



Drinking water quality assessment for geochemical and microbial, parameters in Nowshera District, Khyber Pakhtunkhwa, Pakistan; In an aspect of Geo-ethical Consideration

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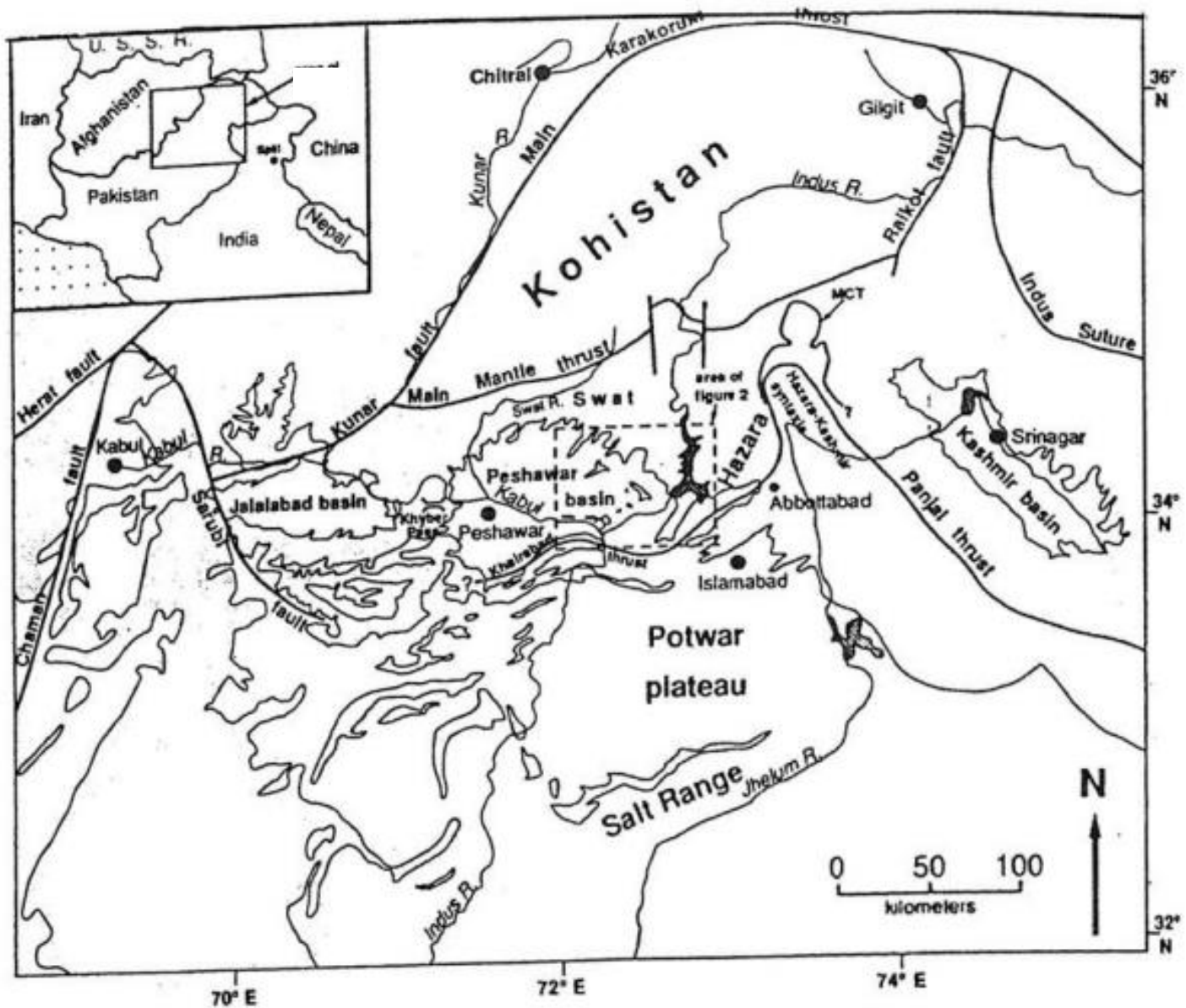
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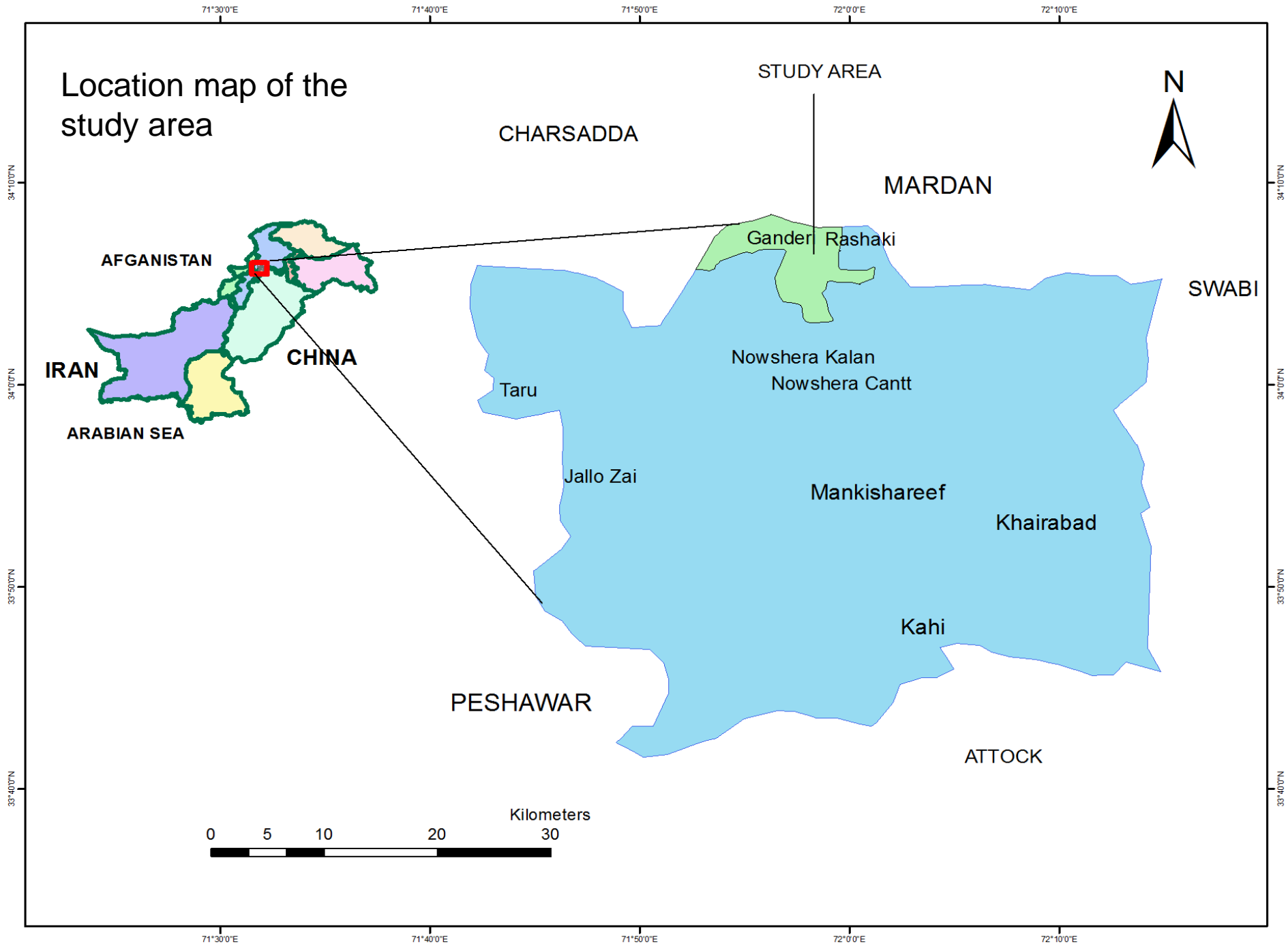
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Outlines

