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Seasonal Assessment of Some Physicochemical Properties of Water from Dutsin-Ma Irrigated Farmlands in Katsina State, North Western Nigeria

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Abstract: *This study was conducted to assess the seasonal variations of some physicochemical properties of water collected from ten different irrigated farmlands in Dutsin-Ma katsina state, Nigeria. The samples were collected from the farming site in wet and dry seasons. Alkalinity, Conductivity, Dissolved Oxygen, pH, Turbidity, and Total dissolved solids, were determined in the water samples. The samples were analyzed using standard analytical test kits. The average reading for two years was used in the analysis. Descriptive and inferential statistics were adopted for data interpretations. The results revealed that the alkalinity (126.9-213.4 mg/L), conductivity (114.0-352.1 µS/cm), DO (5.5-7.2 mg/L), TDS (110.0-148.3mg/L), turbidity (0.85 - 2.81NTU) and pH (6.1 to 7.2) of the waters (Borehole and dam) were within WHO, NESREA, NSDWQ limit except alkalinity in dam water at Daguda (213.4mg/L) and Makera (204.5mg/L) sampling sites which were more than the recommended limit of 200 mg/L. The maximum alkalinity values were obtained in the dry season and lowest in wet. The parameters studied showed variations with seasons and locations of the dams. ANOVA showed a significant difference (p<0.05) between the different seasons and locations. From the results obtained, it was concluded that seasonal variation affects water quality due to changes in parameters such as pH, conductivity, Dissolved Oxygen and Total Solids. The variations may also be influenced by the difference in water source and time of sampling. Periodic monitoring is recommended to always ascertain the quality of the dam and borehole waters.*

Keywords: *Water, Borehole, Dams, Physicochemical Properties, Periodic Monitoring.*

1.0 INTRODUCTION

Water is an important source of life which is extremely essential for survival of all living organisms. Water is one of the abundantly available substances in the nature which human are exploiting more than any other resources for the sustenance of life. Life is impossible on this planet without water, our most important resource apart from air and land is water. However, its quality varies from place to place and season to season (Adegbola *et al.,* 2019). Adequate and safe water supply is therefore a pre-requisite for significant socio-economic development of any community. Water quality is a term used to describe the physical, chemical and biological parameters of water features concerning its standard for specific usage (Diersing & Nancy 2009).

Physicochemical indicators such as pH, dissolved oxygen, temperature, turbidity, and nutrients (nitrogen and phosphorus) are the most common traditional indicators used in assessing water quality and safety. pH is the measurement of acidity or alkalinity of a medium.The pH of water usually range between 4 and 9. Acidic water has a pH lower than 7, Alkaline water has a pH of 8 or above while pure water has a pH of 7 (WHO, 2006)

2.0 MATERIALS AND METHODS

In the preparation of reagents, chemicals of analytical grade purity and deionized water were used throughout the analysis. All laboratory apparatus (glass wares and plastic containers) were thoroughly washed with detergent solution, soaked in 0.1M nitric acid and followed by several rinses with tap water , deionized water and finally with the analyte sample.

2.1 Study Area

Dutsin-Ma LGA is located at the central part of Katsina state, and lies on Latitude 12^0 26'N and longitude 07 ° 29' E (Abaji *et al.,* 2012). With estimated area of 552,323 km, and it is bounded in the North by Kurfi, Charanchi and Kankia LGAs. Matazu in the South-east, Safana and Dan-musa from the west (Fig 1). The climate of Dutsin-Ma is as classify by the Koppens classification is semiarid, tropical wet and dry climate. The climate patterns of Dutsin-Ma signify two main alternative seasons: that is the dry season and wet season. The rainy season is between April to September every year, which a time fluctuates in terms of onset and cessation. The average annual rainfall is about 700mm, and the pattern of the rainfall in the area is highly variable. This can result in a severe wide spread drought that can pose serious economic constrain (Abaji *et al.,* 2012).

The mean annual temperature ranges from 29 °C to 31°C, April and May is the highest temperature and the lowest in December - February. The highest amount of evaporation occurs during the dry season. The vegetation of the study area is the Sudan- Savanna type which combines the characteristics and species of both Guinea and Sahel Savanna (Tukur *et al*., 2013).

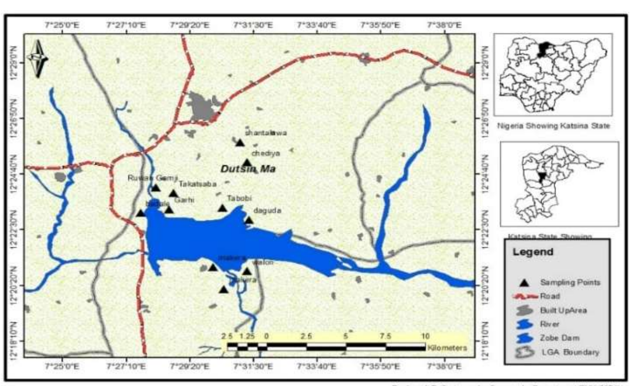

Figure 1: Map of Sampling Locations

2.2 Sampling

Water samples (Borehole and Dam) from ten (Chediya, Garhi, Shantalawa, Tabobi, Katsaba, Badole, Daguda, Makera, Ruwangamji, and Walari) major farmlands in Dutsin-Ma local government area of Katsina state during dry and wet seasons for the period of two years. Sampling was conducted in the dry and rainy seasons from January 2020 to September 2021. The water samples were collected using composite sampling in a polyethylene container that were previously cleaned with detergent, rinsed with tap water and soaked in 0.1M HNO_3 for 24 hours and finally rinsed with deionized water prior to usage (Ademoroti, 1996). Two separate water sample were collected in 1000cm^3 capacity plastic bottles from each of the sampling locations. One for heavy metal determination, the second for determination of physicochemical parameters, which is collected in 1000cm^3 capacity brown bottles.

