EVALUATION OF AVAILABLE DRINKING WATER QUALITY FOR AFGHAN REFUGEES LIFE STYLE IN NORTH WEST BALOCHISTAN

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ABSTRACT: Evaluation of drinking water in Afghans refugee's sites is an interesting feature, before authorized agencies explicitly closed the camps, after more than three decades. Secondary goal is to know, how many types of ethnic groups of refugees are present and highlight there life style. For this purpose two camps were selected as a case study. To support the current study, two residential locations in Quetta city were reported, where the afghan refugees are living. In this context total 50 samples were collected for the analysis of essential water quality parameters. The 21 hydrological parameters were analyzed, colour and taste in selected location is unobjectionable (except saranan), odour is unobjectionable, pH range between 7.7 to 8.0, the maximum value of E.C is 3115 μ/sm^2 , threshold value of turbidity is 8.5 NTU and T.D.S are high in Camp A, alkalinity level is 2.3-6.7m.mol/lit , Ca, CI threshold value is double in Camp A , CO_3 is zero ,F is in prescribed limit, Iron, Hardness K, Mg and NO_3, evaluation is satisfactory, HCO_3 lie between 115-335 ppm, Sodium concretion in camp A is slightly high, The rose up value of SO_4 490 ppm in saran camp rest are in limit and total coliform results show that most of the population is not consuming safe drinking water. There are eight ethnic groups who are residing near and inside Quetta city.

Key words: H_2O, Afghan diaspora, Pakistan.

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INTRODUCTION

The main concern of the current study is to evaluate the drinking water quality as a last study, before closing of all the refugee camps and compare it with the previous study. We are also interested to know how many Afghan refugees (A.R) communities/ tribes /ethnic groups arrived and stayed in Quetta division.

The study of food and drinking habits has a long history in social anthropology and the environmental espouse policy relay on chronological evaluation. This paper describes the available drinking water quality of afghan refugee camps. The host country Pakistan affords totally 2.1 million Afghan refugees, in which almost 1.5 million Afghan refugees are registered now a day (*UNHCR Statistical., 2020*). In 1979 U.S.S.R decided, to deploy their troops toward the silent state (*Khan et al., 2012*). Balochistan is a province of Pakistan ranking second with the most number of Afghan refugees, in which the bulk of Afghan refugees are Pushtuns with a the great number of Hazara ethnic groups migrated toward Quetta valley, when the Hazara armed struggle (*Adamec et al., 2012*) for autonomy was defeated inside Afghanistan. They face extreme conditions and limited opportunities to revive and rebuild their lives (Pandey and Ilavarasan, 2019). After the USSR invasion, another wave of Hazara refugees migrates into Baluchistan, where they have distant relatives and kin, in which most of them speak Hazaragi language Afghan refugees are increasingly viewed as an additional economic and social burden on Pakistan and U.N.H.C.R's budget for refugees also becomes decreased year by year (*Refugees International et al., 2001*). There are 18 camps of Afghan refugees located in five districts of Balochistan Province, in which six camps are labeled as 'new camps' and established in response to refugee influx in November 2001 after 9/11 (Quddus *et al.,* 2006) due to the ongoing security operation in Pakistan (Huffington post *et al.,* 2014). Pakistan highly official likely to shutdown many camps (Dawn *et al.,* 2013) or shift it towards boundary areas and try to return refugees to their home land after December 2015.(Ali *et al*., 2015) which was extended five years more.

Water contains many minerals and salts which act as a nutrient. The sodium and potassium ratio is an essential concerned that inhibit high blood pressure (Yoshimura *et al*.,1991).There is no doubt water plays a major role in human physiology. Indirectly water also plays a role on emotions and mood. If the drinking water composition is altered by any means it also indirectly modifies the structure and chemical composition of organisms' water pollution has an adverse effect on their survival.

Clean water, Sanitation and Hygiene is a basic right of every individual in the humanitarian studies. But it is also been seen that the standard facility of one toilet for 20 persons is not available in these camps (Harvey *et al*., 2002). Water quality analysis is a one of the high priority issues for environmental protection policy (Simeonov *et al*., 2002). The degree of pollution on drinking water is determined by the below mentioned parameters. It is further added that, due to the geophysical shape of the city, the quality of ground water and the depth fluctuates from place to place. The quality of water varies from time to time and place to place due to interaction of local factors (Achakzai A. *et al*, 2014).