- Location Map
- Geology of the area
- Aims and objectives of the study
- Results
- Discussion
- Conclusions
- Recommendations



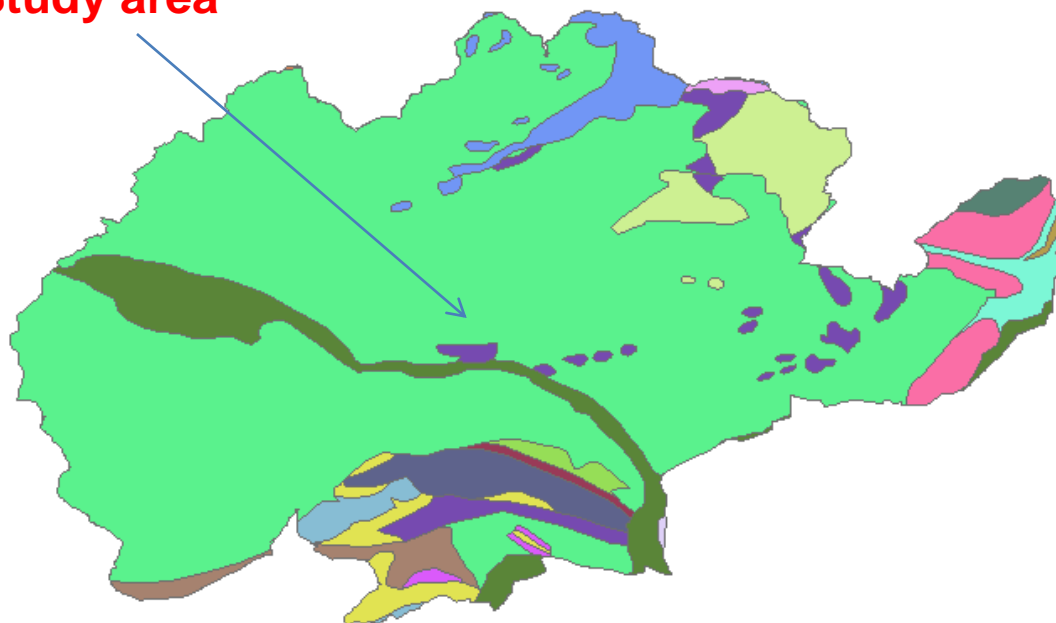
Location Map of Peshawar Basin (after Gansser 1981; Yeates and Lawrance, 1984)