Sample bottles used were rinsed with sampled water three times and then filled to the brim at a depth of one meter below the water from each of the five designated sampling points. Water sample bottles were labeled, stored in ice-blocked coolers and transported to the laboratory while in the Analytical laboratory; they were stored in the refrigerator at about 4°C prior to the analysis (APHA, 2012).

Table 1: Sample Labeling

S/N	Water Sample	Code	S/N	Water Sample	Code
1	Chediya Borehole	CBH	6	Badole Dam	BDM
2	Garhi Borehole	GBH	7	Daguda Dam	DDM
3	Shantalawa Borehole	SBH	8	Makera Dam	MDM
4	Tabobi Borehole	TBH	9	Ruwangamji Dam	RDM
5	Katsaba Borehole	KBH	10	Walari Dam	WDM

2.3 Procedures for Determination of Physicochemical Properties

2.3.1 Determination of Alkalinity

HACH Model CO150 meter was used to measure the alkalinity of the water samples. The mode key was pressed until a unit of part per thousand (ppt) displayed. The probe of the meter was inserted into the sample solutions.The measurement was recorded after stabilization. In measuring the alkalinity of water, the concentration of salt dissolved in the water was considered. Meter is usually kept in gentle motion through the water column while readings were taken insitu. Allow 30 mins for the meter to stabilize before another reading (USEPA, 2001).

2.3.2 Determination of Dissolved Oxygen (DO)

Dissolved Oxygen (DO) was determined on field during sampling using Membrane-Type Dissolved Oxygen Meter. The meter was switched on and its electrode was connected and dipped into an area where there is continuous flow of water and allowed to stay for 5 mins before reading was taken on the screen of the meter (USEPA, 2007).

2.3.3 Conductivity Measurement

Conductivity was measured by dipping the conductivity meter electrode into the individual samples and the readings were recorded after normal stabilization of the meter value shown as µS/cm (USEPA, 2007).

2.3.4 Determination of pH

pH was measured using the HANNA pH 210 Microprocessor pH meter. The pH meter was calibrated using the following procedures. Three (3) pH buffers were prepared (4.0, 6.0 and 7.0). The pH electrode was dipped into each of the three buffers prepared and calibration solutions save. The actual pH values of the samples were recorded after stabilized readings were noted on pH meter (USEPA, 2007).

2.3.5 Determination of Total Dissolved Solids (TDS)

The initial weight of the empty evaporating dish was taken as W_1 then 100 cm^3 of water samples was poured into evaporating dish and evaporated to dryness at 103°C on a steam bath for 24hrs. The evaporated samples were dried in an oven for 1 hour at 105°C. After removing from the drying oven, the sample was placed in a desiccator for at least 3 to 4 hours. After the container cools, the container was re-weighed as (W_2). The initial weight (in grams) of the empty container substracted from the weight of the container with the dried residue gives Total Dissolved Solids as given in equation (1) (APHA, 1998).

Calculation:

Total Dissolved Solids (TDS) = $\frac{(W1-W2)\ X1000}{Volume\ of\ water\ sample}$ ……….. (1)

Where;

W_1 = Weight of clean dried evaporating dish (g)

W_2 = Weight of evaporating dish and residue (g)

2.3.6 Determination of Turbidity

Stock turbidity suspension was prepared by dissolving 1.0 g hydrazine sulphate $(N_2H_4)H_2SO_4$ in deionized water and diluted to 1000 cm^3 mark in a litre volumetric flask. Also, 10g of Hexamethylene tetraamine was dissolved in water and diluted to 1000 cm^3mark in volumetric flask. 5 cm^3 of each of these solutions were pipetted into 100 cm^3 volumetric flask and mixed thoroughly. It was corked and allowed to stand for 24 hours in an incubator set at 25^OC. Then swirled gently and diluted to 100 cm^3 mark. It was thoroughly mixed and the turbidity of this suspension is 400 units. 40 units was prepared by pipetting 10 cm^3 stock turbidity suspension accurately into 100 cm^3 volumetric flask and diluted to100 cm^3 with turbidity free deionized water. Further dilution was done to give 10, 20, and 30 units which were used for turbidity meter calibration. Water samples were thoroughly shaken as to disperse the solid content and air bubbles were allowed to excape. Water samples were poured into the turbidimeter tube to the brim and their readings were taken directly from the calibration curve (APHA, 1998).

