



Preface

Tatweer Petroleum Company Profile

In December 2009, Tatweer Petroleum – Bahrain Field Development Company W.L.L. assumed responsibility for the stewardship and revitalization of the mature Bahrain Field and the execution of all activities related to the petroleum operations pursuant to the terms and conditions of the Development and Production Sharing Agreement (DPSA). The DPSA, dated 26th April 2009, entered into between the National Oil and Gas Authority (NOGA) and Occidental, Mubadala, and The Oil and Gas Holding Company (nogaholding).

As of July 2016, the Company is wholly owned by nogaholding, the business and investment arm of NOGA of the Kingdom of Bahrain, which acts as the steward for the Government's investment in a diversified range of energy-related companies.

The Company's primary goal is to increase the production of oil and the availability of gas to meet the future energy demands of the Kingdom of Bahrain, in line with the nation's Economic Vision 2030.

Tatweer Petroleum utilizes the latest oil production and recovery technologies whilst upholding its commitment to the highest standards of health, safety and environmental protection, and the development of Bahraini nationals. This will support the Company's contribution to energizing the Kingdom's economic growth and social prosperity while maximizing value for stakeholders.

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Conference Paper

Micellization Behavior of Ionic Surfactants in Presence of Butanol Isomers in Non-aqueous Solutions

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Abstract

Electrical conductivity and surface tension measurements of various surfactants, such as sodium caprylate, sodium laurate, sodium palmitate and sodium stearate micellar solution, containing 1-butanol (1-BuOH), 2-butanol (2-BuOH) and tertiary butanol (t-BuOH) in *n,n*-dimethyl acetamide have been determined at various temperatures. Both methods show that micelles are formed in *n,n*-dimethyl acetamide (DMA) solution in the presence of butanol isomers. Critical micelle concentration (cmc) has been determined for each of the surfactants. Critical micelle concentrations have also been measured as a function of temperatures and concentration of butanol isomers added. It is suggested that the addition of alcohol leads to an increase in *n,n*-dimethyl acetamide penetration into the micellar interface that depends on the alkyl chain configuration for three isomeric alcohols. Thermodynamic parameters of micellization, enthalpy (ΔH_m^o), entropy (ΔS_m^o), and free energy (ΔG_m^o) were determined from temperature dependence of CMC. The solvent composition dependence of these thermodynamic parameters is determined in terms of the effect of additives on micellization of ionic surfactants. It is observed that both ΔH_m^o and ΔS_m^o bear out not only the observed order of decrease in cmc but also account reasonably the effects produced by differences in alkyl chain configuration for these isomeric alcohols. In all cases $\Delta G_m^o < 0$, and remained practically constant over the entire solvent composition range studied. It is suggested that due to different structural consequences of intermolecular interactions, both enthalpy and entropy must differ in a mutually compensating manner so that ΔG_m^o is not significantly affected.

Keywords: *n,n*-dimethyl Acetamide, Micelle, Cmc, Conductivity, Surface tension, Butanol Isomers

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1. Introduction

The effect of the presence of additives on the critical micelle concentration (cmc) of surfactant has been widely studied [1-3]. Recently, increasing attention is being devoted to the study of the incorporation or solubilization of neutral molecules into micelle in aqueous solution. Some of the most studied solubilizates are alcohols, because of the important role they have in the preparation of microemulsions [4-15]. It is generally accepted that the alcohol binds to the micelle in the surface region, leading to three principal effects: a) the alcohol molecules intercalate between the surfactants ionic head groups to decrease the micelle surface area per head group and increase of ionization [16-19]. This effect is correlated with modification of the growth and shape of the micelle [20-21]. It seems to be a function of the mole fraction of the type of alcohol used [22-23]. b) The dielectric constant at the micellar interface decreases probably due to the replacement of water molecules in the interface region by alcohol molecules [24]. c) The molecular order of the interface region of the micelle changes [5]. So for the literature cited here are mainly the solubility measurements on alcohols in aqueous surfactant solutions, and it seems that the effect of addition of alcohol in micellar solution of various surfactants in non-aqueous solvents has not been studied. In continuation of our work on micelle formation in non-aqueous solvents [25-31], a systematic attempt has been made to study the effect of butanol isomers of varying polarities on the micelle of various surfactants in *n,n*-dimethyl acetamide, using conductivity and surface tension methods. The various aspects of interaction of these surfactants in *n,n*-dimethyl acetamide during micelle formations in presence of butanol isomers are also discussed.

2. Experimental Details

n,n-dimethyl acetamide (DMA) after drying for 72 hours on freshly ignited quick lime, was repeatedly vacuum distilled and the middle fraction of DMA having a specific conductivity (k) in the range of $2.5 \times 10^{-6} \text{ S cm}^{-1}$ was collected.

The surface tension of surfactant solutions was measured at various temperatures using a TRAUBE'S STALAGMOMETER Model 4855. The instrument consists of a straight tube which widens out in the upper part to form a bulb and narrows to a capillary tube in lower part, the open of which is ground smooth. The instrument is calibrated using water and *n,n*-dimethyl acetamide.

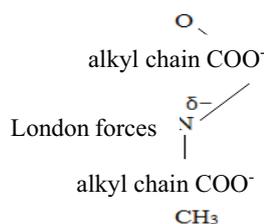
All the surfactants used in the present work obtained from FLUKA (Purity > 99 %), and were used without further purification. The alcohol, 1-butanol (1-BuOH), 2-butanol (2-BuOH) and tertiary butanol (t-BuOH) were either from FLUKA, BDH or MERCK products (research grade), and were used without purification. Specific conductivities of the solutions were measured at various temperatures using a CRISON Model 255 CONDUCTIMETER and a dipping cell with platinum electrodes (cell constant = 0.12 cm^{-1}). The reproducibility of the instruments was better than 0.1 % accuracy better than 0.2 %.

For each of the surfactants the cmcs were determined precise to $\pm 1\%$ from an apparent discontinuity in the plot of Λ vs c as described elsewhere [25–31]. Similarly, a discontinuity in surface tension is also observed at certain concentration, for each of the surfactants. The average cmc values by these methods are reported in Table 1.

3. Results and Discussion

As it is reported in Table I that as the number of carbon atoms in the anionic surfactant increases the cmc decreases. Similar behavior has been observed by some workers [32–36].

The change in cmc with 1-butanol (1-BuOH), 2-butanol (2-BuOH) and tertiary butanol (t-BuOH) at concentration of 0.1 M in *n,n*-dimethyl acetamide at different temperatures are reported in table 2. Table 2 shows that the cmc of sodium surfactants are lower in presence of butanol isomers in *N,N*-dimethyl acetamide than in *N,N*-dimethyl acetamide [25–27]. The ion-solvent interaction in presence of butanol isomers in DMA, in terms of a molecular picture, can be looked upon somewhat as follows: The micelle formation in DMA could be due to the effects like ion-solvent interactions, hydrogen bonding, and dispersion forces, even though the dielectric constant of *N,N*-dimethyl acetamide (DMA) is much lower than acetamide and *N*-methyl acetamide (28–30). It could be suggested that the micelle formation in DMA in presence of butanol isomers, is due to the orientation of the opposite end of the solvent dipole, which causes ion-solvent interaction. It could also be suggested that in DMA, the ability of nitrogen to participate in resonance with the carbonyl group is more likely than in *N*-methyl acetamide and acetamide. The process can be seen as follows



An increase in cmc is seen for 1-BuOH, 2-BuOH and t-BuOH at 25, 30, 35, and 40°C. Increase in cmc upon addition of 1-BuOH, 2-BuOH and t-BuOH is due to the solvent power of the n,n-dimethyl acetamide-alcohol mixture. The hydrophobic effect associated with the hydrophobic moiety of alcohol molecules also favors micellization and increases as dipole of 1-BuOH, 2-BuOH and t-BuOH increases.

TABLE 1: Critical micelle concentration of sodium surfactants in N,N, dimethylacetamide at 25°C in the presence of 1-BuOH, 2-BuOH, t-BuOH at different concentrations.

SURFACTANT	ALCOHOL	≠C.M.C. x 10 ⁻³ M				
		0.1 M	0.5 M	1.0 M	2.0 M	4.0 M
Sodium Caprylate (C ₈)	*	24	27	33	38	47
	1-BuOH	21	24	29	33	42
	2-BuOH	18	22	26	31	38
	t-BuOH	14	17	23	29	33
Sodium Laurate (C ₁₂)	*	19	23	28	37	45
	1-BuOH	16	19	23	33	40
	2-BuOH	14	18	21	28	34
	t-BuOH	10	14	18	24	29
Sodium Palmitate (C ₁₆)	*	18	19	30	36	41
	1-BuOH	12	14	27	32	37
	2-BuOH	10	13	20	26	37
	t-BuOH	8	12	17	22	31
Sodium Stearate (C ₁₈)	*	10	13	21	27	37
	1-BuOH	6	9	16	22	30
	2-BuOH	4	6	13	18	26
	t-BuOH	2	3	9	13	20

* In pure N, N-dimethyl acetamide
 ≠ Average values obtained from conductance and surface tension measurements at 25°C.± 0.01°C

The changes in cmc with increasing the concentration of 1-BuOH, 2-BuOH and t-BuOH are also reported in Table 1 and are shown in figure [1-4].

Change in cmc of sodium surfactants with increasing concentration of **Fig (1)**: N, N Dimethyl acetamide (DMA) **Fig. (2 - 4)** 1-BuOH, 2-BuOH, t-BuOH in N,N Dimethyl acetamide (DMA)

TABLE 2: Critical micelle concentration of sodium surfactants in presence of 0.1M of 1-butanol (1-BuOH), 2-butanol (2-BuOH) and tertiary-butanol (t-BuOH) solution in N-N-dimethyl acetamide (DMA) at different temperatures.

SURFACTANT	ALCOHOL	≠C.M.C. x 10 ⁻³ M			
		298K	303K	308K	313K
Sodium Caprylate (C ₈)	*	24	27	31	34
	1-BuOH	21	23	27	30
	2-BuOH	18	20	22	27
	t-BuOH	14	16	18	23
Sodium Laurate (C ₁₂)	*	19	23	27	30
	1-BuOH	16	20	22	26
	2-BuOH	14	17	19	22
	t-BuOH	10	12	14	18
Sodium Palmitate (C ₁₆)	*	14	18	23	27
	1-BuOH	12	14	20	23
	2-BuOH	10	11	17	20
	t-BuOH	8	10	13	17
Sodium Stearate (C ₁₈)	*	8	12	18	23
	1-BuOH	6	9	15	20
	2-BuOH	4	7	13	16
	t-BuOH	2	4	9	12

* In pure solvent (DMA)
 ≠ Average values obtained from conductance and surface tension methods.

For 1-BuOH, 2-BuOH and t-BuOH, cmc increases on increasing 1-BuOH, 2-BuOH and t-BuOH concentration in n,n-dimethyl acetamide which can be explained on the basis of increased solubility of non-polar part of the anionic surfactants in non-aqueous medium. This is because the addition of 1-BuOH, 2-BuOH and t-BuOH disrupts the n,n-dimethyl acetamide structure or solvates the solute molecules preferentially and can be explained as follows: it is known that the major factor that determines the intermicellar solubility of 1-BuOH, 2-BuOH and t-BuOH is the change in hydrophilic balance of the micelle during the inclusion of alcohol in it [4, 37]. At the minimum cmc, micelles become saturated with 1-BuOH, 2-BuOH and t-BuOH so that molecules move into n,n-dimethyl acetamide causing it to be more hydrophobic. This causes an increase in cmc on further addition of 1-BuOH, 2-BuOH and t-BuOH.

The thermodynamic parameters for sodium surfactants in n,n-dimethyl acetamide in presence of 1-BuOH, 2-BuOH and t-BuOH were calculated. The free energies of micelle formation are calculated using the relationship

$$\Delta G_m^0 = -RT \ln \text{cmc}$$

Even though the size of the micelle is not known at present. Also the high cmc values in *n,n*-dimethyl acetamide may invalidate the use of above mentioned equation, because the monomer activity would be quite different from the monomer concentration. Such ΔG° values should therefore, be taken as only approximation. The results for sodium surfactants in *n,n*-dimethyl acetamide in presence of 1-BuOH, 2-BuOH and *t*-BuOH are mentioned in Table 3.

