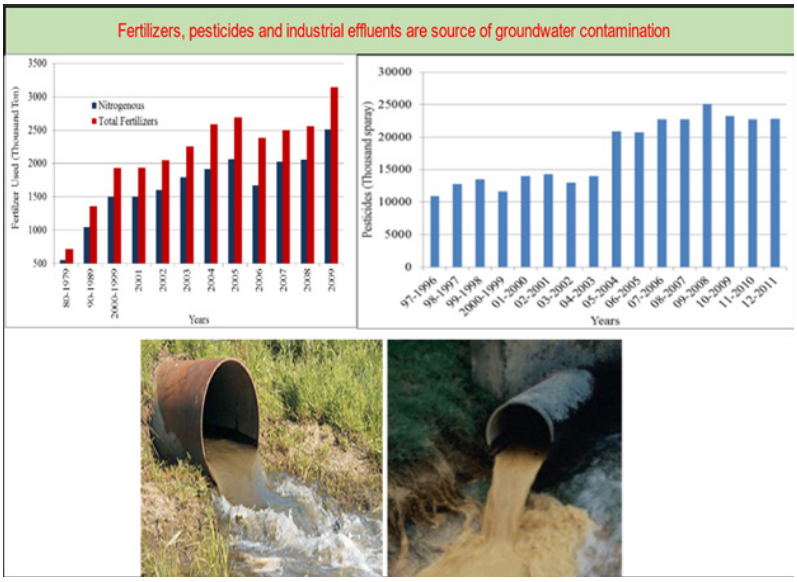

Figure 1 indicates increasing trends in use of fertilizers and pesticides.[10]

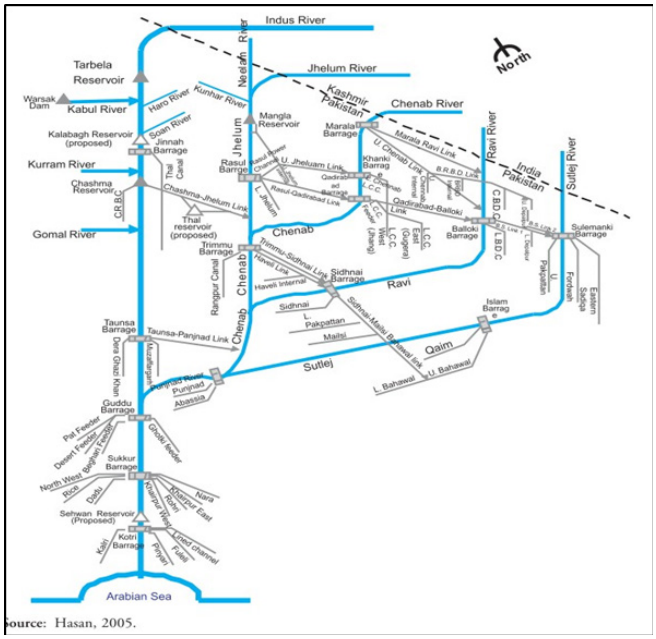

Figure 2 Schematic diagram of Indus River System and its canal network.