2.4 Statistical analysis

Results were mean ± of three determinations of borehole and dam water from ten (10) irrigated farmland. The results were further subjected to Analysis of variance (ANOVA) and Pearson Product Moment Correlations using statistical package for social science (SPSS) 21.0 version software.

3.0 RESULTS

The results of the analysis showed that alkalinity levels in water samples analysed gave a range of 147.5 ± 0.650 mg/L to 218.2± 0.64 mg/L in dry season and 104.7 ± 2.08 - 208.6 ± 2.081 mg/L in wet season. Highest alkalinity (218.2 ± 0.64 mg/L) was obtained in Daguda dam water (DDM) during dry season while Shantalawa borehole water (SBH) recorded the least by 104.7 ± 2.08 mg/L in wet season (Table 1 & 2). Other locations with high alkalinity during dry season were Makera dam water (MDM) (216.2 ± 0.3mg/L) and Badole dam water (BDM) (214.53 ± 0.45 mg/L) (Fig 2).

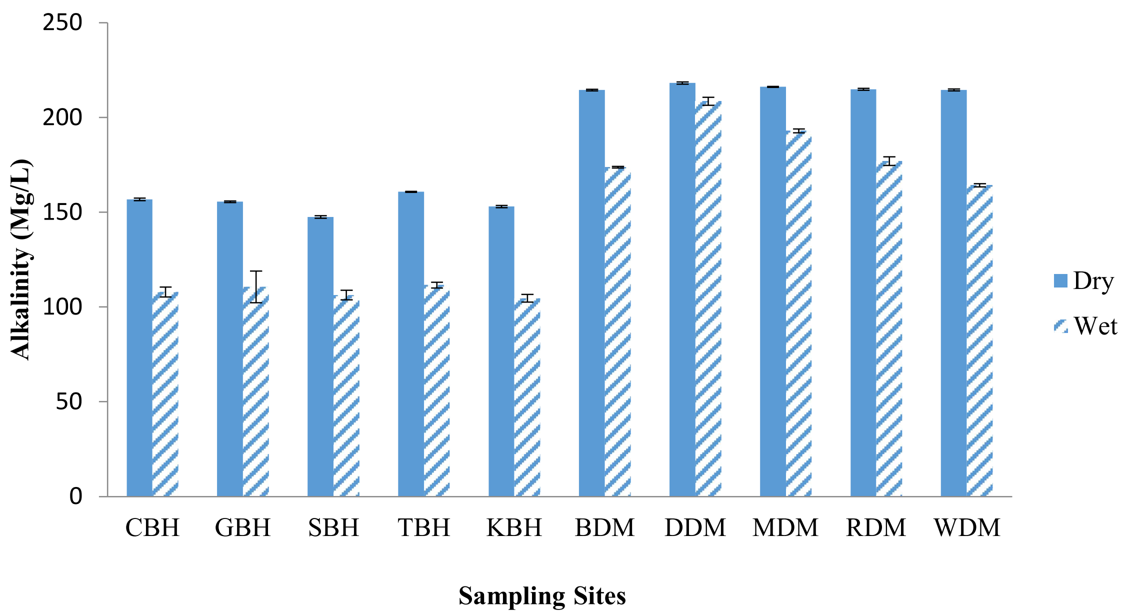

Figure 2: Mean Variation of Alkalinity Level in Water Samples across the Sampling Sites

The result of conductivity in water gave a range of 95.3 ± 0.58 - 131.3 ± 0.577 µS/cm in wet season and 332.6 ± 0.361 - 578.57 ± 2.69 µS/cm in dry season. Highest level was observed in dam water at MDM (578.57 ± 2.69 µS/cm) in dry season while at Tabobi borehole water (TBH) recorded the least by 95.3 ± 0.58 µS/cm (Table 1 & 2). Other locations with high conductivity levels in water during dry seasons were DDM (569.57 ± 1.06 µS/cm), BDM (566.4 ± 2.74 µS/cm), Ruwan gamji (RDM) (565.56 ± 0.80), and Walari dam water (WDM) has (563.73 ± 0.59 µS/cm) (Fig 3).

