Supplementary table 1: Physico-chemical parameters of Ground water from different zone in Funtua Local Government

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Station | Depth (m) | Water temp.(°C) | pH | HCO32- (mg/L) | PO43- (mg/L) | SO42- (mg/L) | NO3- (mg/L) | Cl- (mg/L) | DO (mg/L) | TDS (mg/L) | BOD (mg/L) | COD (mg/L) | EC (µS/cm) | Turb (NTU) | Ca2+ (mg/L) |
|  BG | 7.40±0.10 | 20.56±1.96 | 7.78±0.37 | 308.58±142.56 | 15.76±4.99 | 0.43±0.21 | 11.49±6.49 | 220.37±59.44 | 5.68±1.30 | 1231.65±219.94 | 2.04±0.45 | 100.89±16.38 | 2261.50±430.35 | 4.06±0.36 | 89.00±7.19 |
| MA | 7.85±0.29 | 20.48±2.08 | 7.62±0.32 | 114.07±54.84 | 14.116±4.08 | 0.48±0.28 | 6.09±3.59 | 166.73±47.72 | 6.51±1.68 | 488.00±120.22 | 2.54±0.55 | 49.64±9.03 | 903.00±233.83 | 3.30±0.36 | 65.00±3.54 |
| UD | 7.90±0.33 | 20.89±1.92 | 7.19±0.17 | 308.20±182.56 | 13.97±3.94 | 0.41±0.18 | 4.83±0.85 | 356.03±85.56 | 4.22±1.32 | 624.05±236.33 | 1.17±0.68 | 41.58±6.73 | 1463.66±460.11 | 3.34±0.18 | 45.50±6.60 |
| TW | 9.65±0.15 | 20.96±2.02 | 7.46±0.28 | 110.64±75.08 | 14.12±3.54 | 1.05±0.63 | 7.04±3.32 | 134.33±26.45 | 5.67±1.30 | 253.55±27.33 | 2.25±0.41 | 42.25±6.82 | 454.00±41.69 | 3.27±0.26 | 60.00±6.12 |
| BCGA | 8.48±0.51 | 20.65±1.94 | 7.25±0.27 | 126.49±80.03 | 13.77±3.40 | 0.31±0.14 | 5.53±0.96 | 130.55±26.06 | 4.53±1.11 | 253.10±22.69 | 1.43±0.25 | 41.82±6.77 | 460.25±42.89 | 3.29±0.18 | 62.50±5.20 |
| TIM | 9.40±0.48 | 20.69±1.99 | 7.35±0.20 | 170.80±116.09 | 14.12±3.54 | 0.45±0.18 | 8.09±4.35 | 206.61±40.49 | 7.01±1.67 | 401.30±59.88 | 2.41±0.78 | 99.99±16.27 | 879.25±182.75 | 3.38±0.23 | 60.50±10.66 |
| FK | 9.73±1.60 | 21.12±1.95 | 7.24±0.21 | 192.23±129.31 | 14.12±3.84 | 0.18±0.07 | 4.34±1.87 | 348.79±79.87 | 5.01±1.21 | 579.10±63.45 | 1.97±0.36 | 62.81±10.42 | 1044.50±127.24 | 3.31±0.19 | 41,00±4.30 |