Topography: The Quetta city is a urban area and headquarter of Balochistan, the cool and dry climatic conditions and higher altitudes resemble with the climatic conditions of Afghanistan (Pakistan Paedia *et al*., 2020). Which is an ideal location to live for Afghanistan refuge (A.r), but the key reason is the common heritage that links the people from both sides of the border.

Camp A: UNHCR open an official camp 25 years ago with the name "Saranan Camp", when the first wave of A.r moved towards Pakistan. Now a days this camp is closed in government documents but the camp is run by A.r on their own and with the help of N.G.Os, which provides them with basic facilities of life. The Saranan located almost 40km from the Quetta in Pishin district, a camp that contains hut type houses constructed with mud, consists of more than ten thousand peoples which has been opened since 1979. While the hut type homes are constructed with mud .Due to shortage of power supply (Pakistaniat *et al.*, 2011), Camp A remains cut off from the main electricity grid. A lot of problems face by A.R but residents are happy and say that conditions are much better today than they used to be.

Camp B: Surkhab Camp is also an unofficial camp now days. In early 80s most of the refugees moved from Surkhab Camp (in Pishin district Latitude 30.58,028 longitude 66.99,611) to Saranan, when most of the men (Mujahidins) went back in war for fighting and the remaining family members of freedom fighters negotiated with the Agriculturists of Saranan areas and requested to lease the land to them so that they utilized there land for cultivation. When the government of Pakistan took a notice of this settlement and ordered to legalize the agreement, it was reformulated as a lease between the landowner and the government, after which the UNHCR could officially, established a camp in Sharkhab (Case Study *et al.*, 2006).

Water quality analysis in Quetta district was studied by many (Canfield *et al*., 1998) but all studies which are publically available did not give an accurate result related to below mentioned sites, study of Khattak did not high light the selected locations(Khattak *et al*., 2008).

Site A. Hazara town Quetta.(H.t). 30°10′N, 66°57′E Hazara town grown near the western bypass of Quetta, city and population according to 1998, is 70,000 with the increment of 5% per annum. Most of H.t residents arrived as a refugees in Quetta since 1996 (*Adamec et al., 2012*), with the help of local Hazaras (Mousavi & S.Askar ,1998) who have been declared locals in 1963. They helped them to bypass refugee camps altogether.

Site B. Zamindar Colony and Killi Kamalo Quetta.

The above mentioned locations are located near Sariyab road (the southern part of Quetta, city) both became partially residential areas. The dusty foot hill areas were established two decades ago by A.r. The livelihood facilities are limited and due to electricity shortage in Pakistan, A.r collected water from the adjacent tube wells to fulfill their requirement and transport by themselves. Beside H.t refugees, the A.r of site B first arrived to the camps near Quetta, when they see better opportunities inside Quetta they move towards better opportunities. Most of the suspects were arrested during raids in the city's outskirts from the above mentioned areas (Kasi *et al*., 2015). Now government of Pakistan is likely to clear these areas from refugees as per policy (Yusufzai *et al*., 2015).

MATERIALS AND METHODS

I. Selection criteria: To avoid human error. Random generation method is used to collect water sample form Afghan refugee camp through blind peer process.

II. Verbal Interview: A predefined set questionnaire was asked to know about their ethnic background.

III. **Sample collection method**: Water samples for bacterial analysis collected in sterilized containers (200 ml) under aseptic condition. For hydrological analysis sample were collected in unused polystyrene 1liter capacities.

IV. Statistical analysis: Numbers obtained was subjected to statistical analysis through Statistical package for the social sciences (Software S.P.S.S Version 16).

V. Quality Control: To avoid alter action; the Electric conductivity and pH were measured immediately, whereas all the other hydro chemical parameters were analyzed within ten hours after obtaining samples.

Table 1. Methods used for Analysis hydrological parameters.