Geological Map Peshawar Basin

Peshawar basin is underlain by up to 300 m fluvio-lacustrine sediments derived from a variety of rocks. A sequence of metasediments intruded by granitoids are outcropping at places.

Study area



Legend

Formations

- Besham and Kotla Complexes Undivided
- Indus Suture Melange
- Kashala, Nikanai ghar & Saidu Formations undivided
- Korara Complex and Gandaf Formations Undivided
- Kyber Limestone, Shekhai, Utch Khattak & Shahkot Formations Undivided
- Landikotal Slates and Manki Formation Undivided
- Marghuzar Formation and Duma Formations undivided
- Mesozoic Rocks Undivided
- Muree Formation
- Paleozoic rocks undivided
- Patala Formation
- Quaternary Alluvium
- River
- Samana Suk Limestone
- Sawat and Mansehra Granite Complexes Undivided
- Shagai, Dakhner and Hazara Formations undivided
- Shewa, Ambela, and Warsak Complexes Undivided
- Tanawal & Manglaur Formations Undivided
- PeshawarBas

30 15 0 30 Kilometers



AIMS AND OBJECTIVES



- **Determination of the Physical and Chemical Parameters**
- **Analysis of Microbiological Parameters**
- **Identification of the possible sources of these contaminations**
- **Health hazards associated with various contaminants**



SAMPLING AND MATHODOLOGY



- Spectrophotometer (DR-2800) was used to analyze all the anions such as nitrate (NO_3), sulfate (SO_4), phosphate (PO_4), and fluoride (F), Alkalinity, bicarbonates (HCO_3), (carbonate) CO_3 by titration method.
- Turbidity was determine by turbidity meter (AWWA 1992).
- Sodium (Na), potassium (K), calcium (Ca) and magnesium (Mg) were analysed by atomic absorption spectrometer (Perkin Elmer, AAS-PEA-700) under standard operating conditions and for Arsenic (As) the AAS was equipped with mercury hydride generation (MHS) system..



SAMPLING AND MATHODOLOGY



- A total of 165 samples were collected and stored in separate clean polythene bottle of 250 ml from different sampling points of fifteen villages of District Nowshera
- Each sample was analyzed in duplicate and after every 10 samples, 2 standard samples and 01 blank sample were used for calculating the precision and reproducibility of the results
- Groundwater is present in sand and silt horizons with Water table ranging from 6 meters up to 12 meters depth
- The reproducibility was found to be at 95% confidence level



