



Water Production Systems and Methods for Their Improvement in Gadarif State, Eastern Sudan

Khidir TajElseir Othman Mustafa^{1*}, Rehab Mobark Osman², Mohammad Othman Fathelbari³, M.T. Musa⁴, Don Peden⁵

¹Department of Biology & Chemistry, Faculty of Education, Gadarif University, ²Alnileen University Khartoum Sudan, Gadarif, Sudan, ³Gadarif State Water Corporation, ⁴Animal Resources Research Corporation, Khartoum, Sudan, ⁵Livestock Water Productivity, ILRI, Addis Ababa.

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Abstract The aim of this research was to study the effects of livestock on water depletion by chemical and microbial contaminants, and to evaluate watering structures for defects in design, and to evaluate water from different sources for pH values, turbidity, and electrical conductivity in Gadarif State, Eastern Sudan. Ninety-five water samples from different water sources (open dug wells, micro dams, hafeers, boreholes, springs, and pools) were analyzed for microbiological and chemical contaminations. Two standard methods were applied to detect fecal coliforms including *E. coli* and 12.5% of samples were below the WHO recommended limits, while 1.5, 7.5, 38.8, and 40% had low, medium, high, and very high pollution with fecal coliforms. Samples were checked for specific coliforms, and 42.5 % were positive for *Vibrio sp.*, 22.5% for *Salmonella*, 10% for *Citrobacter*, 20% for *Klביםiella spp.*, and 2.5 % for *E.coli*. Chemical analysis indicated water pollution by nitrate, nitrite, and ammonia content. Shallow and dug wells had high levels of nitrate (compared with the WHO guidelines) in 54.1% of samples, and some had high levels of lead because of faulty installation of water pumps and contamination from lead in gasoline. pH, electric conductivity, and total dissolved solids were normal, but turbidity was high in hafeers and pools. Most of the water sources were at risk of pollution because of human and animal wastes. This was manifested in the outbreaks of acute watery diarrhea in Gadarif State in 2006 and 2007. Possible measures to minimize contamination caused by humans and livestock include separation of water for human use from that of animals, better harvesting of water, and construction of water sources. Water sources were examined for bacterial and chemical contaminants, and 87.5 % were polluted with bacteria and 54.1% with chemicals. Diesel generated boreholes contained lead.

Keywords: *livestock, microbial, chemical, contaminants, open dug wells, hafeers, boreholes, springs, pools*

*Corresponding: E-Mail: khidirothman@yahoo.com; Tel: +24923177149; Fax: +2499155119136