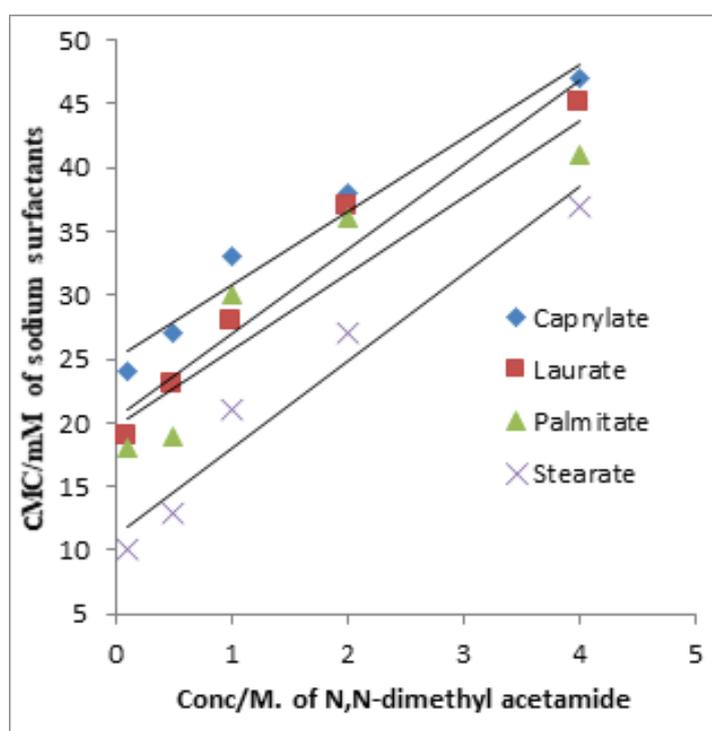


Figure 1

It is evident from Table 3, that there is a decrease in the standard Gibbs energy of micelle formation as the number of carbon atoms in alkyl chain of various surfactant increases. It suggests that a strong solvophobic interaction takes place for longer alkyl chain in *n,n*-dimethyl acetamide.

Table 2 gives the cmc values of sodium surfactants in *n,n*-dimethyl acetamide in presence of 1-BuOH, 2-BuOH and *t*-BuOH at different temperatures. It was observed that with increase in temperature, cmc increased in pure solvent (DMA) and also in the presence of 0.1M butanol isomers in DMA as shown below in figures [5-8].

Change in cmc of sodium surfactants as function of temperature in presence of **fig (5)** pure solvent (DMA) **fig (6)** 1-BuOH in DMA

Change in cmc of sodium surfactants as function of temperature in presence of **fig (7)** 2-BuOH in DMA **fig (8)** *t*-BuOH in DMA

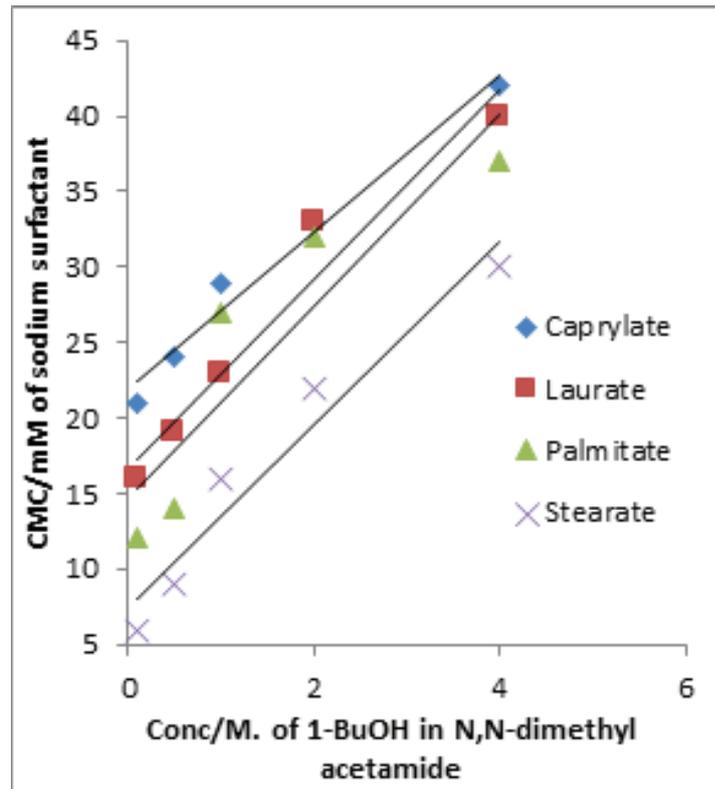


Figure 2

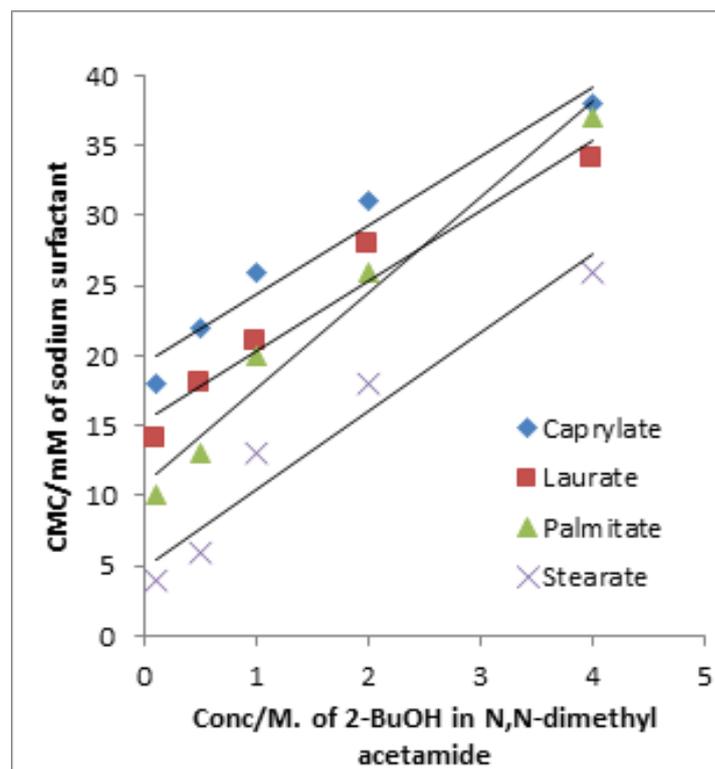


Figure 3

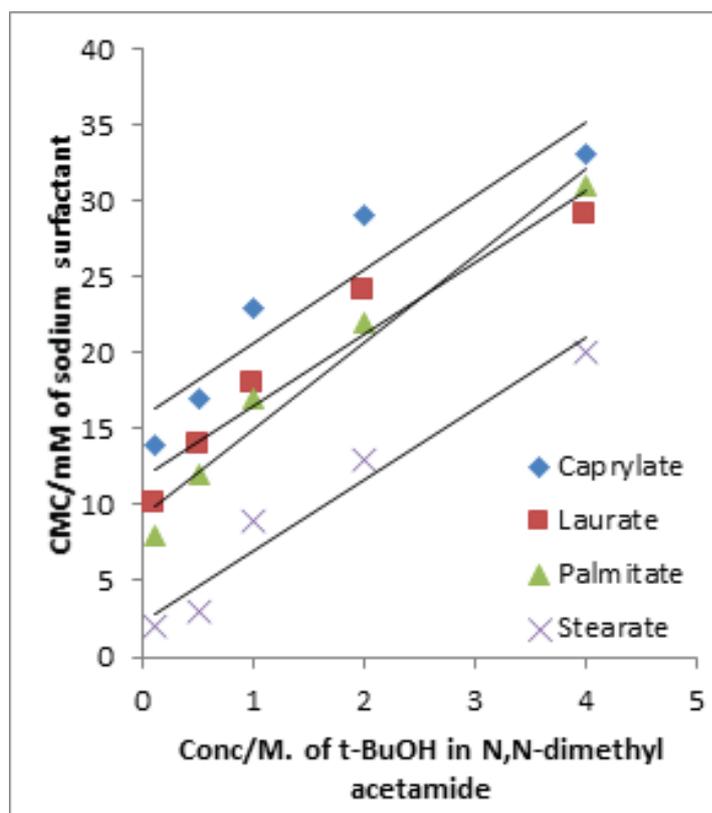


Figure 4

TABLE 3: Thermodynamic parameters ($\Delta G_m^\circ, \text{kJmol}^{-1}$, $\Delta H_m^\circ, \text{kJmol}^{-1}$, $\Delta S_m^\circ, \text{JK}^{-1}$) for sodium surfactants in N,N-dimethylacetamide in presence 1-BuOH, 2-BuOH and t-BuOH (0.1M).

SURFACTANT	PURE SOLVENT			1-BuOH			2-BuOH			t-BuOH		
	ΔG_m°	ΔH_m°	ΔS_m°	ΔG_m°	ΔH_m°	ΔS_m°	ΔG_m°	ΔH_m°	ΔS_m°	ΔG_m°	ΔH_m°	ΔS_m°
Sodium Caprylate(C8)	-9.24	-14.2	16.6	-9.58	-14.8	17.5	-9.96	-15.2	17.6	-10.6	-15.8	17.4
Sodium Laurate(C12)	-9.82	-14.6	16.0	-10.3	-15.0	15.8	-10.6	-15.7	17.1	-11.4	-16.3	16.4
Sodium Palmitate(C16)	-10.6	-15.1	15.1	-11.0	-15.9	16.4	-11.4	-16.2	14.4	-12.0	-17.0	16.8
Sodium Stearate (C18)	-12.0	-15.7	12.4	-12.7	-16.4	12.4	-13.7	-17.0	11.1	-14.2	-17.6	11.4

The plot of $\ln \text{cmc}$ of sodium surfactants against $1/T$ gives a good straight line with a negative slope. This shows that the micelle size does not change within the temperature range studied. In the present work, the Van't Hoff equation

$$\frac{d \ln \text{cmc}}{dT} = \frac{-\Delta H^0}{RT^2}$$

is applicable. The values of ΔH^0 , enthalpy of micellization, have been calculated from the slope of the line and are included in Table 3.