RESULTS



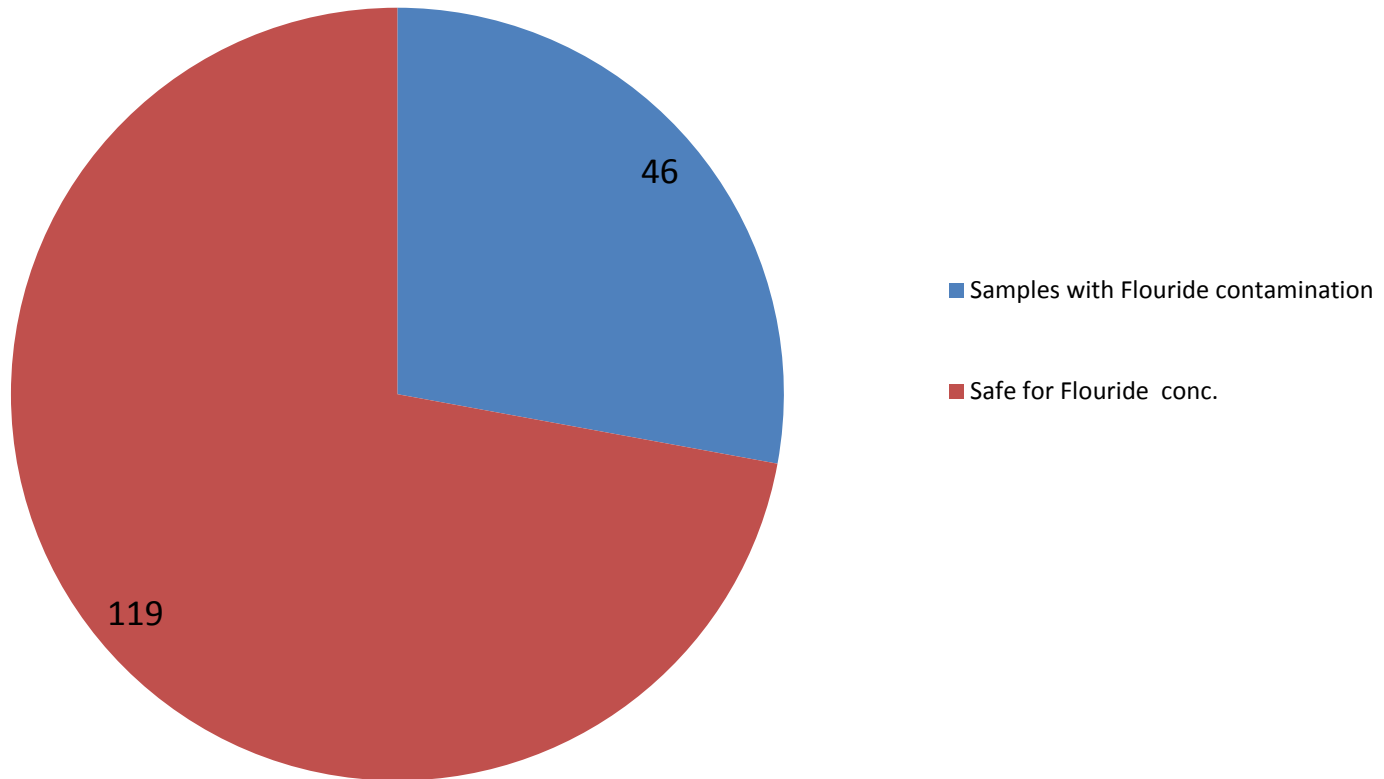
S.No	Parameters	Range
1	pH	7.5-8.73
2	Turbidity (NTU)	0-103 NTU
3	TDS (mg/L)	66-4830
4	Total Colliform	0-900
5	Fecal-Colliform	0-130

- **Na, K, Ca, Mg, Cl, Alkalinity, HCO_3 , CO_3 , SO_4 and As, all lies within the permissible limits of WHO.**
- **Only Two of the samples are showing high pH (8.58-8.73)**