Parameters	Method
pH	pH Meter
Conductivity (µS/cm)	E.C meter
Turbidity (NTU)	Turbidity Meter
Color	Physical Sensory Test
Taste	Physical Sensory Test
Odour	Physical Sensory Test
Alkalinity(mg/l as $CaCO_3$)	Titrimetry Standard method (1992), APHA, USA
Bicarbonate (HCO_3) (mg/l)	Titrimetry, Standard method (1992), APHA, USA
Carbonate (CO_3) (mg/l)	Titrimetry,, Standard method (1992), APHA, USA
Calcium (Ca) (mg/l)	Complexometry, 3500-Ca-D, Standard Method (1992), APHA, USA
Magnesium (Mg) (mg/l)	Calculation, 2340-C, Standard Method (1992), APHA, USA
Hardness (mg/l)	Complexometry, EDTA Titration, Standard Method (1992), APHA, USA
Sodium (Na) (mg/l)	Flame photometer PFP7, UK
Potassium (K) (mg/l)	Flame photometer PFP7, UK
Chloride (Cl) (mg/l)	Titration (Silver Nitrate), Standard Method (1992), APHA, USA
Sulfate (SO_4) (mg/l)	UV Visible Spectrophotometer, Mecasys, Korea
Nitrate (NO_3) (mg/l)	Cd-reduction, Nitrate Ver 5 (HACH Company) Model DR/2800, USA
TDS (mg/l)	2540C, Standard method (1992), APHA, USA
Iron (Fe) (mg/l)	UV Visible Spectrophotometer
Microbiology (P/A)	Standard method (1992), APHA, USA

RESULT AND DISCUSSIONS

Physico-Chemical Calculations: From the reported results, it is clear that there are slight variations in the levels of physico-chemical parameters of the constituents inside the samples collected from four different localities of the concerned area.

Colour: The analytic results as shown in table 3.1 tell us that the colour of drinking water is mostly according to the standard, as setup by concerned authorities. Minor particles add colour to water. Colloidal suspensions and non-colloidal organic acids and neutral salts also alter the natural colour of water.

Taste of Saranan sample water was objectionable rest of mentioned desirable locations had an unobjectionable water samples. Taste aware natural water is usually basic in nature because of presence of carbonates and bicarbonates of alkali and alkaline earth metals (APHA *et al*., 1995).

Odour: Many organic and inorganic substances contribute to the odour of water, Fishy, grassy and musty odour is normally associated with biological growth. Odour in drinking water is an indication of polluted source of water. Mostly all results are odour less and unobjectionable.

pH is of major importance in determining the corrosive quality of water, having the inverse relation. WHO (MacMillan *et al.,* 1984) pH 6.5 - 8.5 recommended value as shown in table 4, although it was recognized that some problems could arise with in distribution system with pH below 7 and the water samples collected from different points of concerned, which is within the safe limits recommended by WHO.

E.C. is a measure of current carrying capacity. With the presence of dissolved salts, E.C also increases. These primary results give an idea. The saranan camp shows moderated rise in E.C as describe by concerned.

Turbidity: High turbidity in drinking water is used as an indicator of other contaminants. The analytical result shows that the turbidity in all selected location is acceptable besides camp A.

Total Dissolve Solid (TDS): The TDS values are within the prescribed limit. TDS is mostly linked to Taste, Hardness, corrosion properties and tendency to incrustation. Principal ions (inorganic ions) contributing to TDS are Carbonates, Bicarbonates, Chlorides, Sulphates, Nitrates, Sodium, Potassium, Calcium and Magnesium.

Chemical parameters: According to chemical analysis data in the form of concentration in above tables;

Alkalinity: Due to current analysis we come to know the Alkalinity in concerned area is below10 m.mol/l.

Calcium: The concentration of calcium is in defining limit of health agency i.e below 75ppm.

Chloride: Cl^{-1} ions presence in water is due to natural minerals and rocks present near the camp A& B. The chloride ion in water mostly present with the combination of sodium, calcium and magnesium. Appraisal results in tables 4.2,5, show that the concentration of chloride in Camp B, Site A,B are in prescribed limit of W.H.O. But threshold value of chloride has increased in Camp A and the taste of water has become salty.

Carbonate: Carbonates in all above mentioned sites are zero.

Fluoride: The Camp A,B and Site B concentration of fluoride is between 0.5-1.5 mg / l, it gives good protection against tooth decay, on the contrary in site A the concentration is slightly above in Quetta site A *i.e* 1.5 ppm, which causes defects in teeth enamel (Atia *et al*., 2013).

Iron: The excess amount of iron in water intake practice can cause toxicity to death of human life (VINCENT *et al.*1995). A most common problem faced by humans is iron deficiency. It also affects oxygen delivery to cells, resulting in fatigue, poor work performance, and poor immunity (Hass and Brownlie, 2001). Due to less concentration of iron there is no chance of iron fixation bacteria in water. Maximum composition of iron in water is 0.02 ppm.