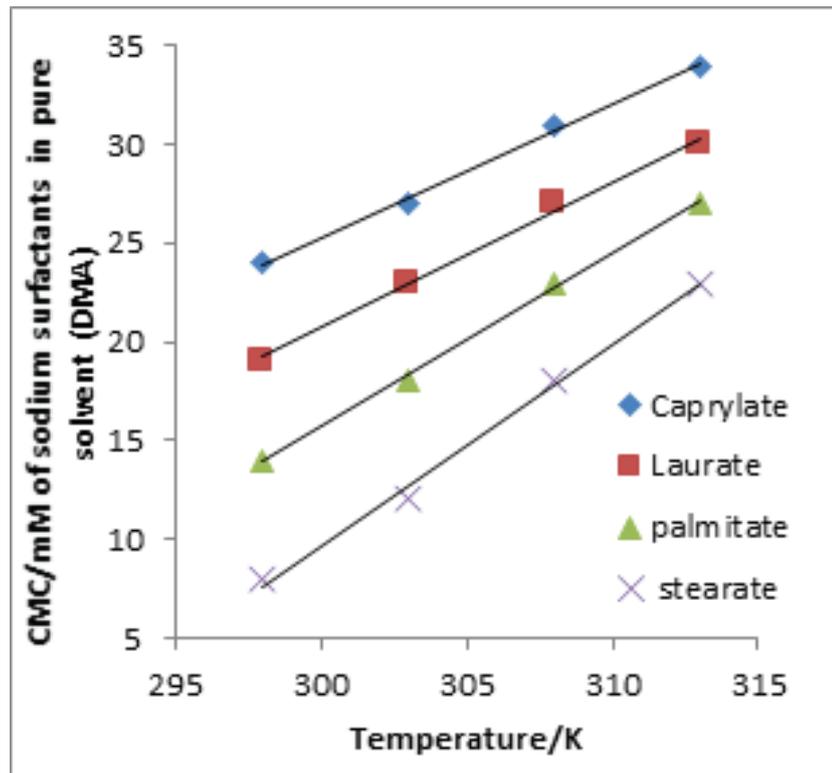


Figure 5

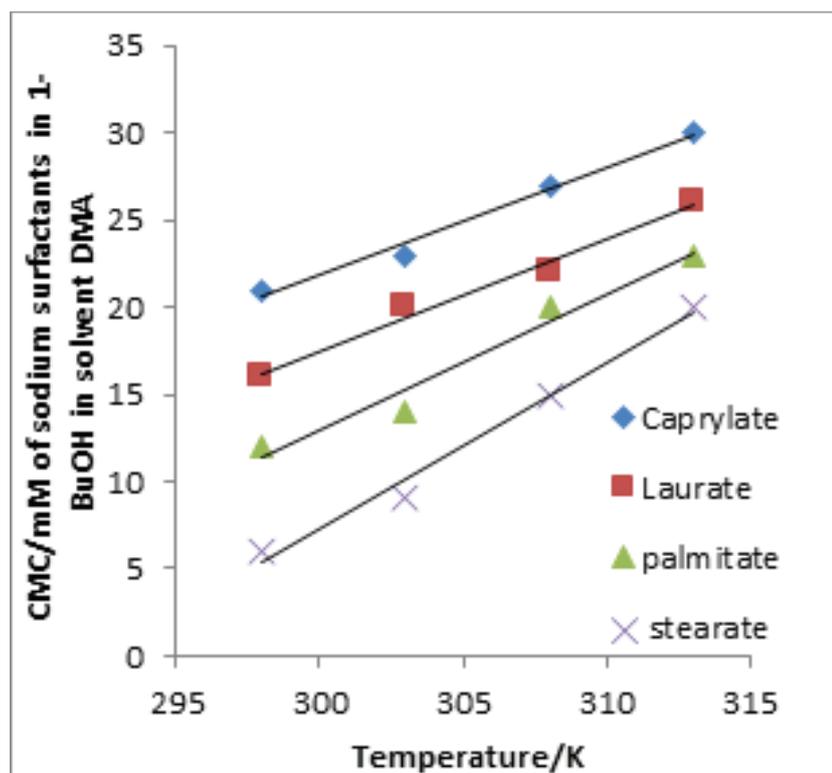


Figure 6

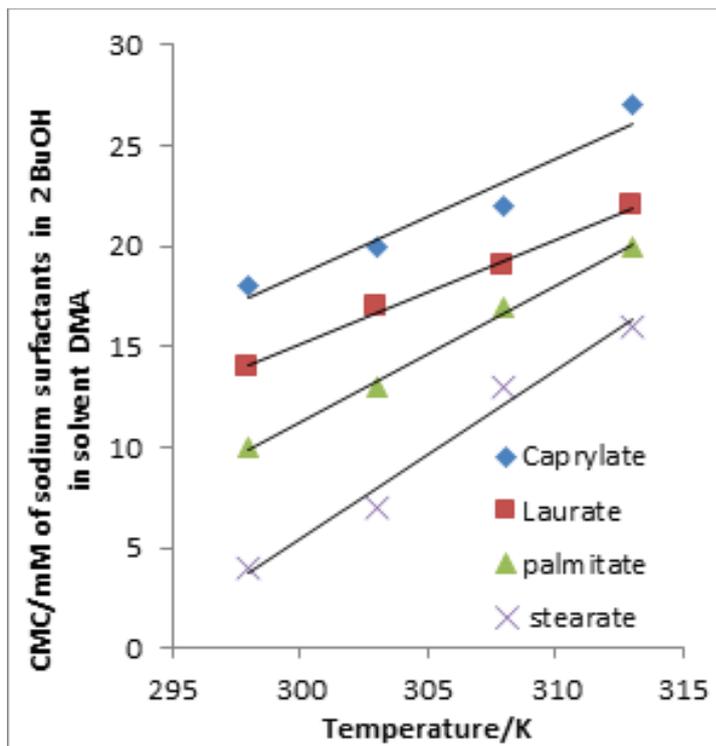


Figure 7

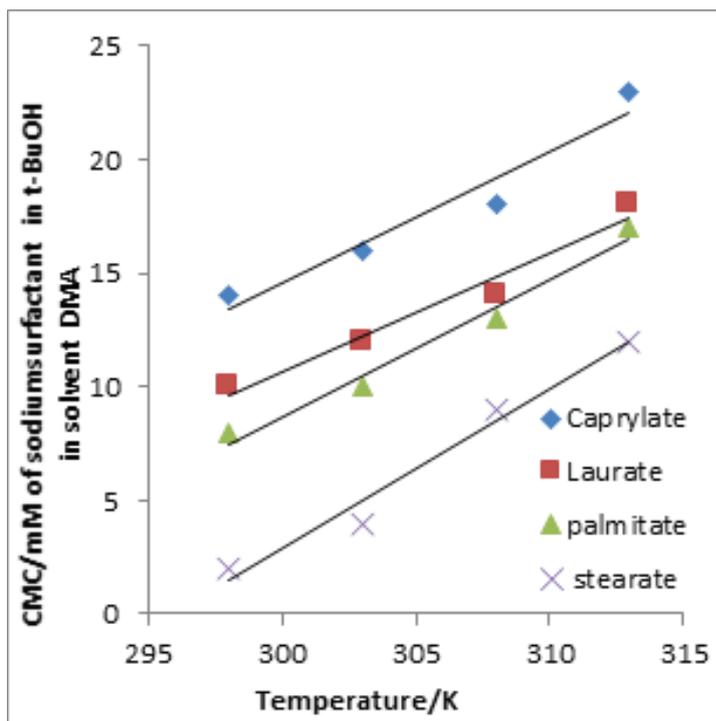


Figure 8

These values are in the range of the hydrogen bond energy. *n,n*-dimethyl acetamide has a strong tendency to form hydrogen bonding. Negative values for ΔH were obtained for the micelle formation of the surfactant tetra decyl-trimethylammonium

bromide (C₁₄ TAB) in water and hydrazine [38]. The standard entropies of micellization were calculated from the values of ΔH_m^o and ΔG_m^o using $\Delta G_m^o = \Delta H_m^o - T\Delta S_m^o$ and are also included in Table 3.

It is evident from Table 3 that in all cases micellization is exothermic. This may be interpreted as a consequence of decrease in energy required to break up the ice-berg structure surrounding the hydrocarbon chains of the monomeric surfactants.

The effects on the enthalpy and entropy were small in 0.1 M 1-BuOH, 2-BuOH and t-BuOH. Possibly this effect is operative primarily on the hydrophobic group of the sodium surfactants while only secondarily on the hydrophilic group.

It was also observed that in presence of 1-BuOH, 2-BuOH and t-BuOH, the enthalpy is more negative and entropy is less positive. Therefore, the contribution of the enthalpy to the micellization becomes increasingly important with 1-BuOH, 2-BuOH and t-BuOH in contrast to the predominance of entropy in the aqueous solution. Similar behavior of more negative enthalpy in presence of organic additives has been observed [39–41].

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References

- [1] W. U. Malik, S.P. Verm, P. Chand, *Indian J. Chem.*, 8 (1970) 826.
- [2] N. Nishikido, Y. Moroi, H. Vehara, R. Matuura, *Bull. Chem. Soc. Japan*, 47 (1974) 2634.
- [3] K. Hayare, S. Hayano, *Bull. Chem. Soc. Japan*, 50 (1977) 83.
- [4] H. N. Singh, S. Swarup, R.P. Singh, S. M. Saleem, *Indian J. Chem.*, 20 (1981) 292.
- [5] P. Baglioni, L. Kevan, *J. Phys. Chem.*, 91 (1987) 1516.
- [6] H. N. Singh, S. Swarup, S. M. Saleem, *J. Colloid Interface Sci.*, 68 (1979) 128.
- [7] P. G. Degennes, C. Taupin, *J. Phys. Chem.* 86 (1982) 2294.
- [8] B. Lindman, H. Wennerstorm. In *Topics in Current Chemistry*, Springer-Verlag, Heidelberg, 1980, Vol. 87 Pg 1-83.
- [9] H. Hoiland, E. Losland, S. Backlund, *J. Colloid Interface Sci.*, 101 (1984) 467.
- [10] C. Bravo, J. R. Leis, M. E. Pena, *J. Phys. Chem.*, 96 (1992) 1957.

- [11] G. M. Forland, J. Sameth, H. Hoiland, K. Mortensen, *J. Colloid, Interface Sci.*, 164 (1994) 163.
- [12] M. Trotta, M. R. Gasco, F. Pattarino, *J. Colloid Interface Sci.*, 158 (1993) 133.
- [13] A. M. Blokhus, H. Hoiland, S. Backlund, *J. Colloid Interface Sci.*, 144 (1986) 9.
- [14] P. Lianos, R. Zana, *J. Colloid Interface Sci.*, 101 (1984) 587.
- [15] A. B. Mandal, L. Wang, K. Brown, R. G. Verrall, *J. Colloid Interface Sci.*, 161 (1993) 292.
- [16] R. Zana, S. Yiv, C. Strazielle, P. Lianos, *J. Colloid Interface Sci.*, 80 (1981) 208.
- [17] P. Lianos, J. Lang, C. Strazielle, R. Zana, *J. Phys. Chem.*, 86 (1982) 1019.
- [18] M. Almgreen, J. E. Lofroth, *J. Colloid Interface Sci.*, 81 (1981) 486.
- [19] M. Almgreen, S. Swarup, *J. Colloid Interface Sci.*, 91 (1983) 256.
- [20] J. N. Israelchvilli, D. Mitchell and B. W. Ninham, *J. Chem. Soc. Faraday Trans.* 272 (1976) 1525.
- [21] D. Mitchel, B. W. Ninham, *J. Chem. Soc. Faraday Trans.* 277 (1981) 601.
- [22] M. Almgreen, S. Swarup, *J. Colloid Interface Sci.*, 91 (1983) 1983.
- [23] M. Almgreen and S. Swarup, *J. Phys. Chem.*, 86 (1982) 4212.
- [24] P. Mukurjee and J. Cardinal, *J. Phys. Chem.*, 82 (1978) 1620.
- [25] M. Salim Akhter, Sadeq M. Alawi, *Colloids and Surfaces*, 164 (2000) 247.
- [26] M. Salim Akhter, Sadeq M. Alawi, *Colloids and Surfaces*, 175 (2000) 311.
- [27] M. Salim Akhter, Sadeq M. Alawi, *Colloids and Surfaces*, 196 (2002) 163.
- [28] M. Salim Akhter, Sadeq M. Alawi, *Colloids and Surfaces*, 219 (2003) 281.
- [29] Sadeq M. Alawi, M. Salim Akhter, *Colloid Journal*, 72 (2010) 295.
- [30] Sadeq M. Alawi, M. Salim Akhter, *J. Korean Chem. Soc.*, 55 (2011) 163.
- [31] Sadeq M. Alawi, M. Salim Akhter, *J. Mol. Liq.*, 160 (2011) 63.
- [32] P. Mukerjee, K. J. Mysels, *Critical micelle concentration of aqueous surfactant systems*. NSRDS-NBS 36. Washington, D.C. U.S. Government Printing Office, 1971.
- [33] H. Garibi, R. Palepu, G.J.T. Tiddy, D.G. Hall, E. Wyne-Jones, *Chem. Soc., Chem. Commun.*, 2 (1990) 115.
- [34] P. Bacher, In *Nonionic Surfactants*, p.478, M. J Schick, (Ed), Dekker New York (1976).
- [35] R.D. Geer, E.H. Eylar, Anacker, E.W., *J. phys. Chem.*, 75, (1971) 369.
- [36] P. Molyneux, C.T Rhodes, J. Swarbrick, *Soc., Faraday Trans.* 61, (1965) 1043.
- [37] E. Vikingstad, A. Skauge, H. Hoiland, *J. Colloid Interface Sci.*, 66, (1978) 240.
- [38] A.W. Ralston, D.W. Eddenburger, *J. Am. Chem. Soc.*, 70 (1948) 983.
- [39] P.D.I. Fletcher, P.J. Gilbert, *J. Chem. Soc., Faraday Trans.* 85 (1989) 148.