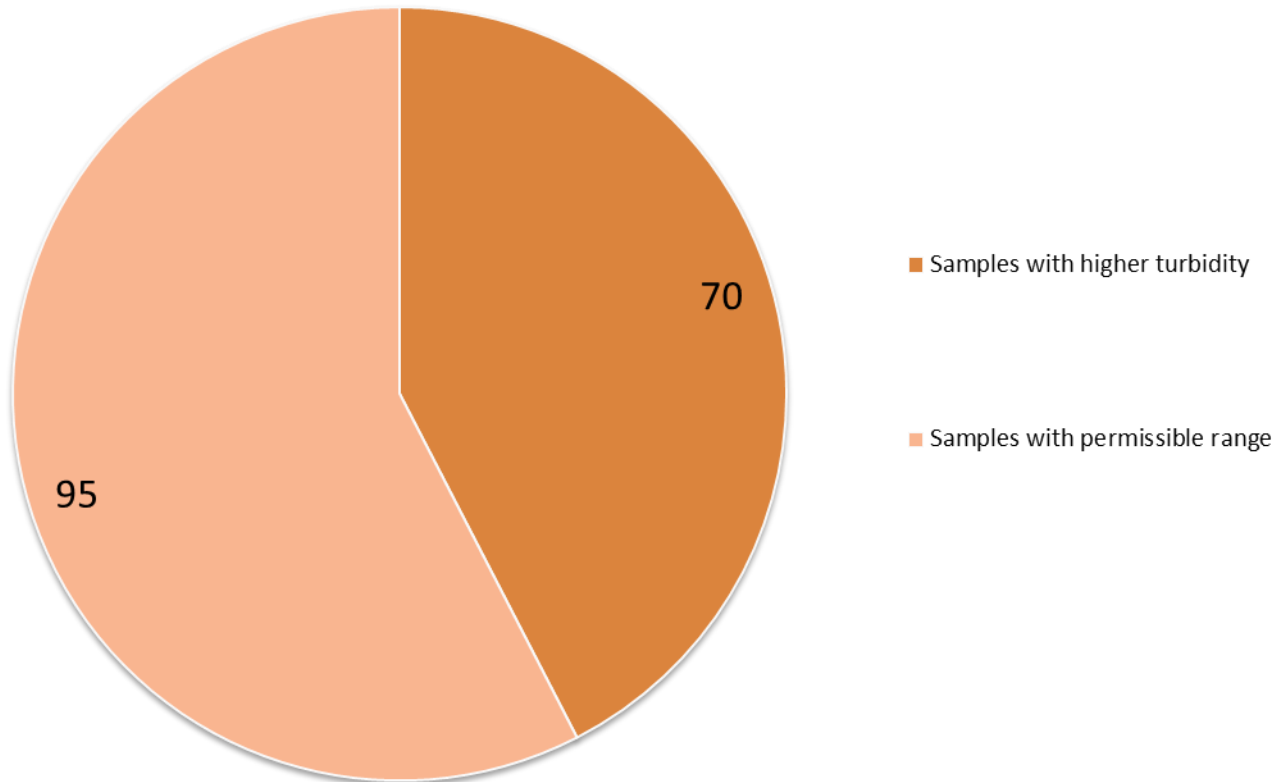
RESULTS

Flouride



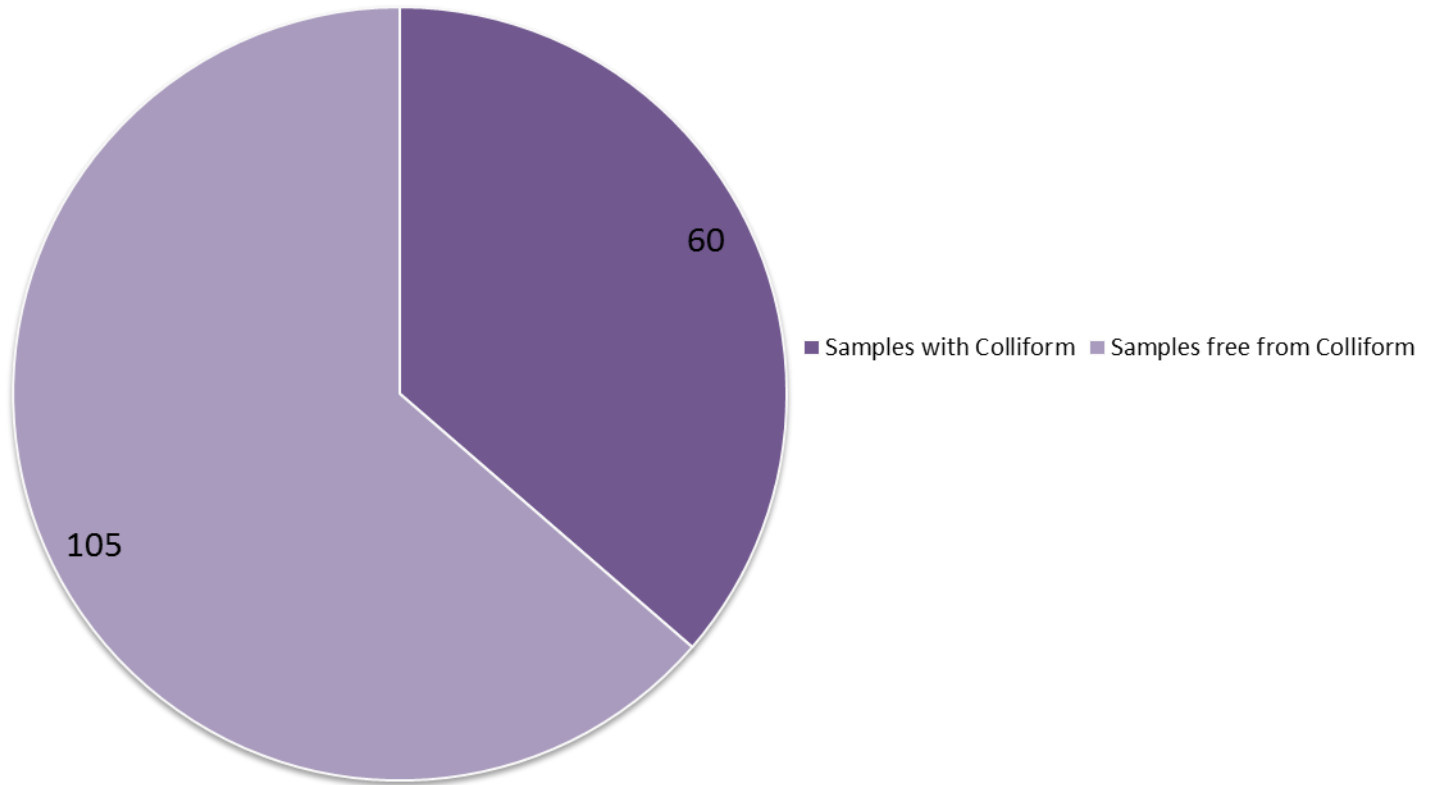
RESULTS

Turbidity



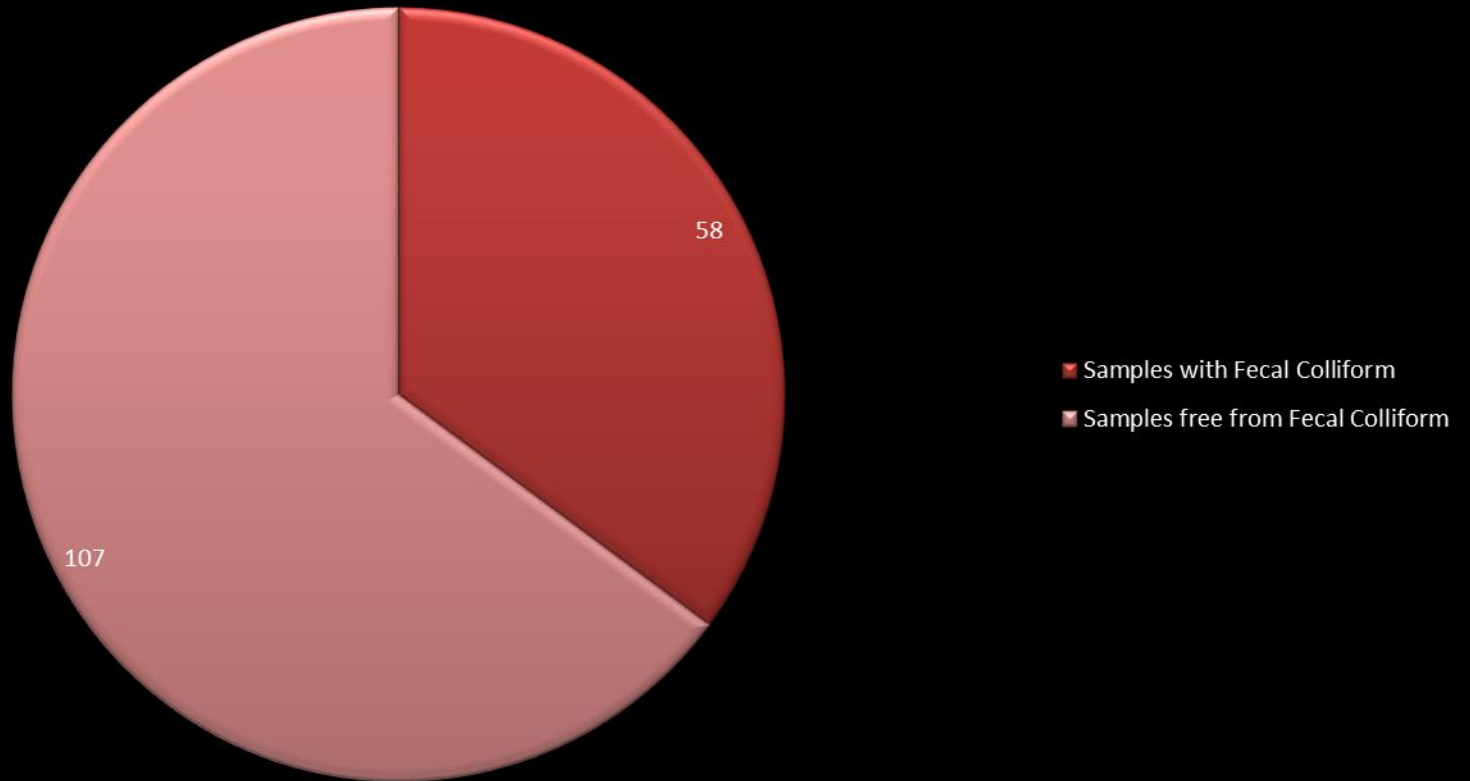
RESULTS

Fecal Colliform



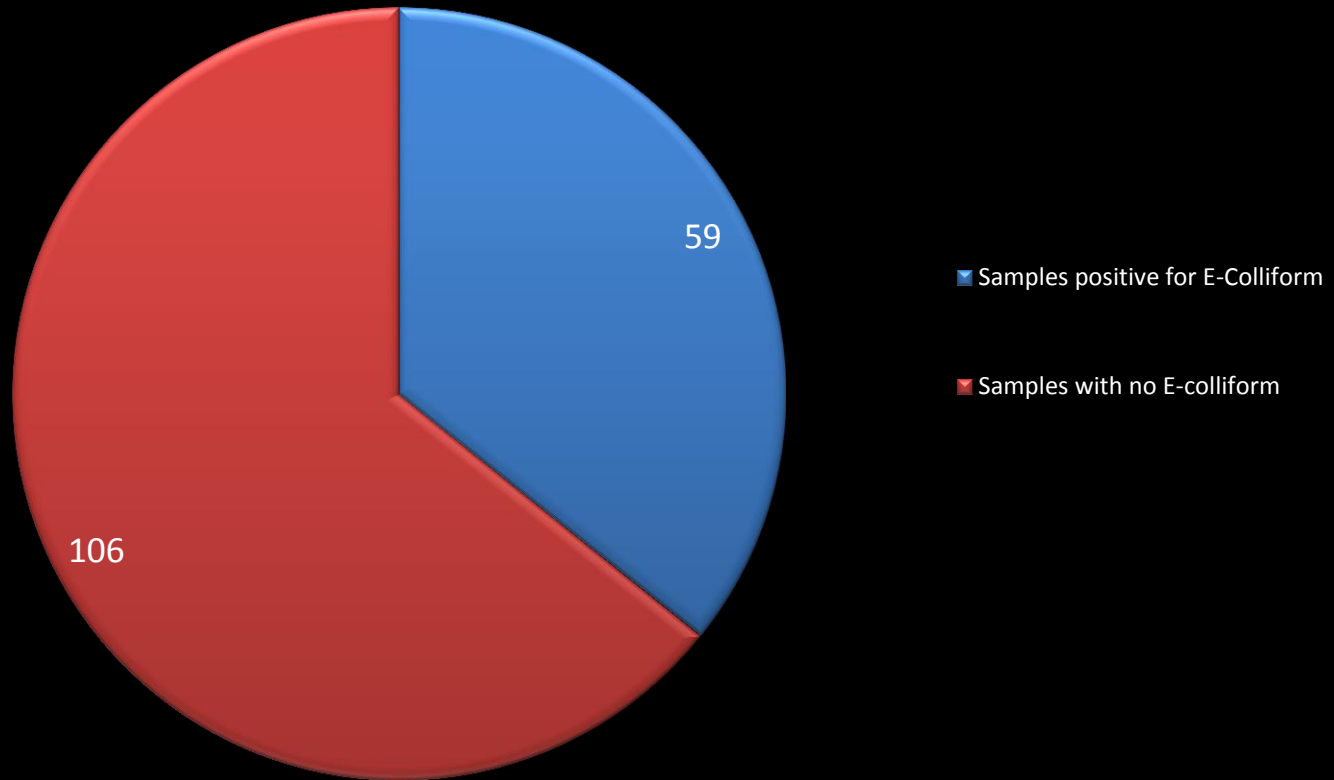
RESULTS

Total Colliform



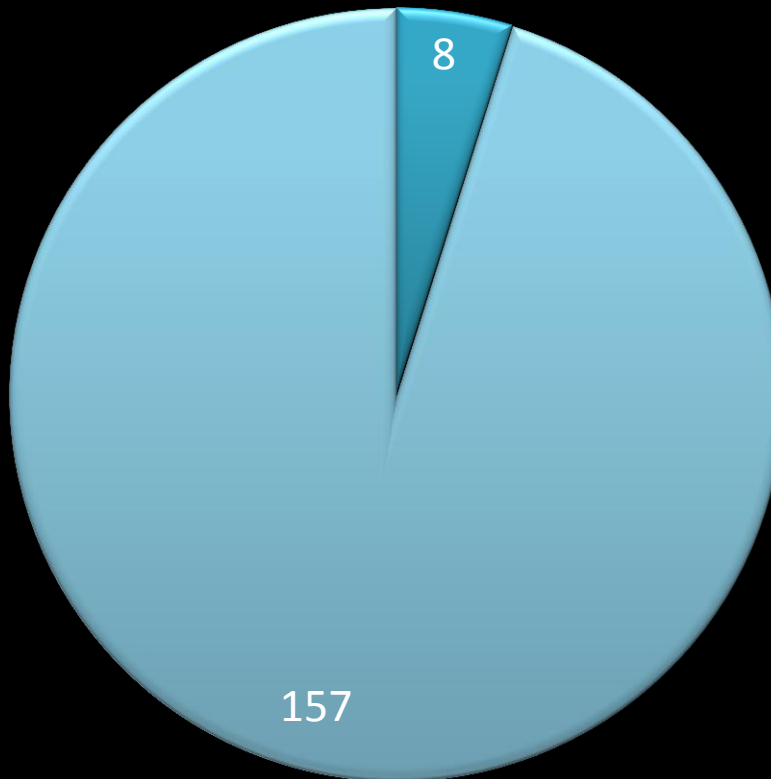
RESULTS

E-Colliform



RESULTS

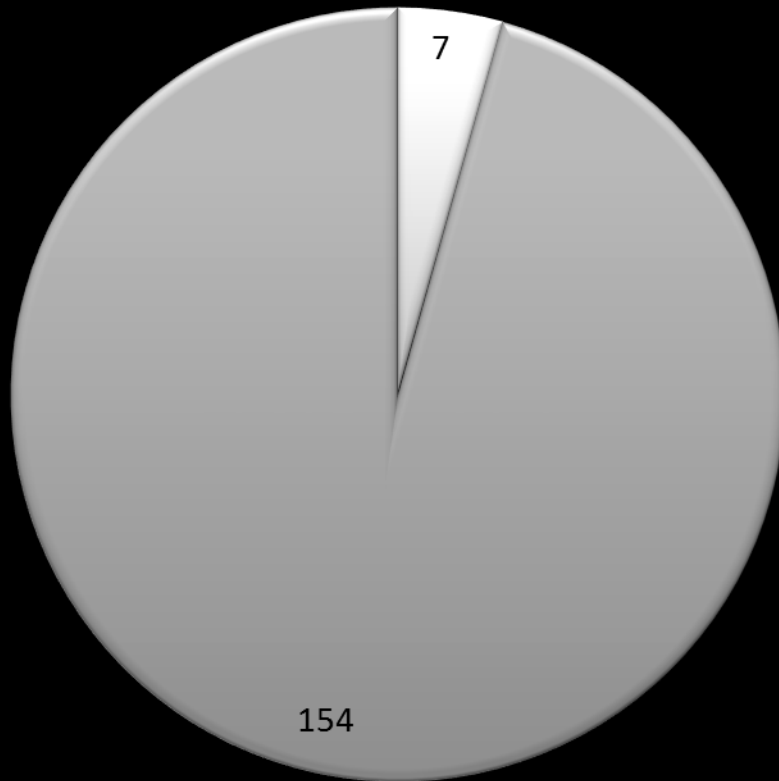
Nitrates



- Samples with Nitrate contamination
- Safe for Nitrate conc.

RESULTS

Dissolved salts



- Samples with anomalous dissolved salts
- samples with permissible range of salts



Discussion



- Either anthropogenic or geogenic sources or both
- The alkaline, mafic and ultramafic rocks exposed in the northern parts of Peshawar Basin as well as fluoride deposits of Khyber ranges are the possible