| KM | 10.05±0.59 | 20.69±1.97 | 6.98±0.17 | 178.65±153.98 | 13.32±3.69 | 0.29±0.13 | 4.59±1.01 | 378.08±151.78 | 4.50±1.09 | 283.50±43.55 | 0.96±0.17 | 45.29±7.39 | 491.25±68.39 | 3.36±0.18 | 50.50±4.11 |
| NA | 7.58±0.09 | 20.47±2.01 | 7.77±0.27 | 164.39±88.02 | 14.27±3.75 | 0.51±0.27 | 5.39±2.90 | 126.89±37.78 | 6.53±1.54 | 590.75±68.97 | 2.59±0.49 | 56.69±9.15 | 1069.00±139.05 | 3.52±0.24 | 65.00±5.40 |
| UT | 8.88±0.83 | 20.59±2.00 | 7.19±0.26 | 73.96±46.63 | 14.72±3.77 | 0.12±0.05 | 6.23±1.45 | 93.45±16.72 | 3.39±1.01 | 116.81±13.34 | 0.98±0.17 | 44.43±7.62 | 212.20±20.19 | 3.79±0.24 | 36.00±3.67 |
| TK | 7.75±0.26 | 20.52±2.01 | 7.64±0.54 | 174.69±84.80 | 19.23±4.63 | 1.12±0.64 | 4.24±0.77 | 514.54±155.83 | 4.82±1.13 | 786.35±113.64 | 1.72±0.39 | 96.93±15.66 | 1437.00±227.89 | 3.87±0.29 | 36.50±11.35 |
| UW | 5.65±0.75 | 20.28±2.09 | 7.47±0.39 | 204.81±155.51 | 14.42±3.66 | 0.28±0.12 | 5.18±0.84 | 132.68±23.53 | 4.42±1.15 | 337.30±69.38 | 1.23±0.28 | 32.71±5.28 | 602.25±105.55 | 3.55±0.29 | 55.50±6.34 |
| JI | 10.08±0.08 | 20.62±2.03 | 7.09±0.23 | 152.63±111.89 | 13.16±3.79 | 0.21±0.08 | 4.24±0.77 | 107.83±34.05 | 3.51±1.07 | 214.93±19.49 | 1.39±0.44 | 26.22±4.52 | 588.75±34.58 | 3.55±0.29 | 29.00±4.20 |
| MG | 9.70±0.20 | 20.61±2.00 | 7.25±0.27 | 171.93±125.81 | 13.97±3.63 | 0.21±0.09 | 4.47±0.92 | 749.94±267.76 | 5.06±1.24 | 533.35±52.56 | 1.66±0.31 | 59.07±9.59 | 950.25±101.43 | 2.99±0.19 | 46.00±8.57 |
| DL | 10.55±0.38 | 21.08±1.97 | 7.37±0.44 | 240.65±164.04 | 14.07±3.82 | 0.29±0.12 | 4.59±1.02 | 643.71±123.05 | 4.55±1.13 | 1042.00±101.83 | 1.45±0.34 | 35.94±5.90 | 1865.25±198.96 | 2.96±0.31 | 21.50±4.35 |
| F | 5.255 | 0.014 | 0.607 | 0.302 | 0.137 | 1.103 | 0.535 | 4.031 | 0.700 | 16.311 | 1.601 | 6.092 | 8.247 | 1.332 | 6.835 |
| Sig. | 0.000\*\*\* | 1.000 | 0.845 | 0.991 | 1.000 | 0.381 | 0.899 | 0.000\*\*\* | 0.762 | 0.000\*\*\* | 0.116 | 0.000\*\*\* | 0.000\*\*\* | 0.227 | 0.000\*\*\* |