- [40] S. Miyagishi, Bull. Chem. Soc. Jpn. 47(1947) 2972; 48 (1975) 2349.
- [41] K.T. Parekh, G.M. Malik, P.H. Kothwala P. Bahadur, Fat. Sci. Technol. 10 (1988) 395.

Conference Paper

Disaster Responses: Psychosocial Support not Optional!

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Abstract

Whenever there are disasters, conflicts and health emergencies, Psychosocial Support (PS) becomes a core component of humanitarian response. Disaster is described as a disruptive and/or destructed event causing loss of life, property, injuries and damage to communities. The purpose of this article is to raise awareness about disaster preparedness, response and recovery including the best practice in PS following disasters and traumatic events. The World Health Organization and International Federation of Red Cross and Red Crescent Societies have increasingly recognized the important dimension for immediate and long-term disaster response. Since 1993, the International Federation Reference Centre has worked to improve the psychological well-being of beneficiaries, staff and volunteers. The psychosocial support is a proven approach to help affected people during and after the crisis based on the principle of “DO NO Harm”. It builds people capacity to recover by helping them identify their immediate needs, own strengths and abilities to cope with crisis. The literature shows that people who believe in their abilities to cope can predict the outcomes. Furthermore, people who received PS experienced sense of hope, feeling, safe, calm, self-confident and socially connected.

Keywords: Disaster, Psychosocial support, Humanitarian, Psychological First Aid

- Theme: Health
- Subtheme: Health Management after Crisis (Earthquakes/ War)

1. Introduction

On August 23rd year 2000, Gulf Air Airbus A320 an evening flight from Cairo to Manama-Bahrain, crashed into the Arabian Gulf. In aim to rescue as many as possible; Bahrain Official authorities asked the American Navy helicopters to help scan the Gulf water and search for survivals. As rescuers searched for survivals, relatives of

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passengers pleaded with police officers who put a security ring around the airport. Many did reach the airport, and cries and screams echoed in its halls. Dozens of men and women with reddened eyes wept loudly. Some comforted one another, while others screamed out for their loved ones.

Unfortunately, the catastrophic event resulted in the death of all 143 people on board including 8 crew members. As a response, measures were taken by Gulf Air to ease the communication with victims' families, they urged worried relatives to call the information hot line to address their concerns. As well as arranging for a special flight from Cairo to Bahrain later that day to take families of the deceased to the crash site and similar arrangements were made for other families (1).

None of these measures involved emotional or mental health support for the victims' families at that point or later in time. This unfortunate sudden event that happened in Bahrain is an example of a possible situation that requires a ready team to provide support to the victims' families, relatives and friend. This brings us to the question, ARE WE READY?

Many countries worldwide are at risk of multiple natural hazards, including earthquakes, tsunamis, volcanic eruptions, landslides, hurricanes, floods, wildfires, heat waves and droughts, as well as human-caused hazards. Every year natural disasters kill around 90, 000 people and affect close to 160 million people worldwide. These events have twofold impact on health systems directly and indirectly. Directly, through damage of the infrastructure and health facilities and the consequent interruption of services at a time when they are most needed, and indirectly, by potentially causing an unexpected number of casualties, injuries, and illnesses in affected communities (2).

The international organizations such as International Federation of Red Cross and Red Crescent Societies (IFRC), World Health Organization (WHO) and United Nations High Commissioner for Refugees (UNHCR), responses are based not only on the traditional needs that are necessary after any disaster like shelters, food distribution and basic health care, but further extends to provide mental health and psychosocial support. This helps individuals and communities to cope with the crisis appropriately and change people's attitude from passive victims into active survivors.

The term psychosocial refers to the close relationship between the individual and the collective aspects of any social entity. Psychosocial support can be adapted in particular situations to respond to the psychological and physical needs of the people concerned, by helping them to accept the situation and cope with it. Psychosocial support can be described as "a process of facilitating resilience within individuals, families

and communities. By respecting the independence, dignity and coping mechanisms of individuals and communities, psychosocial support promotes the restoration of social cohesion and infrastructure” (3)

Most who are affected by emergency crisis /disaster will experience some level of mental distress. Usually the mental health professionals communicate with the psychosocial support team after an emergency happens. Therefore, mental health professionals and psychosocial support team need to be prepared and ready to respond before the disaster takes place. This will reduce the number of mental health and psychosocial problems such as post-traumatic stress disorder (PTSD) and many other mental health and psychosocial problems happened in emergencies. (4)

The ability of individuals to cope in the aftermath of a disaster depends largely on their resources and capacities. The immediate impact on human lives often results in the destruction of the affected people physical, mental and social life, thereby having a longer-term impact on their health, well-being and survival. (5)

This paper addresses the importance of psychosocial support in enhancing individual, family and community wellbeing, in addition to reducing physical, psychological and social consequences of a disaster. It discusses the methods of applying psychosocial support in various stages of the disaster. It emphasizes on ways to help people to overcome overwhelming changes that occurred in their health and daily function that affected their wellbeing on the short and long term. In addition, it will elaborate on the importance of providing psychosocial support as early as possible to help people return to their normal wellbeing by positively adapting to a changed reality.

2. Mental Health and Psychosocial Support

World Health Organization (WHO), United Nations High Commissioner for Refugees (UNHCR) (6) and International Federation of Red Cross Red Crescent Societies (IFRC) share the concept of integrating the mental health and psychosocial support activities in any humanitarian response, and as such are recognized as requirements of humanitarian response across a range of contexts and scenarios.

Although the two terms—mental health and psychosocial support—are closely related and can overlap to many health professionals; they reflect different, yet complementary approaches. Hence, agencies outside the health sector tend to speak of “supporting psychosocial well-being,” whereas people working in the health sector tend to speak of “mental health.” Exact definitions of these terms can vary slightly between and within aid organizations and countries (4).

Mental health is not simply the absence of mental disorder. The World Health Organization (WHO) defines mental health as a state of wellbeing in which every individual realizes his or her own potential, is able to cope with normal stresses of life, can work productively and fruitfully and is able to contribute to their community (7).

Many of National Societies realizes that when a disaster happen it could lead to not only physical, but also mental issues in the affected population. Therefore, the IFRC in the early 1990s founded the Psychological Support Programme. As a result, the Psychosocial Support (PS Centre) was established in 1993 as a “Centre of Excellence” to support National Societies in promoting and enabling the psychosocial well-being of beneficiaries (3).

Currently focus is going towards community-based approaches, which enhances the resiliency of children and families as a unit (3). Humanitarian responses now include programming for mental health and psychosocial support (MHPSS). This often includes interventions in wide range of thematic areas such as health, education, community-based protection, sexual and gender-based violence, and child protection. There is growing awareness that all staff involved in the humanitarian response should know the basics of MHPSS and understand how their own actions can influence mental health and psychosocial wellbeing (8).

3. The Implication of Psychosocial Support on Different Stages of Disaster

To understand the methods of applying psychosocial support to real situations, it is vital to understand the various stages of the disaster. As each stage has its own specific needs which must be taken into consideration.

According to Academy for Disaster Management Education, Planning and Training (2005) (9) the disaster stages are:

1. Preparation and planning:

when the disaster is anticipated with varying degrees of accuracy. The government plans adaptive strategy, educating and public training through disaster exercises, the psychosocial support team response requires planning and building relationships with community members before the disaster. This will increase the individual's and the community's capacity to respond appropriately, to recognize and deal with stress effects.

2. Threat and warning:

refer to the time before a disaster when there may be either a general recognition that such a disaster could occur (threat) or a specific warning that a disaster is approaching (warning). Accurate information is helpful to people. It should cover what to expect and what to do.

3. **Impact:**

the focus on relief efforts that generally include life-saving activities, emergency care and rescue, and ensuring the immediate needs of impacted populations such as food, shelter, water, sanitation, and psychological support. Most people respond appropriately during the impact of a disaster and react to safeguard their own lives and others, especially children, elderly and family members. On the other hand, some people react in shock, helplessness and powerlessness stunned or apathetic and may not be able to respond appropriately to protect themselves. The early PS intervention following disasters, especially when the disaster is associated with high prevalence of trauma in the form of injuries, threat to life, and loss of life will reduce the impact to disaster (10).

4. **Immediate post -disaster period:**

This is the phase where there is recoil from the impact and the initial rescue activities takes place. The psychosocial problems start to appear such as people may suffer from confusion or anxiety. During this phase people start to build up a picture about what happened and try to re - establish contact with family and community. It is also a time to assess the likely short and longer-term effects of the disaster and to start to make provision for the basic Psychosocial support services that are in readily accessible places for the community. Psychological first aid that should be available to sustain life, promote safety and survival, comfort and reassure, and provide protection. It does not involve probing those affected for their reaction but rather provides a calm, caring and supportive environment to set the scene for psychological recovery.

5. **Recovery:**

This phase is the extended period that takes the community and individual to adjust and reach equilibrium state. It commences as rescue is completed and individuals and communities face the task of bringing their lives and activities back to normal. This period is often called the phase of disappointment, it becomes imbedded and severe, the post -disaster of disaster. Recovery will certainly take time and things will never be quite the same again as before the disaster. Psychosocial services have to be available during this phase of disaster. The provider

should be aware of emotional reactions and psychosomatic symptoms, e.g. Sleep disturbance, indigestion, fatigue, as well as social effects such as relationship or work difficulties.

4. Why Psychosocial Support Action Plan for Emergencies is Needed?

Mental health and psychosocial support components should be part of any national health sector emergency plan. Each country should set a plan of actions that includes guidelines for mental health and psychosocial support in case of any disaster or emergency. It is important to involve interdisciplinary, multi-sector working groups, and volunteers from national organizations in designing and implementing the methodology. Certain principles should be followed when designing the action plan, these principles include, the principle of **DO NO HARM**, protect human rights, community involvement and flexibility and adjustment to local circumstances.

The goals of the setting an action plan is to:

- Eliminate the suffering of psychosocial injury
- Prevent and control wide range of social problems raised during the disaster
- Treat occurred mental disorder and its consequence after the crises.
- Providing psychosocial care for members of the response team
- Ensure the psychosocial recovery of the affected population by the disaster

This is in order to protect, promote, and offer an appropriate response to the mental and psychosocial needs of the affected population.

According to Mental Health and Psychosocial Support in Disaster Situation in the Caribbean (2), Inter-Agency Standing Committee Guidelines on Mental (4) and WHO (11) which includes:

1. **Prior preparedness actions:**

which include planning and organization of the response and training staff.

2. **Assessment:**

Assessment of damage and mental health needs after a disaster using a tool or a guide for rapid assessment is considered the high-priority response. The assessment of mental health problems amongst emergency-affected populations needs to use instruments that are culturally validated for the local population.

4,12. In order to identify the priorities and evaluate the available resources related to psychosocial support, the assessment needs to review of existing mental and psychosocial problems faced by the population. This includes general humanitarian assessments and reports by non-governmental organizations. 12 Assessment reports should include data about the perceived physical, social and psychological needs in the affected population. The final assessment report should be shared with relevant agencies and stakeholder and disseminate recommendation for action.

3. **Coordination:**

Coordination is essential part to be done between different humanitarian sectors and agencies in order to fill the gaps, avoid duplication and get the best outcomes. Coordination can also help to ensure that various aspects of the humanitarian response are implemented to promote mental health and psychosocial wellbeing and ensuring that specific mental health and psychosocial interventions and mechanisms are included in the humanitarian response 4. As well as the coordination between groups can serve as referral system to different local and international agencies. In Jordan, for example, the Mental Health Psychosocial Support coordination group has developed a common referral form for mental health problems including consent to refer and provide essential information, which was then used by many different agencies (13,14).