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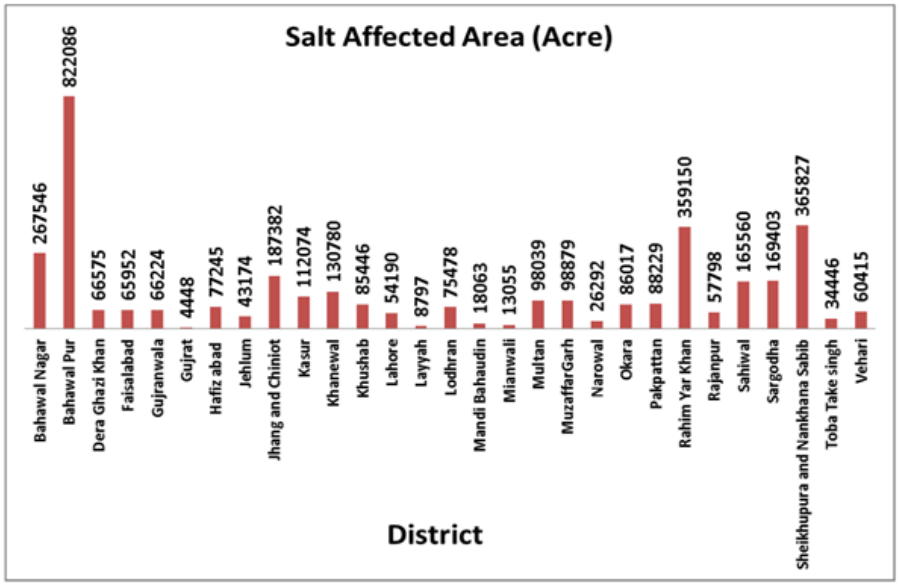

Figure 3 Salt affected area in different districts of Punjab.[24]

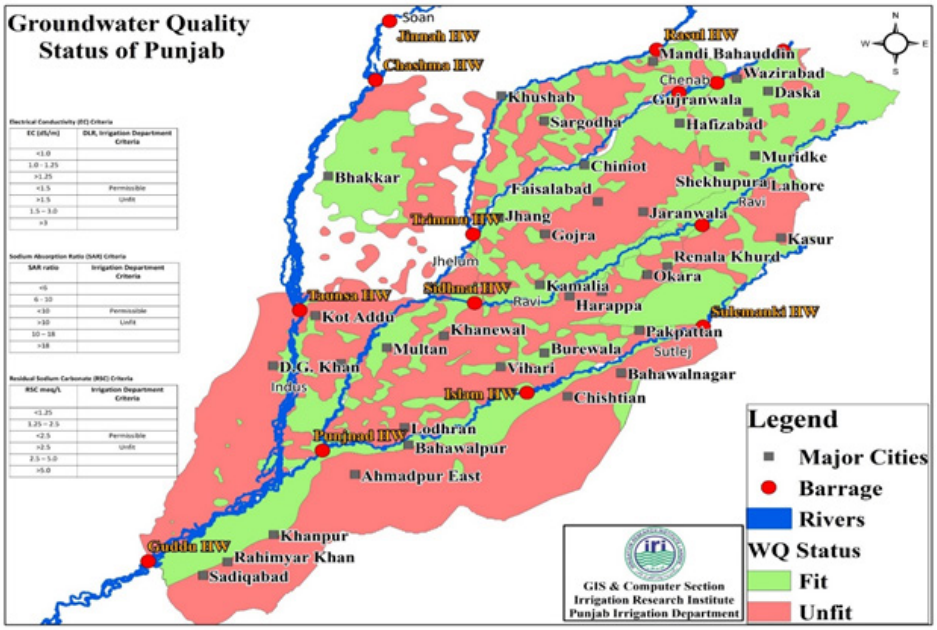

Figure 4 Groundwater quality status in Punjab province of Pakistan.

It has been proved through research that pollutants have been found in meat and milk of animals who used contaminated groundwater. Fresh groundwater availability is under stress due to excessive consumption, contamination of aquifers, inadequate waste management, lack of proper water distribution technologies, intensive farming etc.[16]

Recently, government has promulgated the National Water Policy 2018, Punjab Water Policy 2018 and Punjab Water Act 2019 where due importance has been accorded to the groundwater development, protection and management. Depleting freshwater resources, growing population, emerging, environmental degradation, and climate change are the major threats for groundwater degradation. Degradation of groundwater is a challenge for food-security, livelihood and nutrition in the IRB. Therefore, it is imperative to safeguard the quality of groundwater to ensure the human health and nutrition challenges.[24]

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Conflicts of interest

The authors declare that they have no competing interests.

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