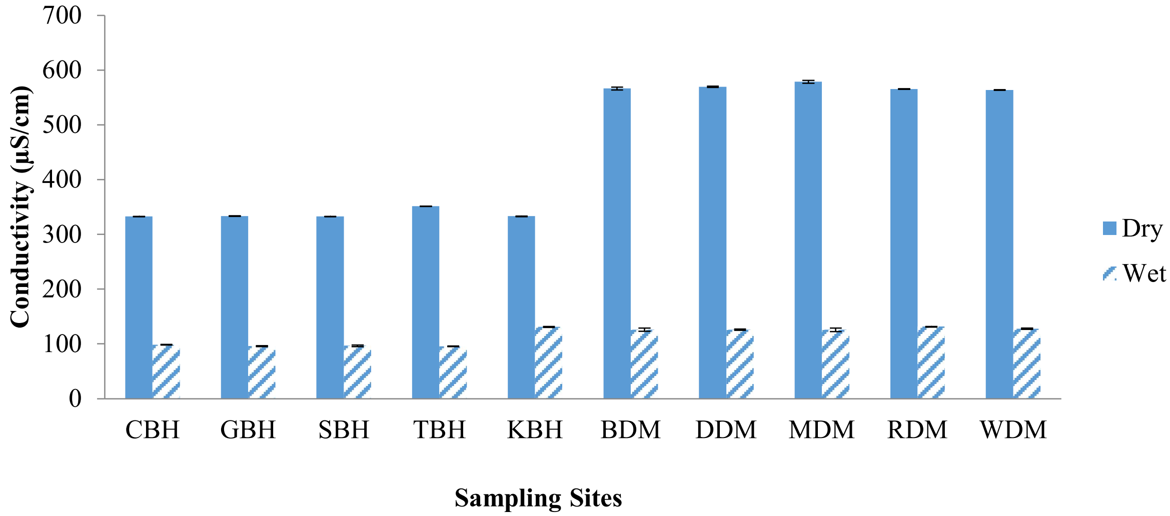

Figure 3: Mean Variation of Conductivity level in Water Samples across the Sampling Sites.

Dissolved oxygen analysed gave a range of 4.62 ± 0.07 - 7.62 ± 0.07 mg/L. Highest level of 7.62 ± 0.07 mg/L was observed in WDM during wet season and lowest value of 4.62 ± 0.07 mg/L was recorded in SBH in dry season (Table 1 & 2). Other locations with high DO during rainy season were MDM (7.58 ± 0.02), BDM (7.53 ± 0.01 mg/L), and DDM (7.52 ± 0.025 mg/L) (Figure 4).

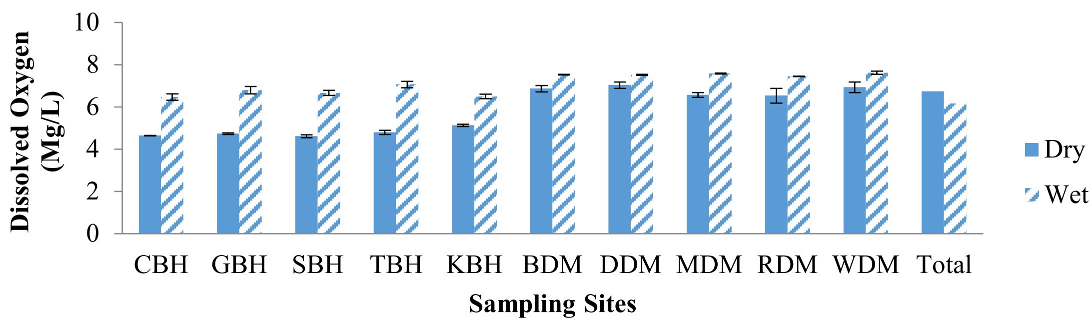

Figure 4: Mean Variation of Dissolve Oxygen in Water Samples across the Sampling Sites.

The pH levels of the waters analysed showed a mean of 6.0 ± 0.05 to 6.2 ± 0.06 in dry season and 6.6 ± 0.1 to 7.9 ± 0.06 in wet season. The pH ranges from alkaline (7.9) to slightly acidic (6.0). Highest level of 6.6 ± 0.1 and 7.9 ± 0.06 were obtained in CBH and BDM respectively in wet season while DDM recorded least value of 6.0 ± 0.05 in dry season

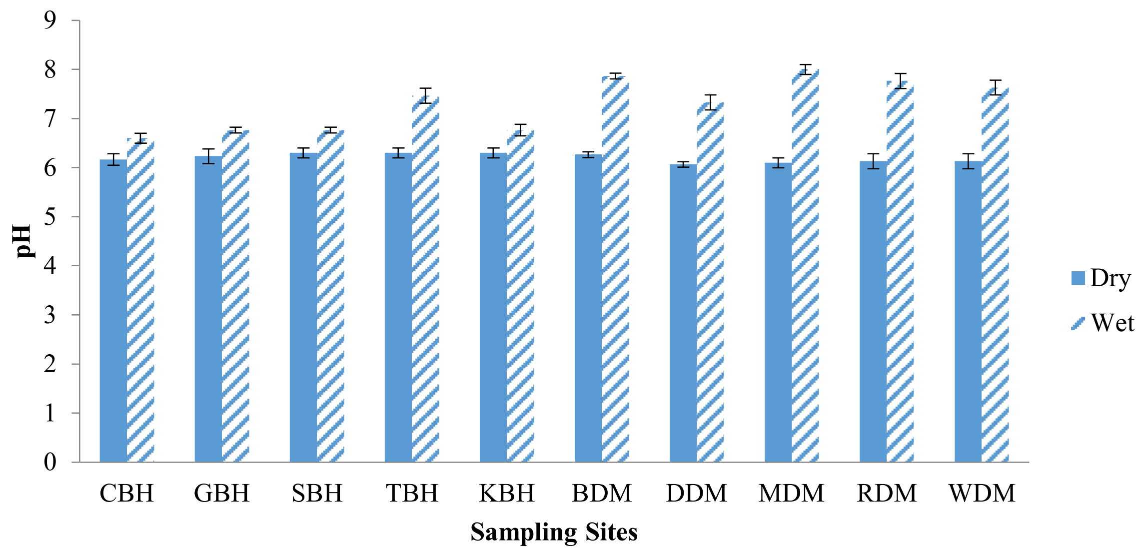

Figure 5: Mean Variation of pH in Water Samples across the Sampling Sites.