4. **Psychological first aid by unspecialized personnel:**

Humanitarian aid workers, volunteers, search and rescue personnel and community agents are the "first responders" following an emergency, they have direct contact with the population. Psychological consequences of the lack of access to social support tend to manifest in different ways with a broad range of reactions, impacting not only on the individual but also extending to deeper layers of the general population. These reactions are not necessarily pathological in nature and should not be regarded as precursors to subsequent mental disorders. Adequate provision of support and access to services will result in normalcy, fostering the healing process and resilience of affected populations (15).

5. **Specialized care:**

Carried out by psychiatrist, such advanced care should be reserved for cases with more complex mental disorders. Special care of referrals to therapy of those with developed psychiatric symptoms and chronically psychiatrically ill. This assistance should include psychological or psychiatric supports for people with severe

mental disorders whenever their needs exceed the capacities of existing primary/general health services. Such problems require referral to specialized services if exist. Also, another aspect of providing special care involves caring for more vulnerable risk groups. like children, women, elderly and people of special needs (2).

6. Training on mental health and psychosocial support, including crisis intervention and psychological first aid:

Training primary health workers who will first contact with victims and survivors in different areas that are found to be needed. Training should focus on the recognition of various cultural presentation of symptoms as well on the available range of service for survivals in the communities (16).

7. Health education for the population:

Health education to bring public awareness about normal emotional responses and its psychosocial manifestations to an adverse event and train people on some simple measures to cope with these situations.

8. Social communication:

is essential to promote calmness and reduce fear and suffering experienced during the emergency event among population. Although fear is common reaction to any disaster, it is even more common in cases when chemical or biological agents are present (11).

9. System for registering information, indicators, and follow-up:

are important issues to start a scheme of recording all relevant information about people's experiences, mental health and psychosocial problems in the emergency and the available resources to deal with these problems (2).

5. Psychosocial Support Ethics

It is crucial to understand that, providing this type of services is not charity or pity, rather, it is an essential aspect of the human rights of the survivors to live with dignity in any disaster situations. The main ethical principles that need to be followed are maintaining confidentiality all the time, do not make false promises, avoid being biased and keep smiling. (9)

6. Community-Based Psychosocial Work

With a greater involvement, people become more hopeful, more able to cope and more active in rebuilding their own lives and communities. Community mobilization and support are critical to care for people with mental distress and disorders. According to UNCHR (17) the key actions to include communities are listed below:

- Avoid doing what local people can do for themselves and instead build on what local people are already doing to help themselves, including using internal community resources, knowledge, individual skills and talents.
- Support community initiatives and encourage additional ones to promote family and community support for all emergency-affected community members.
- Use multifunctional teams in United Nations and Non-Governmental Organizations (NGOs) in emergency sittings.
- Use participatory and community-based approaches.
- Advocates within and beyond the community on behalf of severely mental disorder people.
- Address human right abuses in sensitive and culturally competent way, and address stigmatizing or abusive practices (18).

7. Psychosocial Support for Workers

The responders and humanitarian workers carry a higher personal risk than others. Generally, the high expectations from staff workers and volunteers often leave them with a feeling of not having done enough, that contributes as an additional stressor on them.

A 21 years old medical volunteer named Razan Alnajjar, was shot in Gaza June 2018 while treating the wounded on the Israel-Gaza border. In one of her interviews she stated that “with all pride I want to continue helping others till the last day” she was aware of the risky nature of her act, yet she felt obligated to help others as long as she can.

First-response rescue workers are a potentially vulnerable group for psychological dysfunction. On a study conducted to assess psychiatric disorders in firefighters after approximately 34 months of the Oklahoma City bombing, indicated a 13% prevalence rate of PTSD specifically related to the event (16). This greater exposure to stressful contexts as they continue to help people through a post-disaster adaptation period.

This can lead to harmful use of alcohol or psychoactive drugs. Risk increased in situations where team cohesion or social support are lacking (3).

It is acknowledged that volunteers and staff workers are exposed to emotional stressors and can enter a state of crisis as a result of their work. It is important to understand that they would respond to stress differently, depending on their personality, coping styles and social support network. The psychological wellbeing of staff and volunteers is highly critical; therefore, they need to seek help whenever the pressure of work or dealing with human suffering become overwhelming, in order to do self-care and prevent burnout.

These are two statements gathered from a WHO psychological assessment survey taken by more than 200 Syrian health workers. "I feel depressed because of the traumatic experiences of the people I help" and "I find it difficult to separate my personal life from my life as a helper". The survey measures burnout, defined as "work-related hopelessness and feelings of inefficacy", as well as the effects of secondary exposure to extremely stressful events – for example, seeing images of the victims of an attack. (19)

Supportive measures for volunteers and staff workers to minimize stress: (According to Reference Center for Psychological Support- Community Based Psychosocial Support), (2009)

- Taking some preventive actions to enable them to cope with stress such as sharing difficulties with persons who are very trustable, exercise, and other relaxation techniques for stress reduction and to maintain the homeostasis of the body.
- Staff must take responsibilities to treat each other with compassion and respect, this is called care for carers.
- An organizational culture where people can talk openly and share problems without fearing consequences. And maintain confidentiality.
- A work culture that getting together after a critical event is the norm, for example, peer support system.
- Accessible guidance and support from managers and peer.

8. Conclusion

As has been noted, the impact of a disaster or emergency crisis on mental health has shown consistency across wide range of age groups and population and applying

psychosocial support during this crucial time has been shown to reduce the short- and long-term traumatic effect of the disaster. It can help victims, staff workers and volunteers to deal with their psychosocial reactions during and after the emergency event. In addition, it facilitates community participation to support each other using the available resource's in a proper culturally accepted manner.

A comprehensive disaster preparedness plan should include mental health and psychosocial support component. Each country has to have a prepared plan that targets its own population, taking into consideration meeting mental health and psychosocial needs assessment. Being ready before the crises takes place puts us a few steps ahead and optimize our survival rates.

References

- [1] The Guardian Newspaper <https://www.theguardian.com/world/2000/aug/24/1>
- [2] Pan American Health Organization. (2012). Mental Health and Psychosocial Support in Disaster Situations in the Caribbean. PAHO <http://www.who.int/iris/handle/10665/173271>.
- [3] IFRC Reference Centre for Psychosocial Support. (2009). www.ifrc.org/docs/appeals/annual10/MAA0000110ppsc.pdf.
- [4] IASC (2007) guidelines on mental health and psychosocial support in emergency settings [Internet]. Geneva: IASC. https://interagencystandingcommittee.org/system/files/legacy_files/guidelines_iasc_mental_health_psychosocial_june_2007.pdf.
- [5] World Health Organization. *Assessment Instrument for Mental Health Systems (AIMS) country reports*. Available from: http://www.who.int/mental_health/who_aims_country/
- [6] United Nations High Commissioner for Refugees Policy Development & Evaluation Service, (2013). Geneva, <http://www.unhcr.org/51bec3359.pdf>
- [7] World Health Organization. Mental health: a state of well-being [Internet]. 2014. http://www.who.int/features/factfiles/mental_health/en/.
- [8] IASC Reference Group for Mental Health and Psychosocial Support. Mental health and psychosocial support in humanitarian emergencies: what should camp coordination and camp management actors know? 2012.
- [9] Gauthamadas, (2005) Disaster Psychosocial Response: Handbook for community counselor trainers, Academy for Disaster Management Education, Planning and Training <https://www.preventionweb.net/organizations/4572>

- [10] Norris F., Matthew J., Fridman, Watson P., (2000). 60,000 Disaster victims Speak: Part II. Summary and Implication of disaster Mental Health Research. *Psychiatry*, 65(3) Fall,240-260
- [11] World Health Organization (2005). *Mental health of population exposed to biological and chemical weapons*. Geneva.
- [12] World Health Organization, United Nations High Commissioner for Refugees. *Assessing mental health and psychosocial needs and resources: toolkit for major humanitarian settings* [Internet]. 2012. http://apps.who.int/iris/bitstream/10665/76796/1/9789241548533_eng.pdf?ua=1.
- [13] IASC. (2017). *Inter-Agency Guidance Note for Mental Health and Psychosocial Support Jordan Response to Displaced Syrians* [Internet]. <https://data.unhcr.org/syrianrefugees/download.php?id=4079>.
- [14] Weissbecker, I., Hanna, F., El Shazly M., Goa J., and Ventevogel P., (2018). *Integrative Mental Health and Psychosocial Support Intervention for Refugees in Humanitarian Crises Setting*. [Internet]. http://doi.org/10.1007/978-3-319-72914-5_6
- [15] Hobfoll S, Watson P, Bell C, Bryant R, Brymer M, Friedman M, et al. (2009). Five essential elements of immediate and mid-term mass trauma intervention: empirical evidence. *7*(2):221-42.
- [16] World Organization of Family Doctors & World Health Organization. *Integrating mental health into primary care: a global perspective* [Internet]. 2008. http://www.who.int/mental_health/resources/mentalhealth_PHC_2008.pdf.
- [17] UNHCR. *Protection policy paper understanding community-based protection* [Internet]. 2014. <http://www.refworld.org/pdfid/5209f0b64.pdf>.
- [18] UNHCR. *Community-based protection and mental health & psychosocial support*. Geneva. 2017.
- [19] WHO news (9-10-2017) "We're doctors but we're also human": helping Syrian health workers handle severe stress. <http://www.euro.who.int/en/health-topics/noncommunicable-diseases/mental-health/news/news/2017/10/were-doctors-but-were-also-human-helping-syrian-health-workers-handle-severe-stress>

Conference Paper

Food Label Use and Awareness of Nutritional Information Among Consumers in Bahrain: An Exploratory Study

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Abstract

Nutritional labeling provides consumers with the information that can be used to make informed and healthier food choices. It is particularly useful for people who are on special diets to select suitable foods for their health conditions. Considering the significant role of consumers' awareness about food labels in making healthy food choices, 430 consumers (60% were female) were interviewed while shopping at various grocery stores in the Kingdom of Bahrain to assess their knowledge, attitudes and practices using a questionnaire. Consumer's responses showed little awareness for reading the food label. Although, 65% of the consumers buy prepackaged food, only 42% read the food label. The majority of the consumers (92%) read the basic information like production and expiry dates; 60% believed that food labels are useful tools for consumers. In addition, they reported that amount of fat and sugar were the most important items to be looked at when they buy the product for the first time. In summary, this study was important to enlighten consumers about the importance of reading the food labels. In addition, it also has an educative health and nutrition implications to help consumers make an informed choice when buying pre-packaged foods. A lot of work is needed to raise the level of awareness of the consumers about the nutrition aspects of reading food labels in order to assist them to make their best healthy food choices.

Keywords: Food Labels, Pre-packaged Foods, Awareness, Nutrition, Health

1. Introduction

Food labels are found to be a very important public health tool that is used to promote a balanced diet [1]. Food labels information assists consumers to better understand the nutritional value of food and enables them to compare the nutritional values of similar food products and to make healthy informed food choices based on the relevant

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nutrition information [2]. As consumers are becoming more aware of the relationship between diet and disease; their demand for nutrition information increases [3]. Consequently food label is very useful for people who are on special diets (e.g. people suffering from diabetes or high blood lipid) to select suitable foods for their health conditions.

There are many important diet related -public health problems and diseases such as poor nutrition; obesity high blood pressure; cancers, diabetes; osteoporosis and cardiovascular diseases [3]. The World Health Organization (WHO) reported that dietary factors accounted for approximately 30% of cancers in industrialized countries [4].

Consumers perceive themselves as knowledgeable regarding food label use. The most frequently parts of the label read were the calorie; fat; sugar; sodium and fiber contents. They also use serving size; ingredient list; the % daily values; health and nutrient claims; price; and brands when making their food purchasing decisions [5-6]. Many consumers feel confident that they understand how to read labels and prefer using a food label than relying on their own knowledge [7].