Hardness: Hardness in water causes gastric disorder.

Bicarbonate: The higher value of bicarbonate in Camp A and lower value in zamindar colony.

Potassium: All samples are in prescribed limit.

Magnesium: Current study indicated all results are acceptable.

Sodium: Sodium is present in cation form and reacts with other anions present to make a combination of NaCl, Na_2So_4. The concentration of sodium is below the threshold limit of W.H.O. The concentration of sodium is exceeding in Camp A.

Sulfate: The concentration of sulfate in water is acceptable except camp A.

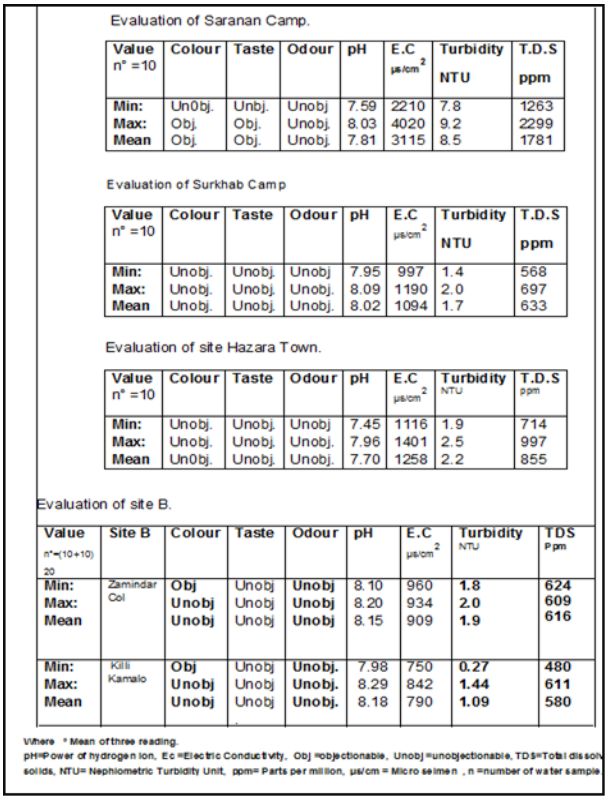
Nitrate: The level of nitrate is noted in the range of 2.0-6.8 ppm (means) lower to higher be noted from site B to camp B respectively.

Bacteriological result: As described earlier in the report of (PEP *et al*., 2007) no bacteria contaminates are presents in tube well water, but when this water is transported from one point to another becomes contaminated and it also depends on the storage conditions and water handling. According to survey conducting in 2007, 20-40% of the patients, in Pakistan were suffering from water related diseases. The Microbiological result mentioned above show a great health risk and alarming signal for refugees.

Livelihood situation: Through current study we also came to know about eight A.R ethnic groups/ communities dwelling in and around Quetta, city. Pushtun, Uzbek, Turkman, Tajik, Hazara, Baloch , Kirghiz and Qizilbash. Most of them are Muslim (according to their own statement)

The livelihood condition is too poor in above mentioned sites and camp. There no proper sewerage system and waste bin. Therefor these pollutants become a part of the system. Pollution can be naturally caused by hydrological processes in which decomposition of animals and regrettable water and weathering are brought into main water resources. All these processes and poor livelihood conditions lead to the degradation of natural environment. Pishin is surrounded by mountains therefore it is difficult for air carrying particles to come into direct contact with water and become a part of surface water. But weathering of soil and rock minerals produce inorganic ions in natural water resources. (*Bricker et al*., *1997*).

Table 3.1. Water Quality results of Physiochemical.



Evaluation of Saranan Camp.

Value n° =10	Colour	Taste	Odour	pH	E.C µs/cm²	Turbidity NTU	T.D.S ppm
Min:	Un0bj.	Unbj.	Unobj	7.59	2210	7.8	1263
Max:	Obj.	Obj.	Unobj.	8.03	4020	9.2	2299
Mean	Obj.	Obj.	Unobj.	7.81	3115	8.5	1781

Evaluation of Surkhab Camp

Value n° =10	Colour	Taste	Odour	pH	E.C µs/cm²	Turbidity NTU	T.D.S ppm
Min:	Unobj.	Unobj.	Unobj	7.95	997	1.4	568
Max:	Unobj.	Unobj.	Unobj.	8.09	1190	2.0	697
Mean	Unobj.	Unobj.	Unobj.	8.02	1094	1.7	633

Evaluation of site Hazara Town.