Turbidity is a measure of suspended minerals, bacteria, planktons, dissolved organic and inorganic substances. These suspended materials determine the clearness of water (Effendi *et al.,* 2015; Onojake *et al.,* 2017). Turbidity levels of water recorded in this study range from 0.52 ± 0.08 NTU in dry season and 5.78 ± 0.03 NTU in wet season. Highest level of 5.78 ± 0.03 NTU was obtained in BDM followed by 5.64 ± 0.106 NTU DDM while CBH recorded the least by 0.52 ± 0.08 NTU

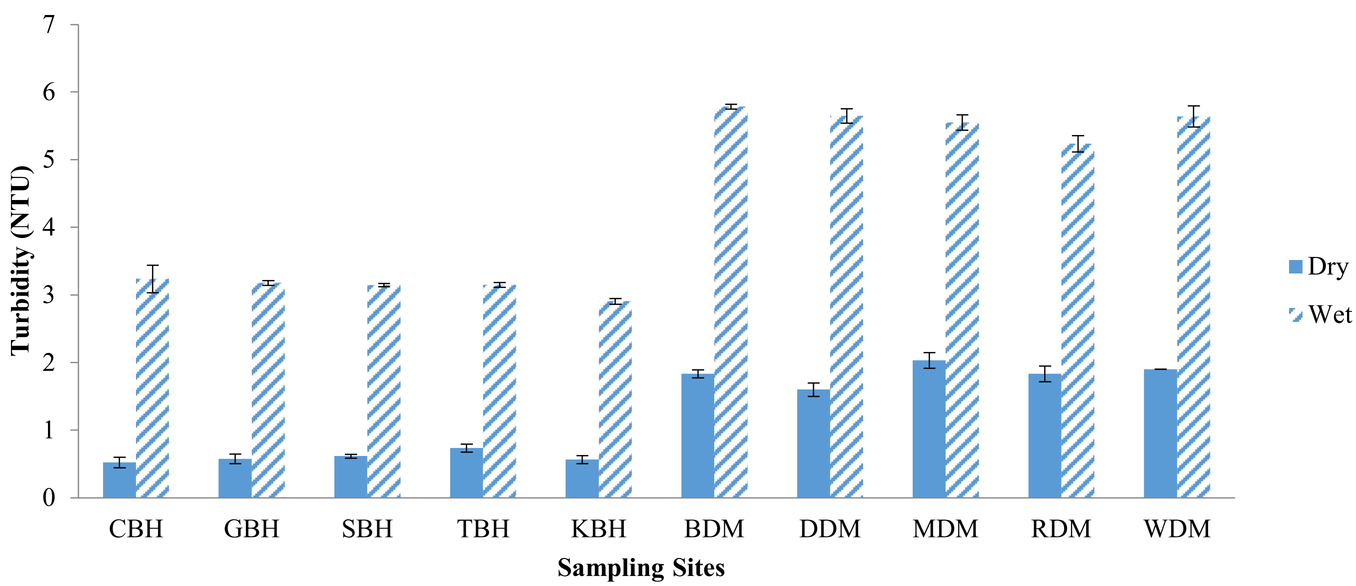

Figure 6: Mean Variation of Turbidity in Water Samples across the Sampling Sites.

The levels of Total dissolved solid in water range from 42.5 ± 0.153 to 138.2 ± 0.579 mg/L. Highest level of 138.2 ± 0.579 mg/L was recorded in DDM during wet season followed by BDM, MDM, RDM and WDM while GBH recorded the least by 42.5 ± 0.153 mg/L in dry season (Figure 7)

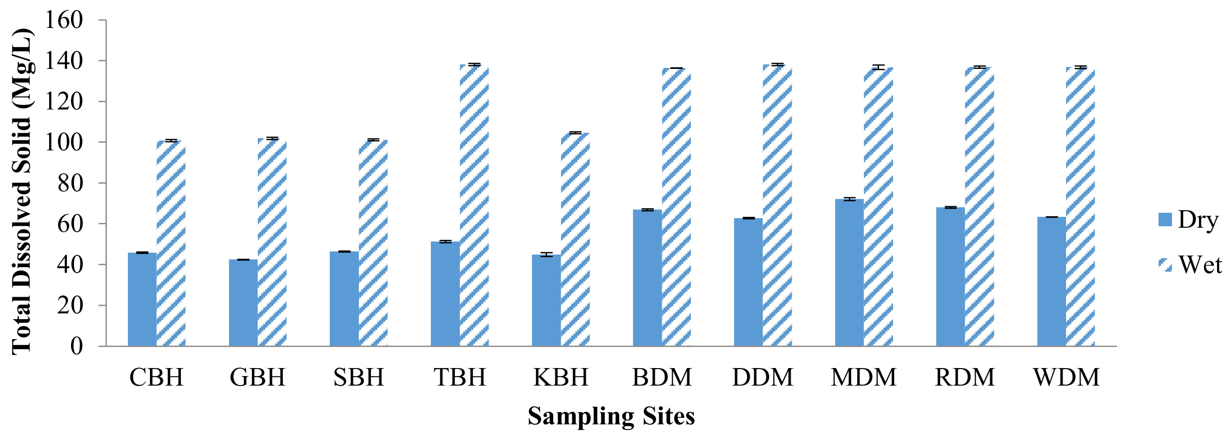

Figure 7: Mean Variation of Total Dissolve Solid in Water Samples across the Sampling Sites.