Assessing the consumer's nutrition knowledge level about dietary sugars, fats and cholesterol and their attitudes towards selecting healthier food is important. Review of consumer research studies of food labeling focused on whether consumer read and understand food labels or use them when buying pre-packaged food [8-9]. It has also been reported that consumers' knowledge and attitudes were positively correlated with their educational level. Those with higher education are usually more receptive to nutrition and health education [3, 10-11]. Some studies have indicated that food label use decreases with age [12]; however, some other researchers have demonstrated the reverse [13]. Evidence suggests that males are less likely to use nutritional labels than females [3, 14].

In addition to demographic factors, nutritional knowledge plays a key role in the food label use. Previous studies have reported a positive relationship between knowledge and label use [15], however Nayga et al., [12] found no evidence supporting this relationship.

There were few attempts to address the consumer's awareness of nutritional aspects of food labeling use in the region. It was evident that even though consumers were aware of the importance of reading food labels; they regarded information on manufacturing date; expiry date and content of the package as the most important information on labels [16]. This might be attributed to the fact that most of the foods manufactured or repackaged in the region have labels lacking many of the nutrition

information required by the American standards such as nutrition facts; serving size; special characteristics; health claims; special usage and health warnings [17].

Considering the significant role of consumers' awareness about food labels in making healthy food choices, it was therefore important to enlighten Kingdom of Bahrain consumers about the importance of reading the food labels. Therefore this study has aimed to assess consumer knowledge, attitudes and practices on food labels in the Kingdom of Bahrain. No similar study was previously conducted in the kingdom; this study will provide new data related to the use of food labels by consumers in the Kingdom which are necessary to put them in public health recommendations and health educational programs to improve consumers' behaviors towards better use of the information on the food label for better nutritional status of Kingdom of Bahrain consumers.

2. Methods and Materials

This descriptive cross-sectional study has assessed Kingdom of Bahrain consumers' knowledge; attitudes and practices towards food labeling. This study was conducted in randomly selected Food Market Centers (Al-Jazeera supermarket, Lulu Hypermarket, Mega Mart, Carrefour) during January to May 2017.

3. Sample Size and Selection

Convenient sampling was used to recruit participants into the study. Data was collected from 430 subjects who agreed to be interviewed in the Food Market Centers using a questionnaire by trained students enrolled in nutrition course. Data were collected through a structured questionnaire developed based on questionnaires used reliably in previous studies [3, 17]. The questionnaire contained 8 sections; Demographic characteristics, consumer knowledge, attitudes and practices on food labels, item on food label and the level of importance to the consumer and finally consumers' health concerns for not reading food label. The questionnaire was pilot tested for face validity and minor modification was made accordingly. Since Food labels require nutritional knowledge to understand, after the interview, the students explained the consumers how to read food labels.

Questionnaires were completed in the presence of the students who provided assistance when needed. The collected data was consolidated, tabulated and analyzed statically. Data were analyzed using SPSS Inc.; version 20.0; Chicago; IL. Descriptive

statistics analysis was used to calculate Frequency and Percentage. T test was applied to determine the awareness regarding food label between consumers of different Nationality. Chi-square test was performed as appropriate to assess if there were statistically significant differences between the Demographic characteristics with regard to label use. Statistical significance was set at 0.05.

4. Results and Discussion

The present study was carried out to study the awareness of consumers regarding food label. Information about food label such as expiry date, storage condition, brand name, price and nutrition facts label were collected using structured questionnaire. Awareness of the selected consumers about nutrient content written on food label and their health concern were also studied.

The collected data on general information of the selected consumers is given in Table 1. The majority of respondents were female (60 %), a total of 60.2 % were university graduates reflecting higher educational level among Food Market Centers shoppers interviewed. The largest percentage of respondents were Bahrainis (74.7%). In regard to health conditions, 29% of the respondents were diabetic.

TABLE 1: Demographic characteristics of the sample (n=430).

Variable	Frequency	Percent
Gender		
· Male	173	40
· Female	258	60
Education		
· University	259	60.2
· School (High/middle)	118	27.4
· No education	53	12.3
Nationality		
· Bahraini	321	74.7
· Non Bahraini	109	25.3
Health Condition (Diabetes)		
· Diabetic	125	29
· Non-diabetic	306	71

When consumers interviewed were asked if they buy prepackaged food and read the food label; 65% stated that they buy prepackaged foods. About 42 % stated that they read the food label (Figure 1); that could be due to low level of nutritional knowledge among consumers in the Kingdom. However the percentage of those who

read food label was higher in studies conducted in other countries [3, 18, 19, and 20]. Furthermore, 71% of the respondents believed that Food label have an effect on nutritional awareness.

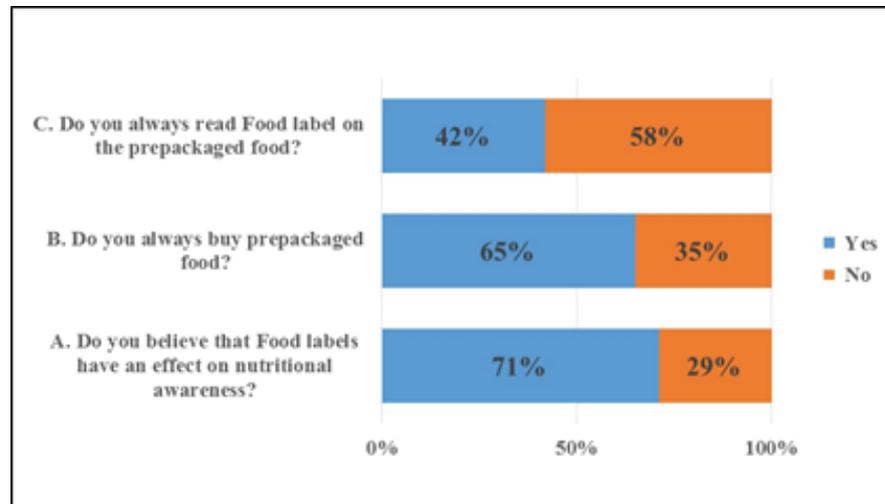


Figure 1: Consumer’s Knowledge regarding food labels.

The analysis of consumers’ attitude towards information on food labels were shown in Figure 2. Around 65 % of the respondents believed that food labels are useful tools for consumers. 42% of the respondents declared that they have no opinion about the accuracy of the nutrient information that is provided in the food label. We think this result is due to inadequate awareness on use of food labeling information in the Kingdom. However, 55% believed that food label is easy to understand and 51% found that nutrition warnings on food label are truthful.

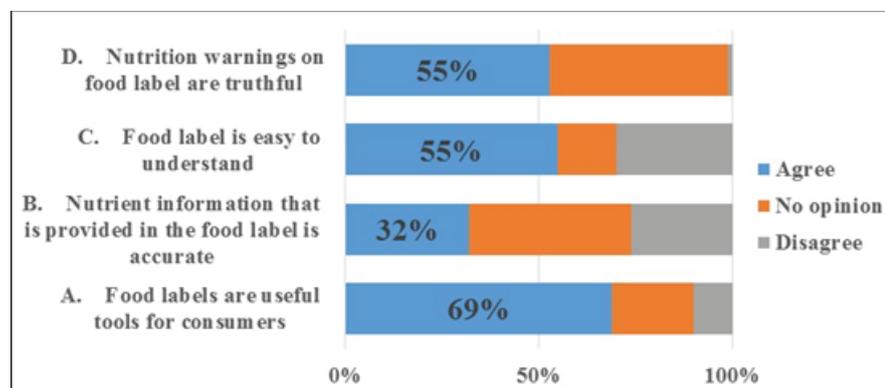


Figure 2: Consumer’s attitude regarding food labels.

There are many food items which might relatively be available in the food label and the consumers may be looking at when buying the food packages. 5 items only were identified and interviewees were asked to identify which food item they were looking at on the food label more (Figure 3). The analysis showed that the majority

of the consumers (85.5%) look to see the information about expiry dates; followed by food price (69%). The percentage of the expiry date in this study is consistent with most of the studies conducted in different countries [3, 18, 19, and 20]. Around 42.7 % look for the brand name of the food product followed by storage conditions of the packaged food (48.5%). Nutrition fact label was found to be the least important (37.6%) among the five identified items. Similar results have been reported by studies from various countries as there were factors related to consumers not reading and using food labelling information in purchasing food.

A study conducted in India reported that consumers purchase pre-packaged food without reading labelling information because the food was routine/familiar to them [19]. Another study in Iran found other factors such as: small print on food labels to be the main reason for not reading food labels information, followed by no interest, do not believe and do not understand the food label [18]. In addition, UAE study reported that very low percentage of consumers (9.2%) want to see the nutritive value of food [3].

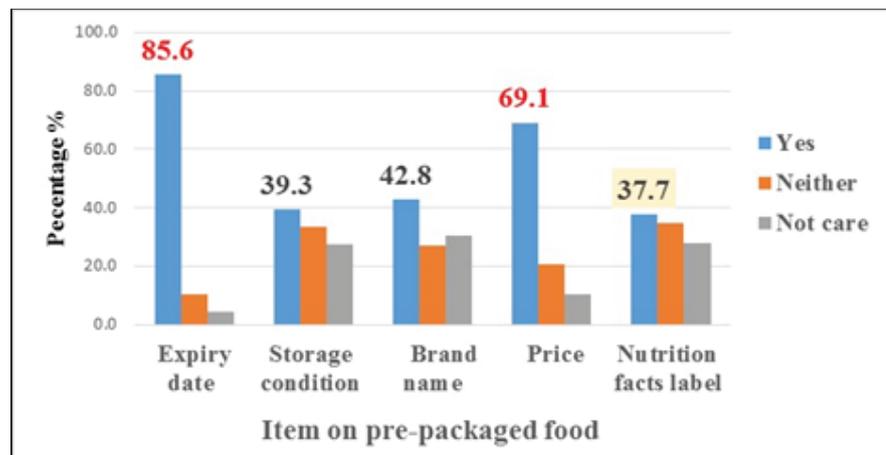


Figure 3: Information that consumers are looking for on the food label.

The analysis of consumers' practice towards information on food labels were shown in Figure 4. Around 60.9 % of the respondents always read production & expiry date followed by food price (50%). This result is consistent with the results shown in Figure 3 and it is in sound with results in other studies [3, 18, 19, and 20]. Almost a similar result were found when the consumers read the storage condition of the food (31.9%) and care about the quality of food (29.8%). In addition, the results of the consumers looking at the brand name (22.6%), reading the importance of health statements (24.2%) and any alarms about forbidden foods or ingredients for certain patients (21.4%) were very close. only 16% of consumers always use food label when purchasing prepackaged food and this can be explained due to factors related to consumers not reading and

using food labelling information in purchasing food. We believe that the main factors have been reported in other studies such as: the food was routine/familiar to them [19], or they do not believe and do not understand the food label [18]. According to Themba & Tanjo (2013), lack of nutrition knowledge, lack of interest, do not believe nutrition information on food products, small print on labels, read nutrition information only when purchasing food items for the first time and time pressures were ranked in order of priority [21].

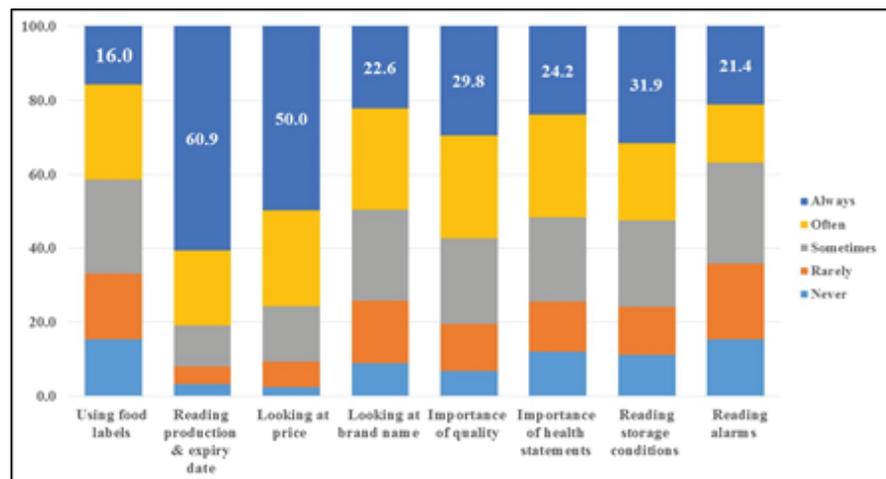


Figure 4: Consumer practice towards information on food label.