Value n° =10	Colour	Taste	Odour	pH	E.C µs/cm²	Turbidity NTU	T.D.S ppm
Min:	Unobj.	Unobj.	Unobj	7.45	1116	1.9	714
Max:	Unobj.	Unobj.	Unobj.	7.96	1401	2.5	997
Mean	Un0bj.	Unobj.	Unobj.	7.70	1258	2.2	855

Evaluation of site B.

Value n°=(10+10) 20	Site B	Colour	Taste	Odour	pH	E.C µs/cm²	Turbidity NTU	TDS Ppm
Min:	Zamindar Col	Obj	Unobj	Unobj	8.10	960	1.8	624
Max:		Unobj	Unobj	Unobj	8.20	934	2.0	609
Mean		Unobj	Unobj	Unobj	8.15	909	1.9	616
Min:	Killi Kamalo	Obj	Unobj	Unobj.	7.98	750	0.27	480
Max:		Unobj	Unobj	Unobj.	8.29	842	1.44	611
Mean		Unobj	Unobj	Unobj.	8.18	790	1.09	580

Where * Mean of three reading.
pH=Power of hydrogen Ion, Ec =Electric Conductivity, Obj =objectionable, Unobj =unobjectionable, TDS=Total dissolved solids, NTU= Nephlometric Turbidity Unit, ppm= Parts per million, µs/cm = Micro seimen , n =number of water sample

Table 3.2. Water Quality Results of Chemical.

Saranan

Name	Alk	Ca	Cl	CO_3	F	Fe	Hard	HCO_3	K	Mg	Na	NO_3	SO_4
Unit	m.mol	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
n° =10													
Min:	5.6	80	240	0	1.02	0.03	490	280	4	80	190	4.0	240
Max:	7.8	180	660	0	1.09	0.05	800	390	8	132	510	5.0	660
Mean	6.7	130	450	0	1.01	0.04	645	335	6	106	350	4.5	450

Surkhab

Name	Alk	Ca	Cl	CO_3	F	Fe	Hard	HCO_3	K	Mg	Na	NO_3	SO_4
Unit	m.mol	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
n° =10													
Min:	4.2	68	46	0	0.24	0.01	320	210	3	24	99	1.9	190
Max:	5.0	80	88	0	0.40	0.04	330	250	2	32	120	2.7	220
Mean	4.6	74	67	0	0.32	0.03	280	230	2.5	28	109	2.3	205

Hazara Town

Name	Alk	Ca	Cl	CO_3	F	Fe	Hard	HCO_3	K	Mg	Na	NO 3	SO_4
Unit	m.mol	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
n° =10													
Min:	3.6	48	108	0	1.48	0.08	190	180	1	18	120	3.0	181
Max:	4.4	70	210	0	1.59	0.10	390	220	3	52	164	3.6	203
Mean	4.0	59	159	0	1.54	0.09	290	200	2	35	142	3.3	192

site B

Name		Alk	Ca	Cl	CO 3	F	Fe	Hard	HCO_3	K	Mg	Na	NO_3	SO_4
Unit		m.mol	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
n° =20(10+10)														
Min:	Zamindar Col	1.6	46	116	0	0.30	0.18	240	80	1.0	28	82	5.6	112
Max:		3.0	52	122	0	1.37	0.22	272	150	2.0	38	100	8.0	114
Mean		2.3	49	119	0	0.83	0.20	256	115	1.5	33	91	6.8	113
Min:	Killi Kamalo	3.0	34	94	0	0.9	0.03	195	150	1.0	15	94	2.0	110
Max:		3.6	62	180	0	1.1	0.07	380	180	2.0	61	110	6.0	190
Mean		3.3	48	137	0	1.0	0.05	287	165	1.5	38	102	4.0	150

* Each Mean of three reading
** w here
Alk=Alkalinity, Ca = Calcium, Cl =Chloride ,Co_3 = Carbonate, F = Fluoride, Fe =Iron ,Hard =Hardness, Hco_3 Bicarbonate, K =Potassium, Mg = Magnesium, Na = Sodium, No_3 = Nitrate, SO_4 = sulfate.

Table 3.3. Water Quality Results of Bacteriological Contamination.