Keys:- Sampling station Areas: BG= Bagari; MA= Makera; UD= Unguwar Dahiru; TW= Tudun Wada; TIM= Tuduna iya mai; FK= Filino Kwallo; KM= Kasuwar mata; NA= Nasrawa; UT= Unguwar Tukur; TK= Tsohuwan Kasuwa; UW= Unguwar Wanzama; JI= Jabiri; MG= Mai Gamji and DL= Danlayi

Supplementary table 2. Correlation matrix between pit latrine distant, groundwater quality and human fecal coliform counts in different wards of Funtua Local Government Area

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | well distant to latrine (m) | Depth (m) | Water temp.(°C) | pH | HCO32- (mg/L) | PO43- (mg/L) | SO42- (mg/L) | NO3- (mg/L) | Cl- (mg/L) | DO (mg/L) | TDS (mg/L) | BOD (mg/L) | COD (mg/L) | EC (µS/cm) | Turb (NTU) | Ca2+ (mg/L) |
| MA | TCC | 0.70\* | -0.45 | 0.46 | 0.38 | 0.99\*\*\* | 0.19 | -0.29 | 0.99\*\*\* | -0.41 | 0.58\* | 0.00 | -0.22 | 0.76\* | 0.57\* | 0.67\* | -0.50 |
| FCC | 0.72\* | -0.42 | 0.43 | 0.35 | 0.99\*\*\* | 0.16 | -0.26 | 0.99\*\*\* | -0.43 | 0.56\* | -0.03 | -0.25 | 0.74\* | 0.55\* | 0.69\* | -0.48 |
| SG | TCC | -1.00 | -0.92 | 0.25 | 0.96\*\*\* | -0.85 | 0.95\*\*\* | -0.96 | -0.06 | 0.37 | 0.99\*\*\* | 0.28 | 0.73\* | -0.82 | -0.21 | -0.48 | -0.99 |
| FCC | -0.98 | -0.83 | 0.06 | 0.88\*\* | -0.73 | 0.88\*\* | -0.89 | 0.14 | 0.18 | 0.99\*\*\* | 0.09 | 0.59\* | -0.92 | -0.40 | -0.30 | -1.00 |
| TIM | TCC | 0.99\*\*\* | -0.73 | 0.08 | 0.89\*\* | -0.18 | 0.92\*\* | -0.95 | 0.52\* | 0.99\*\*\* | 0.99\*\*\* | 0.99\*\*\* | 0.88\*\* | 0.95\*\*\* | 0.99\*\*\* | -0.31 | -0.95 |
| FCC | -0.96 | 0.85\*\* | -0.27 | -0.97 | 0.36 | -0.98 | 0.99\*\* | -0.35 | -0.98 | -0.95 | -0.99 | -0.96 | -0.88 | -0.97 | 0.48 | 0.99\*\*\* |
| UI | TCC | -0.96 | -0.52 | 0.24 | 0.55\* | -0.19 | 0.92\*\* | -0.99 | -0.68 | 0.47 | 0.99\*\*\* | 0.99\*\*\* | 0.41 | 0.98\*\*\* | -0.31 | -0.66 | -1.00 |
| FCC | -1.00 | -0.80 | 0.58\* | 0.82\*\* | -0.54 | 0.99\*\*\* | -0.97 | -0.90 | 0.11 | 0.92\*\* | 0.89\*\* | 0.71\* | 0.83\*\* | 0.06 | -0.89 | -0.93 |
| UR | TCC | 0.99\*\*\* | -1.00 | 0.29 | 0.99\*\*\* | -1.00 | 0.99\*\*\* | -1.00 | -0.35 | -0.97 | 0.98\*\*\* | 0.99\*\* | 0.78\* | 0.99\*\*\* | -0.54 | -0.64 | -0.99 |
| FCC | 0.29 | -0.28 | -0.85 | 0.25 | -0.20 | 0.17 | -0.26 | 0.81\*\* | -0.50 | 0.52\* | 0.26 | -0.40 | 0.10 | -0.96 | 0.57\* | -0.37 |
| DE | TCC | -0.77 | -0.48 | 0.95\*\*\* | 0.47 | -1.00 | 0.61\* | -0.90 | -0.93 | -0.40 | 0.40 | -0.91 | 0.98\*\*\* | 0.04 | 0.40 | -1.00 | -0.36 |
| FCC | 0.75\* | 0.46 | -0.96 | -0.45 | 0.99\*\* | -0.59 | 0.89\*\* | 0.92\*\* | 0.42 | -0.38 | 0.92\*\* | -0.97 | -0.02 | -0.38 | 0.99\*\*\* | 0.34 |
| MG | TCC | 0.59\* | -1.00 | 0.40 | 0.97\*\*\* | -0.63 | 0.72\* | -0.99 | -0.83 | 0.92\*\* | 0.97\*\* | -1.00 | 0.61\*\* | -0.69 | 0.99\*\*\* | -0.84 | -0.73 |
| FCC | -0.29 | 0.92\*\*\* | -0.68 | -1.00 | 0.85\*\* | -0.90 | 0.88\*\* | 0.97\*\*\* | -1.00 | -0.85 | 0.96\*\*\* | -0.83 | 0.42 | -0.91 | 0.97\*\*\* | 0.91\*\* |
| GA | TCC | -0.98 | -0.10 | 0.38 | 0.97\*\*\* | 0.45 | 0.61\* | -1.00 | -0.72 | -0.45 | 0.99\*\*\* | 0.39 | 0.47 | -0.98 | 0.99\*\*\* | 0.89\*\* | -0.97 |
| FCC | -0.83 | 0.26 | 0.02 | 0.83\*\* | 0.74\* | 0.29 | -0.91 | -0.42 | -0.10 | 0.96\*\*\* | 0.69 | 0.13 | -0.84 | 0.99\*\*\* | 0.68 | -0.81 |

Keys: TCC= Total coliform counts, FCC= Fecal coliform Counts

Wards name MA= Makera; SG= Sabon Gari; TIM= Tudun Iya Mai; UI= Unguwar Ibrahim; UR= Unguwar Rabiu, DE= Danduste; MG= Mai Gamji; and GA= Goya