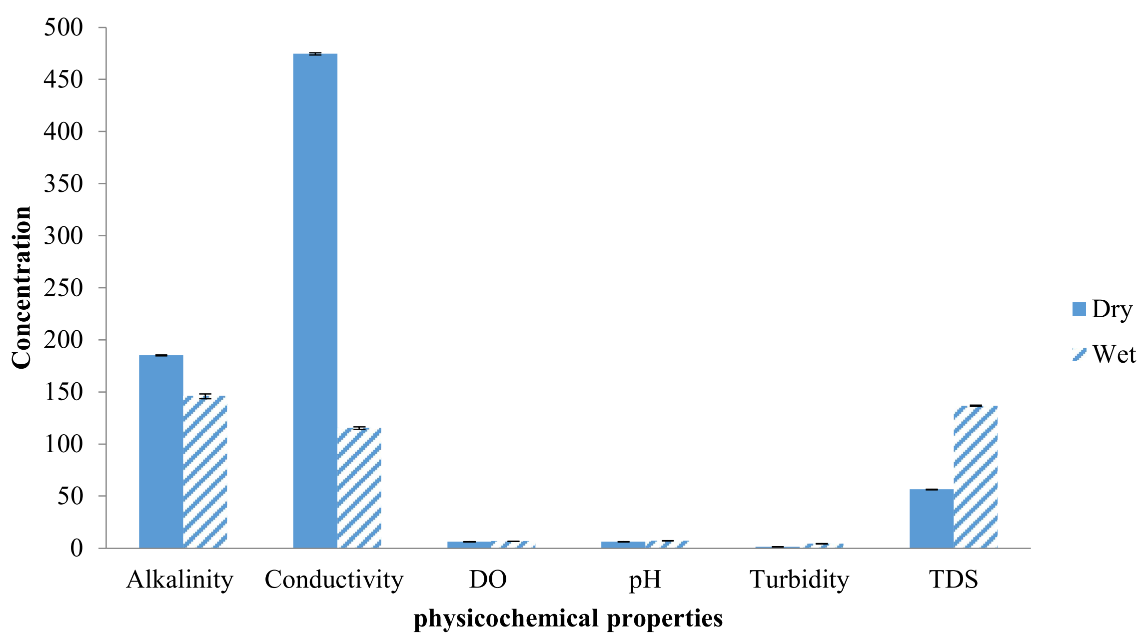

Figure 8: Seasonal Variation of physicochemical Parameters of Water Samples from Dutsin-Ma Irrigated Farmlands, Katsina State.

Appendix I: Physicochemical Analysis Result for Water samples during dry season

	Alkalinity		**Dissoved Oxygen**		**Conductivity**	
S/Sites	Mean	Stdev	Mean	Stdev	Mean	Stdev
Chediya (CBH)	156.8	0.650	4.64	0.011	332.6	0.360
Garhi (GBH)	155.6	0.458	4.73	0.035	333.3	0.680
Shantalwa (SBH)	147.5	0.650	4.62	0.07	332.6	0.360
Tabobi (TBH)	160.8	0.264	4.8	0.1	351.2	0.378
Katsaba (KBH)	153.0	0.611	5.13	0.057	333.2	0.608
Badole (BDM)	214.5	0.450	6.86	0.152	566.4	2.740
Daguda (DDM)	218.2	0.642	7.03	0.153	569.5	1.069
Makera (MDM)	216.2	0.3	6.56	0.115	578.5	2.685
Ruwangamji(RDM)	214.9	0.529	6.53	0.351	565.5	0.802
Walari (WDM)	214.6	0.503	6.93	0.251	563.7	0.585
Mean	185.2	0.506	6.74	0.129	474.5	1.027
WHO (2011)	100		4. - 10			
NSDWQ (2013)	200		4		1000	
NESREA (2011)	500		1.0- 2.0		1000	

	pH		**Turbidity**		**TDS**	
S/Sites	Mean	Stdev	Mean	Stdev	Mean	Stdev
Chediya (CBH)	6.2	0.115	0.523	0.08021	45.8667	0.30551
Garhi (GBH)	6.2	0.152	0.576	0.07234	42.4667	0.15275
Shantalwa (SBH)	6.3	0.1	0.616	0.02887	46.4667	0.20817
Tabobi (TBH)	6.3	0.1	1.66667	0.05774	51.3667	0.55076
Katsaba (KBH)	6.3	0.1	0.56667	0.05774	44.9333	0.90738
Badole (BDM)	6.2	0.057	1.83333	0.05774	66.9	0.45826
Daguda (DDM)	6.0	0.057	1.6	0.1	62.8	0.3
Makera (MDM)	6.1	0.1	2.03333	0.11547	72.1667	0.75719
Ruwangamji (RDM)	6.1	0.152	1.83333	0.11547	68.1	0.4
Walari (WDM)	6.1	0.152	1.9	0	63.3667	0.15275
Mean	6.2	0.108	1.315	0.06856	56.4433	0.41928