Saranan Camp.			
Camp A	T.Coliform	Safe for Drinking	Unsafe for Drinking
n° = 10	10 (100%)	1 (10%)	9 (90%)
Surkhab Camp.			
Camp B	T.Coliform	Safe for Drinking	Unsafe for Drinking
n° = 10	10 (100%)	3 (30%)	7 (70%)
Site Hazara Town			
Site A.	T.Coliform	Safe for Drinking	Unsafe for Drinking
n° = 10	10 (100%)	4 (40%)	6 (60%)
Site B.			
Site	T.Coliform	Safe for Drinking	Unsafe for Drinking
Zamindar Col n° = 10	10 (100%)	3 (30%)	7 (70%)
Killi Kamalo n° = 10	10 (100%)	2 (20%)	8 (80%)

Table no 4. Drinking Water Quality Standards.

	Name	Guide line values	Difference ($_{mean}$)				
			Camp A	Camp B	Site A	Site B	
						Zamindar Col	Killi Kamalo
Chemical	**Alk**	10m.mol/lit ($_{WHO}$)	6.7	4.6	4.0	2.3	3.3
	Ca	75ppm ($_{WHO}$)	130	74	59	49	48
	Cl	250ppm ($_{WHO}$)	450	67	159	119	119
	CO_3	*	0	0	0	0	0
	F	1.5ppm ($_{WHO}$)	1.01	0.32	1.54	0.83	1.0
	Fe	0.3ppm ($_{WHO}$)	0.04	0.03	0.09	0.2	0.05
	Hard	500ppm ($_{WHO}$)	645	280	290	256	287
	HCO_3	NGVS*ppm (WHO)	335	230	200	115	165
	K	12ppm ($_{E.C}$)	6	2.5	2	1.5	1.5
	Mg	150ppm ($_{WHO}$)	106	28	35	33	38
	Na	200ppm ($_{WHO}$)	350	109	142	91	102
	NO_3	10ppm ($_{WHO}$)	4.5	2.3	3.3	6.8	4.0
	SO_4	250ppm ($_{WHO}$)	450	205	192	113	150
Physicochemical	**Colour**	Unobj	Obj	Unobj	Unobj	Unobj	Unobj
	Taste	Unobj	Obj	Unobj	Unobj	Unobj	Unobj
	Odour	Unobj	Unobj	Unobj	Unobj	Unobj	Unobj
	pH	6.5-8.5 ($_{WHO}$)	7.81	8.02	7.70	8.15	8.18
	E.C	$\mu s/cm^2$ ($_{WHO}$)	3115	1094	1258	909	790

Bacteriological	**Turbidity**	5 NTU ($_{WHO}$)	8.5	1.7	2.2	1.9	1.09
	T.D.S	100ppm ($_{WHO}$)	1781	633	855	616	580
	Total Coliform MPN/100	**0/100 ml**	Safe= 10% Unsafe= 90%	Safe= 30% Unsafe= 70%	Safe= 40% Unsafe =60%	Safe=30% Unsafe=70%	Safe=20% Unsafe=80%

(NGVS= No guideline valu, E.C= Europian Community. **pH=Power of hydrogen ion, Ec =Electric Conductivity, Obj =Objectionable, Unobj =Unobjectionable, TDS=Total dissolve solids, NTU= Nephlometric Turbidity Unit, ppm= Parts per million, µs/cm = Micro Siemen**

Conclusion: The monographic information present in the current study worth sharing as there is limited scientific work present on quality of drinking water in A.R campuses and sites, it may support other public health concerns in understanding their habit towards eating and drinking in their communities after they return to Afghanistan. According to the quality of water is a rather complex issue and it can be solved by integrated approach (Enzo and Massimo, 1997). Health status of refugees is inhumane. Human waste is spread everywhere, there is no proper sewerage system. Refugee camps and sites are lacking of necessary health requirement. During study when they were asked what they will do after 2020? About 85 % of them were not interested to return to their homeland right now. They replied our generations are grown in Pakistan now to face the prospect of returning to a land which they are not familiar. The result of current study also helps to minimize the waste of health budget, if the concerned authority takes a notice of improper water handing. The spread of Typhoid and hepatitis can be controlled to a great extent which is more prevalence in Quetta at the moment. (Atia *et al*., 2013)

List of abbreviation used: A.R =Afghans Refugee, USSR = Union of Soviet Socialist Republics, UNHCR= United Nations High Commissioner for Refugees, NGO = non-governmental organization, H.t =Hazara town quetta, PPm =parts per million, WHO= world health organization, Col =colony.

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