Surveying perception of consumers about the importance of reading information on food labels, 48.4% perceived reading food label as very important, and 36.5% respondents perceived it as moderately important. While 15.3% respondents perceived reading food label as not important (Figure 5). A study conducted in India also showed a similar result [19]. However, the results in both studies did not reflect the awareness and use of the information in purchasing pre-packaged foods among consumers in Kingdom of Bahrain.

In this study, the consumers were also asked about the most important nutritional items that they will look at when buying the food for the first time. The result in Figure 6 showed that the three most nutritional items are: the fat content of the food (61.4%), the sugar content of the food (55.8%) and the food total calories (53%). While protein (42.1%), vitamins (40.0%) and minerals (30.2%) in the food were the least important.

Increased diet related diseases in the Kingdom may be related to increased consumption of pre-packaged foods and inadequate awareness on use of food labeling information. Accordingly, the consumers were asked to choose only one health concern that they believe it is related because they don't read the food label. The analysis showed that the majority of the consumers perceive overweight as the most health

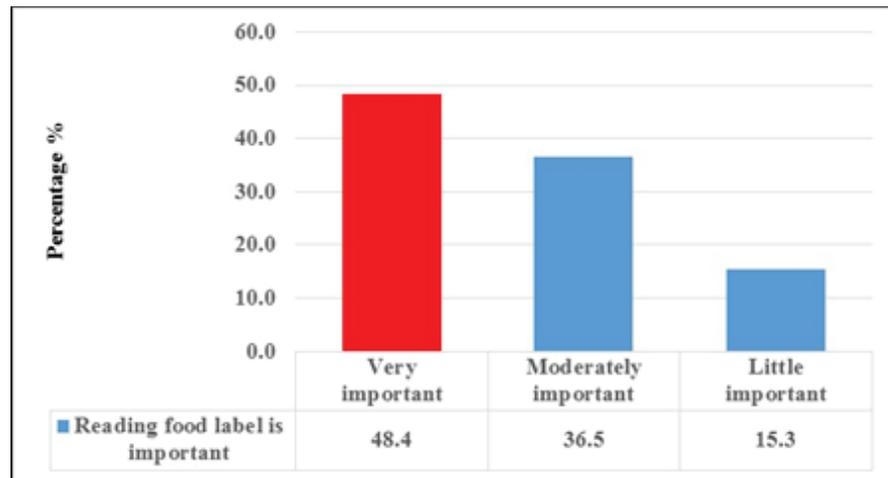


Figure 5: Consumers perception about the importance of reading food labels.

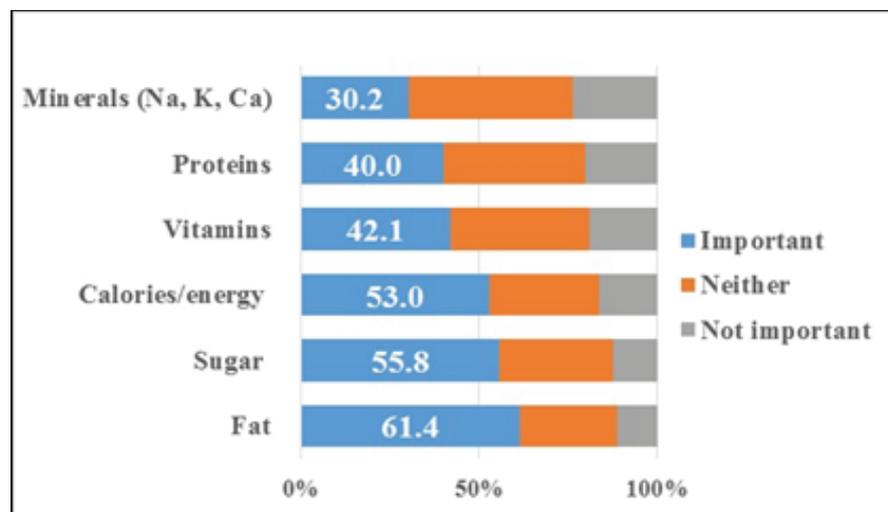


Figure 6: Consumers perception about the most important items in the food label.

concern (34%), followed by diabetes (30%), heart disease and high cholesterol level were perceived similarly (14%). Finally, hypertension was the least concern (8%) of the consumers.

Significant relationships were found between high level of education and knowledge of food labels ($\chi^2=12.79$; $df=2$; $P=0.002$), and their attitudes towards selecting foods based on their nutritive value ($\chi^2=43.64$; $df=8$; $P=0.000$). In addition, significant relationship was found between highly educated consumers and using food labels when purchasing food products compared to others ($\chi^2=24.26$; $df=8$; $P=0.002$). Similar result was found by Washi in UAE in 2012; which showed statistical correlation between the level of education and consumer’s interest in reading and using the food label. Health condition also showed relationship with the attitudes toward selecting healthy foods

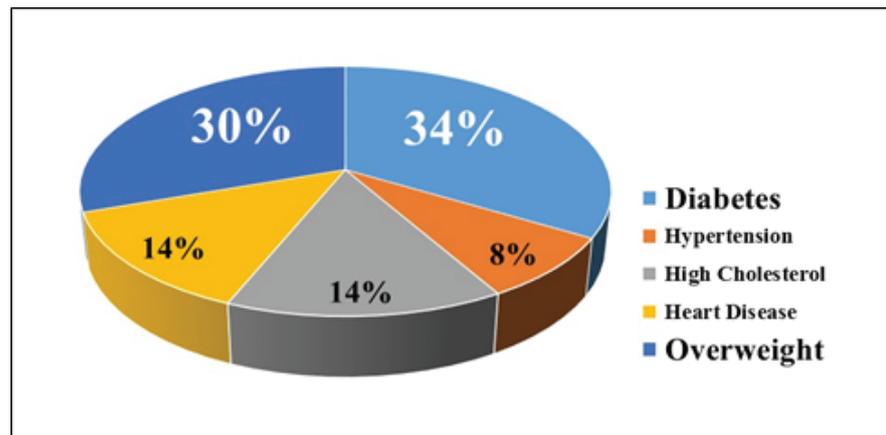


Figure 7: Consumers perception about most health concern related to not reading food label.

($\chi^2=44.50$; $df=4$; $P=0.000$). More diabetic consumers consider the food label as a useful tool than non-diabetic.

5. Conclusion

The study assessed the consumers' knowledge; attitude and practices towards food labeling in the kingdom of Bahrain. We found limited usage and understanding of nutrition labels among consumers. The overall knowledge, attitude and practice of the consumers showed significant correlation only with high level of education in this study. Consumers need to be familiar with the terminology and language on the current nutrition panel, and the need for basic nutrition education and user-friendly label formats. A lot of work is needed to raise the level of awareness of the consumers about the nutrition aspects of the food labeling in order to assist them in bridging the gap between current dietary practices and dietary recommendations which will be useful to make healthier food choices. Health programs and awareness campaign in Food Market centers are also required to educate consumers regarding food labeling and its benefits on preventing lifestyle-related diseases. The study also recommends further studies to get the impact of a wide range of consumers with convenient selection of study sample and equal presentation which will enable studying the impact of all the variables.

References

- [1] Vijaykumar S., Lwin MO., Chao J., Au C. (2013). Determinants of food label use among supermarket shoppers: a Singaporean perspective. *J Nutr Educ Behav*, 45(3), 204-212.
- [2] Al Tamimi & Company (2004). Standardization and Classification in the UAE. Retrieved from Center for Food safety (2006). Benefits of Nutrition Information on Food Labels.
- [3] Washi S. (2012). Awareness of Food Labeling among Consumers in Groceries in Al-Ain, United Arab Emirates. *International Journal of Marketing Studies*, 4(1), 38-47.
- [4] WHO/FAO. (2003). WHO/FAO Diet, Nutrition and the prevention of chronic diseases. Available online: <http://www.fao.org/docrep/008/y7867e/y7867e02.htm#bmo2>
- [5] McLean, P. E. (2001). An analysis of nutritional label use in the Southern United States. *Journal of Food Distribution Research*, Food Distribution Research Society, 32(1), 110-114.
- [6] Whitney E., & Rolfes S. R. (2005). *Understanding Nutrition* (10th ed.). WADS Worth; P: 55-61.
- [7] Godwin S. L., Speller H. L., Thompson C. (2006). Evaluating the nutrition label: its use in and impact on purchasing decisions by consumers. *Journal of Food Distribution Research*, Food Distribution Research Society, 0 (1), 1-5.
- [8] Cowburn G, Stockley L. (2005) Consumer understanding and use of nutrition labelling: a systematic review. *Public Health Nutrition*, 8(1), 21-8.
- [9] Grunert K, Willis J. (2007). A review of European research on consumer response to nutrition information on food labels. *Journal of Public Health*, 15(5), 385-399.
- [10] Levy S., Feins S. B., Schucker R. E. (2001). More effective nutrition label formats are not necessarily preferred. *Journal of the American Dietetic Association*, 92 (10), 1230 - 1234.
- [11] Himbachi J. T., Stokes, R. C. (2003). Nutrition labeling and public health: Survey of American Institute of nutrition members, food industry and Consumers. *American Journal of Clinical Nutrition*, 96, 700 - 708. Available online: <http://www.jheimbach.com/published.html>
- [12] Nayga RJ. (2000). Nutrition knowledge, gender, and food label use. *The Journal of Consumer Affairs*, 34(1), 97-112.
- [13] Satia JA, Galanko JA, Neuhouser ML. (2005). Food nutrition label use is associated with demographic, behavioral, and psychosocial factors and dietary intake

- among African Americans in North Carolina. *Journal of the American Dietetic Association*, 105(3):392-402.
- [14] McLean-Meyinsse P. (2001). An analysis of nutritional label use in the Southern United States. *Journal of Food Distribution Research*, 32(1),110-114.
- [15] Guthrie J, Fox J, Cleveland L, Welsh S. (1995). Who uses nutritional labeling, and what effects does label use have on diet quality? *Journal of Nutritional Education*, 27(4),163-172.
- [16] Washi S. (2002). Knowledge, attitudes and practices of Saudi consumers on food labeling. *Arab Nutrition Journal*, 6, 23-31. Center for Studies and Research, Bahrain.
- [17] Washi, S. (2001). Nutritional aspects of food labeling in Saudi Arabia. *Ahfad Journal*, 18 (2), 17-29.
- [18] Bazhan M, Mirghotbi M, Amiri Z. (2015). Food labels: An analysis of the consumers' reasons for non-use. *Journal of Paramedical Sciences (JPS)*, 6(1), 1-10.
- [19] Patel D, Dutta S. (2017). Study of Consumer Awareness on Food Labelling and Use of Pack Information for Purchase of Pre-Packaged Food Products. *The International Journal of Indian Psychology*, 4(4), 63-72.
- [20] Song J, Huang J, Chen Y, Zhu Y, Li H, Wen Y et al., (2015). The understanding, attitude and use of nutrition label among consumers (China). *Nutricion Hospitalaria*, 31(6), 2703-2710.
- [21] Themba G, Tanjo J. (2013). Consumer awareness and usage of nutrition information in Botswana. *Business and Management Horizon*, 1 (1), 44- 58.

Conference Paper

The Serological Findings of Parvo Virus B19 and Neopterin Detection Among Sickle Cell Disease Patients and Blood Doners in the Kingdom of Bahrain

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Abstract

Introduction. Parvovirus B19 (PV B19) is a small, non-enveloped, ss DNA virus with an icosahedral capsid having a size of 18–26 nm. PV B19 transmits through respiratory droplets, blood transfusion and nosocomial infections that have also been documented recently. The virus targets the actively dividing Erythroid Progenitor Cells (EPCs) that are found in the human bone marrow, fetal liver and human umbilical cord.