WHO (2011)	6.5 -8.5	5 - 10	500
NSDWQ (2015)	6 - 9	---	---
NESREA (2011)	6 - 9	10.0	500

Appendix II: Physicochemical Analysis Result for Water samples during Wet season

	Alkalinity		DO		Conductivity	
S/Sites	Mean	Stdev	Mean	Stdev	Mean	Stdev
Chediya (CBH)	108	2.64575	6.46667	0.15275	98.3333	0.57735
Garhi (GBH)	110.667	8.32666	6.8	0.17321	96	1
Shantalwa (SBH)	106.333	2.51661	6.66667	0.11547	96.6667	1.52753
Tabobi (TBH)	111.667	1.52753	7.06667	0.15275	95.3333	0.57735
Katsaba (KBH)	104.667	2.08167	6.5	0.1	131	1
Badole (BDM)	173.833	0.35119	7.53	0.01	126	2.64575
Daguda (DDM)	208.667	2.08167	7.52333	0.02517	126	1
Makera (MDM)	193.007	1.06566	7.58333	0.02082	125.667	3.05505
Ruwangamji(RDM)	177.1	2.26495	7.45333	0.00577	131.333	0.57735
Walari (WDM)	164.3	0.81854	7.62	0.07211	127.667	1.1547
Mean	145.824	2.36802	6.164	0.0828	115.4	1.31151
WHO (2011)	100		4 - 10		-----	
NSDWQ (2013)	200		4		1000	
NESREA (2011)	500		1.0- 2.0		1000	

	pH		Turbidity		**TDS**	
S/Sites	Mean	Stdev	Mean	Stdev	Mean	Stdev
Chediya (CBH)	6.6	0.1	3.23667	0.20232	100.867	0.55076
Garhi (GBH)	6.76667	0.05774	3.17667	0.03512	103.9	0.52915
Shantalwa (SBH)	6.76667	0.05774	3.14667	0.02517	102.2	0.43589
Tabobi (TBH)	7.46667	0.15275	3.15	0.03606	113.167	0.59231
Katsaba (KBH)	6.76667	0.11547	2.90667	0.04163	104.633	0.51316
Badole (BDM)	7.86667	0.05774	5.78333	0.03512	136.437	0.07095
Daguda (DDM)	7.33333	0.15275	5.64667	0.10599	138.167	0.57951
Makera (MDM)	8	0.1	5.55	0.11136	136.8	1.12694
Ruwangamji(RDM)	7.76667	0.15275	5.23667	0.12014	136.833	0.57951
Walari (WDM)	7.63333	0.15275	5.64	0.15524	137.167	0.57951
Mean	7.29667	0.10997	4.34733	0.08681	123.182	0.55313
WHO (2011)	6.5 -8.5		5 - 10		500	
NSDWQ (2015)	6 - 9					
NESREA (2011)	6 - 9		10.0		500	

Table 3: Correlation Matrix for physicochemical properties of water during dry season

	Alkalinity	DO	Conductivity	TDS	pH	Turbidity
Alkalinity	1					
DO	0.561862	1				
Conductivity	0.388066	0.683316	1			
TDS	0.571056	0.912087	0.881575	1		
pH	0.558856	0.612654	0.875927	0.765804	1	
Turbidity	0.8215	0.630574	0.728451	0.781742	0.56377	1

Table 4: Correlation Matrix for physicochemical properties of water during wet season

	Alkalinity	DO	Conductivity	TDS	pH	Turbidity
Alkalinity	1					
DO	0.779227	1				
Conductivity	0.895382	0.80301	1			
TDS	0.879375	0.896735	0.756246	1		
pH	-0.74042	-0.77785	-0.67457	-0.70035	1	
Turbidity	0.970222	0.758856	0.840894	0.919393	0.65311	1

DISCUSSIONS

Figure 2-8 shows the physicochemical parameters of water samples from Dutsin-Ma irrigated farmlands during dry and wet seasons. Comparing the level of alkalinity between dry and wet season, it was revealed that dry season had higher concentration of alkalinity than wet season (Fig.8). High alkalinity in water during dry season could be attributed to high deposition of carbonate and hydroxide from discharged waste into the water source as observed by Ademorati (1996). WHO (2006) recommends 200 mg/L as maximum level for alkalinity in water indicating this water is contaminated with alkaline. Highly alkaline water has a foul-taste, unpalatable and leads to scale formation (Shrestha & Basnet, 2018). The use of water with a high alkalinity level could lead to diseases like gastrointestinal illnesses such as stomach cramps, abdominal distress and diarrhea. The result of alkalinity in this study agrees with Sadiya *et al.,*(2018), Also Sa'eed and Mahmoud, (2014) reported high alkalinity values ranging from 205 ± 5.6 to 850 ± 31.6mg/Lin borehole water samples from Kano metropolis in Kano State. Contrary to the result of high alkalinity obtained in this study, Shalom (2011) reported low alkalinity levels ranging between 0.26 ± 0.15 to 14.20 ± 1.60mg/Lin surface water points in Canaan land, Ota in Ogun State. In another study, also Shrestha and Basnet, (2018) reported low alkalinity. Variations in the level of alkalinity may be due to the differences in hydro-geological regimes, weather patterns and contaminant entry point (Iroha *et al.,* 2020). Moderate positive correlation was observed between alkalinity and pH (0.56) in dry season while -0.74 was observed in the wet season (Table 3 and 4). Statistical findings revealed strong positive correlation (r) between conductivity and pH (0.875) in dry season (Table 3) which became strong and negative in the wet season (-0.674) (Table 4). The higher electrical conductivity recorded in dry season might be attributed to reduced water volume and high rate of evaporation. The values of conductivity of water in this research were below the WHO (2006) recommends 1200 µS/cm limit.