sources of F as these contribute the fluoride bearing minerals such as fluorite, apatite, fluor-apatite, muscovite, hornblende and serpentine to the soil of the basin.
- Consistent with previous work (Shah et al., 2003, Danishwar et al., 1994).
- Finer sediments, in lacustrine and alluvial deposits of the study area, are considered to be the main contributors of increased turbidity in the groundwater.
- Higher water table contribute towards higher amount of dissolved Salts.

Dental Fluorosis affecting the residents





Discussion



Sources of Nitrates and Microbes:

- High amount of nitrates may have been contributed from the fertilizers, human and animal wastes as there are no industries available in the study area.
- Both animal and human wastes are the possible sources for Microbial contamination as these seep down and mix with ground water



- According to the survey conducted through the Basic Health Units (BHUs) and field evidences in the study area, it was found that due to the use of fluoride contaminated drinking water, the inhabitants of the area are suffering from yellow and cracked teeth (dental fluorosis), and skeletal fluorosis.
- Similarly diarrhea and other stomach diseases are the result of high nitrates, salts and microbes concentration.



CONCLUSIONS



- This study shows that the samples collected from the study area have the higher concentration of fluoride (28%), Microbes (3%), Nitrates (05%) as compared to the permissible limit set by WHO.
- Survey conducted shows Skeletal fluorosis, bone deformation, stomach disease have affected the inhabitants because of the use of unsafe drinking water since long period of time.
- This study suggests the geogenic source for the higher amount of fluoride in the groundwater sources of the area and Anthropogenic sources for Nitrate and Microbes.



RECOMMENDATIONS



- Proper remedial measures should be taken for the removal of fluoride, Nitrate, Microbial contamination in the drinking water of the study area.
- Simple household defluoridation filters and simple water filters should be provided to the inhabitant.
- Various defluoridation techniques should be adopted
- Awareness about the hazardous nature of fluoride, Nitrates, and microbes is also urgently needed.
- Deeper level water resources may be evaluated for a relatively better alternative.

THANK U