Figure 8 shows a significant difference in the Dissolve oxygen levels across the sampling locations and seasons. Wet season (6.8 mg/L) had higher DO than dry season (6.2 mg/L). The high values in the wet season could be due to aeration with continuous disturbance of the water from wind storms usually occurring in the wet season while the lower value in the dry season could be due to increased water temperature which can reduce the amount of oxygen it can hold as observed by Fatima and Audu (2014). The values of dissolve oxygen in water at all the sampling sites were within the standard recommended limit of dissolved oxygen in water is 7.5 mg/L by WHO (2006) and USEPA (2002) limit of 9.0mg/l. Levels of dissolve oxygen obtained in this study is in line with the findings by Iroha *et al.* (2020); Shrestha and Basnet (2018) but negates the study conducted by by Nwali *et al.* (2016); Reuben *et al.,* (2018).

The high values of dissolved solid in the wet season observed in this current might be because of dilution of the water due to the high rate of rainfall and introduction of particles by runoff into the water. Harrison (2007) reported that high total dissolved solid reduces water clarity, which could contribute to reduced photosynthetic activities and possibly lead to an increase in water temperature. There is a high relationship between the disease-causing microbes and high level of total suspended solids (Ho *et al.,* 2003). The standard recommended limit of total dissolved solid in surface water is 500mgL^{-1} by WHO (2006). The result of this study is higher than level reported by Reuben *et al.,* (2018) but lower than level reported by Iroha *et al., (*2020).

Turbidity is a measure of suspended minerals, bacteria, planktons, dissolved organic and inorganic substances. These suspended materials determine the clearness of water (Effendi *et al.,* 2015; Onojake *et al.,* 2017). The high turbidity values in the wet season could be attributed to surface run-off into water bodies. Water with high turbidity has a cloudy appearance and is usually not acceptable for drinking purposes unless when treated .Water with high turbidity is normally associated with high microbiological contamination. High value of turbidity reduces the aquatic vegetation and subsequently reduces the food sources for many aquatic animals (Tiwari, 2015). This situation can also interfere with disinfection and provides a medium for microbial growth that causes symptoms such as nausea, cramps, diarrhea, and associated headaches (Akoto &

Adiyiah , 2007). The standard recommended limit of turbidity in water is 5.00 NTU as given by WHO (2006). Contrary to the result obtained in this present study, higher turbidity level was obtained from the findings of Ifenna *et al.,* (2020) who reported 11.50±0.96 – 19.97±0.32 NTU in water samples from Usuma dam, Abuja.

pH is the measure of H^+ concentration in a samples. It is an important indicator of the chemical status of the water. It regulates the biogeochemical reactions and processes in water bodies (Catanis *et al.,*2018). Low pH of water obtained in this present study during dry season could be due reduced water volume associated with increased evaporation rate and deposition of some organic matter into the water. Also a moderate positive correlation was observed between pH and alkalinity (0.56) in dry season, this means that as pH increases alkalinity also increases. The use of water with very high or low pH could have adverse effects on the digestive and lymphatic systems of human (Shalom, 2011).World Health Organization (2006) recommends pH of is 6.50-8.50 for fresh water and this shows that all the water samples studied for both dry and wet season indicate good quality. These results are consistent with the results of Micheal *et al.,* (2015); Reuben *et al.* (2018); Iroha *et al.* (2020).

4.0 Conclusions

The physicochemical parameters assessed in this study were within recommended limits except for alkalinity in dam water from daguda and Makera. High alkalinity in water could be attributed to high deposition of carbonate and hydroxide from discharged waste into the water source. There is also significant difference in physicochemical properties of the water during dry and wet season**,** the variations may also be influenced by the difference in water source and time of sampling. periodic monitoring is recommended to always ascertain the quality of the dam and borehole waters. Further study should also include other irrigated farmlands within Katsina states.

Declaration:

Ethics approval and consent to participate Not applicable.

Consent for publication Not applicable.

Availability of data and materials The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests The authors declare that they have no competing interests.

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Authors' contributions MSD ran the experiment, FM interpreted the data and reviewed the literature, GIY ran the data analysis and typed the manuscript. All the authors read the manuscript and approved it.

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