Methods. The study was particularly conducted on Sickle Cell Disease (SCD) patients and focuses on the determination of parvovirus B19 among Bahraini population by relying on their clinical status. The serological study of PV B19 was performed using Enzyme Linked Immunosorbent Assay (ELISA) technique and includes 150 SCD patients and 100 healthy blood donors in which both males and females were employed. The samples were taken from the emergency unit of Salmania Medical Complex (SMC) and Ibrahim Khalil Kano Center (IKKC).

Results. Of the 150 SCD patients, 100 were with vaso-occlusive crisis (VOC) and 50 non-vaso-occlusive crisis (NVOC). The three groups showed significantly higher percentages of PV B19 IgG but the percentage in SCD was relatively high compared to the control group of age-matched healthy donors – 70% of the VOC patients, 76% of the NVOC cases and 57% of blood donors were found to be IgG sero-positive.

Discussion and Conclusion. PV B19 is a pathogenic virus and sometimes considered as life-threatening specifically for those individuals who have SCD due to which a risk of transient aplastic crisis increases. This virus is only associated with those patients who have some hematological disorders such as hemolytic anemia and erythro-cytopenia. An effective screening test must be performed in the future to reduce the risk of PV B19 infection.

Keywords: Aplastic Crisis, Seroprevalence, Bahraini Population, Genotypes, Vaso-occlusive crisis, Neopterin

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1. Introduction

Human parvovirus B19 infections are prevalent worldwide; and, many studies confirmed its association with Aplastic Crisis (AC) in SCD patients, however, limited data about the virus prevalence have been published. Likewise, no such studies have been published for the Bahraini population despite the high burden of SCD in this area. Therefore, the present study was planned to analyze the prevalence of PV B19 infection in selective Bahraini population, hence, forming a platform for better management of SCD in Bahrain.

PV B19 is a small, non-enveloped, ss DNA virus with an icosahedral capsid having a size of 18-26nm. The capsid is constituted of 60 structural viral proteins (VP) and are of two types: a minor structural protein VP1, that makes up about 5% of the capsid and a major structural protein VP2 that form the bulk of the total capsid composition (Adamson, 2013) and the genome of the PV B19 contains around 5000 nucleotides. (Palinski, 2016). An epidemiological survey observed that half of the adult population has the immunoglobulin antibodies of this virus in their serum (Aminu & Koledade, 2014). PV B19 is the most common source of infection mostly seen after the winter season. The mode of transmission of infection is the respiratory droplets. However, some other routes of transmission also exist such as through blood transfusion and parental transfer. Moreover, some nosocomial infections also give a chance to PV B19 for causing an infection (Moschovi & Vlahopoulos, 2016).

The actively dividing EPCs are in the human bone marrow and liver, PV B19 attacks on these cells and thus causing erythrocytopenia, decreased erythrocyte production. The hereditary hematological disorders such as spherocytosis, thalassemia, or SCD in particular are at risk of transient aplastic crisis if infected by PV B19 (DeBaun & Kirkham, 2012). SCD is caused by the abnormal type of hemoglobin (Hb), hemoglobin S (HbS). The hemoglobin of red blood cells (RBCs) is distorted as a result of homozygosity for a mutant gene that causes the normal hemoglobin (HbA) to alter to hemoglobin S. The SCD condition is created due to less oxygen in which RBCs become rigid and Sickle-shaped and cannot be able to pass through the small blood capillaries (Li & Karniadakis, 2016). It has been observed that the prevalence of SCD increases the rate of mortality and morbidity around the world. These disorders increase the risk of transient aplastic crisis and can be life-threatening if PV B19 is the source of infection (Guillaud & Michel, 2012).

According to the research of Koury (2014), PV B19 is responsible for several disease conditions, especially in blood-related infections. It has been found that the primary

interest of PV is to replicate in the bone marrow where EPCs is actively dividing (Claros & Andrades, 2012). As a result of this, the production of erythrocytes is terminated, and ultimately the hemoglobin concentration becomes reduced. However, the virus shows an adverse impact on those patients who have another erythrocyte disorders either acquired or inherited (Rogo & Rezaei, 2014)

2. Methodology

2.1. Study design

It is a prospective study based on the serological findings and Neopterin detection for the erythrovirus PV B19. The current study focuses on the determination of parvovirus among Bahraini population. The study was particularly conducted on SCD patients, and the duration of this research was October (2012) -September (2013).

Three groups have been taken for the serological study of PV B19 among which 100 patients were associated with VOC, and 50 were NVOC and 100 healthy blood donors in which both the males and females were included. The target population includes patients from the emergency unit of SMC and IKKC. During the study, some patient's samples were excluded because they were non-Bahraini, below 18 years of age, and they had other hereditary blood disorders such as thalassemia and other blood abnormalities.

2.2. Sample collection and its processing

The phlebotomist took a sample of 2-3 ml venous blood into the first vacutainer tubes with an anticoagulant which prevents blood clotting. Ethylene Diamine Tetra-acetic Acid (EDTA) is used as an anti-coagulant. In the second vacutainer tube, 2-3 ml whole blood was collected without an anti-coagulant. The purpose of using EDTA is to find out the Complete Blood Count (CBC), erythrocyte count, Hemoglobin concentration, and the percentage of the reticulocytes. All these tests were performed on the same day when the blood sample was collected. The second sample remained untouched and was allowed to clot. After this, the tube was centrifuged by using Centaur Density Gradient Centrifugation (CDGC). It was set at 3500 rpm (revolution per minute) and the tube was centrifuged for only 10 minutes. After 10 minutes, the serum was separated from the blood and stored at -80 °C till the process started.

2.3. Detection of immunoglobulin by using ELISA

ELISA technique was used for the detection of immunoglobulin in human serum or plasma. Here, two immunoglobulins were found by using the blood sample of patients infected with PV B19. IgG and IgM were the immunoglobulins detected by using the Immuno- enzymatic assay. The manufacturer of ELISA was the Nova Tech (Immundiagnostica GmbH, Nova LisaTM, Germany) and the product number of ELISA which was used for this procedure is PARGo370/PARMo370.

2.4. Measurement of Neopterin concentration

The concentration of Neopterin (NPT) was also measured from the serum sample of patients and control samples by using ELISA technique, for 88 SCD vaso-occlusive crisis, and 32 of the age and gender matching control group. NPT level of SCD vaso-occlusive crisis patients were correlated to the patients' laboratory findings. Laboratory tests for bacterial and viral infections in blood culture, urine culture and respiratory profile were recorded as (present, absent or not done). For measuring the concentration of Neopterin, an IBL International GMBH product was used. ELISA is a quantitative assay utilized for the detection of Neopterin concentration in human serum, urine, and plasma. The test was performed as per manufacturer's instructions.

2.5. DNA extraction

The process of DNA extraction was performed by using molecular techniques. For this purpose, the QIAGEN DNA extraction kit was used which contained two separate kits, first was QIAamp DNA mini and the second was QIAamp DNA blood mini kit. This kit was made in Germany in which the extracted DNA was stored for later use at -20 °C.

2.6. Polymerase chain reaction method (PCR)

It is a technique used for making copies of small segments of DNA. This method was used to confirm the detection of PV B19, and done according to the protocol illustrated by Aebischer and Beer (2014). The samples of SCD patients were screened by using the consensus PCR assay with the help of primers present in the NS1 gene. This screening was specifically for the detection of the erythrovirus DNA. Thus, in the current study, the serological and molecular test were performed, On the other

hand, Neopterin concentration was only measured from 88 samples of SCD patients with VOC, and 32 controlled samples. Furthermore, the current study investigated the circulating genotype of PV B19 among the Bahraini population.

3. Results

In the VOC patients, the age extended from 18 to 68 years whereas, in the NVOC group, patient's age ranged from 18-71 years. All patients were Bahrainis only, no other ethnic group was found. The age range of the control group was 21 to 61 years.

The sample distribution was also based on gender differences among the population enrolled in the study. The samples of 51 male patients were found as SCD with VOC whereas, 32 males were found as SCD with NVOC. Around 49 females were found as SCA with VOC, and 18 females have SCD with NVOC. It was observed that the percentages were same in both the male and female groups i.e. 33.2%. The percentage for the control group was 33.6 % in which 84 males and 16 females were included.

3.1. Parvovirus antibodies in the serum sample

The samples which showed positive results for PV B19 containing IgG immunoglobulin were 165 (66%) whereas, 9 (3.6%) samples showed the presence of IgM immunoglobulin. The total number of positive SCD samples was 108 (72%) in which IgG was found. Among these SCD samples, 70 suffered from VOC and 38 were NVOC samples, and 57 samples were IgG positive from the control group. The comparison showed the importance of IgG among SCD patients which is commonly known as the anti-parvovirus B19. In contrast, another anti-parvovirus B19 that is IgM was detected only in 6 samples of SCD patients with VOC. IgM was not detected in the SCD patients with NVOC. Around six samples with both the IgG and IgM antibodies showed positive results of PV B19 among which four samples were taken from SCD patients with VOC and two samples from the control group.

Based on the findings mentioned above, all 250 samples were moved towards the molecular DNA extraction of PV B19. When PCR was performed, four samples were found to be positive for DNA presence, two samples from VOC group, one from the NVOC group, and the last sample was from the control group. The given table was based on the relationship of parvovirus infection with IgM which is considered as an anti-parvovirus immunoglobulin. These results were compared by molecular findings

of genotype with anti-IgM serology. The comparison between SCD patients with VOC, NVOC and the control group is presented in the table given below (**Table 1**).

TABLE 1: Molecular detection and response of antibodies in serum samples that showed positive results of PV B19.

Group tested	PV B19- IgG positive n (%)	PV B19- IgM positive n (%)	PV B19- IgG & IgM positive n (%)	PV B19 viral DNA n (%)
SCD vaso-occlusive crisis	70 (70)	6 (6)	4 (4)	2 (2)
SCD non-vaso-occlusive crisis	38 (76)	0 (0)	0 (0)	1 (2)
100 control	57 (57)	3 (3)	2 (2)	1 (1)

3.2. Neopterin concentration

Upon comparison between bacterial and viral laboratory findings in SCD vaso-occlusive crisis patients, it was found that the number of viral infections tested in those patients were limited, 4 only (5.7 %), but, the NPT concentrations were significantly high ($p=0.037$). On the other hand, bacterial testing were more in number 11 (15.7%), nevertheless, the NPT concentrations were lower. **Table 2** shows the comparison between NPT positive samples of SCD vaso-occlusive

crisis patients and the healthy controls samples, the correlation was significantly high ($p=0.000$), as, all control samples were negative for NPT incidence.

TABLE 2: The comparison between NPT positive samples of SCD vaso-occlusive crisis patients and the healthy controls ($p=0.00$ by Fisher’s Exact Test).

NPT	% SCD (n) vaso-occlusive crisis	% Control (n)
Positive	80.7 (71)	0 (0)
Negative	19.3 (17)	100 (32)
Total	100 (88)	100 (32)

3.3. PCR results

All the 250 clinical samples were extracted, DNAs from the serum samples were amplified by PCR using consensus primers. Out of 150 SCD patient 3 (2%), (2 from SCD vaso-occlusive crisis patients and 1 from SCD non-vaso-occlusive crisis patients) and 1% (1/100) of the controls recruited for this study were found positive for viral DNA by PCR. All the 4 positive samples were subjected to genotyping procedure and the restriction

digestion revealed 2 bands each for NS1 restriction (36 & 67 bp of the 103 bp uncleaved fragment and VP1u restriction 149 and 55 bp of the 204 bp uncleaved fragment).

Representative gel electrophoresis for NS1, VP1u bands and their restriction products were photographed and are shown in **(Figs. 1)** The 4 positive results were amplified by nested PCR **(Fig. 2)** and sent for sequencing. A representative chromatogram of the sequences received from the Genoscreen is shown as **(Fig. 3)**. Analyses of our sequences with "Chromas", "Blast" and "Clustal W" revealed that the sequences belonged to Genotype 1.

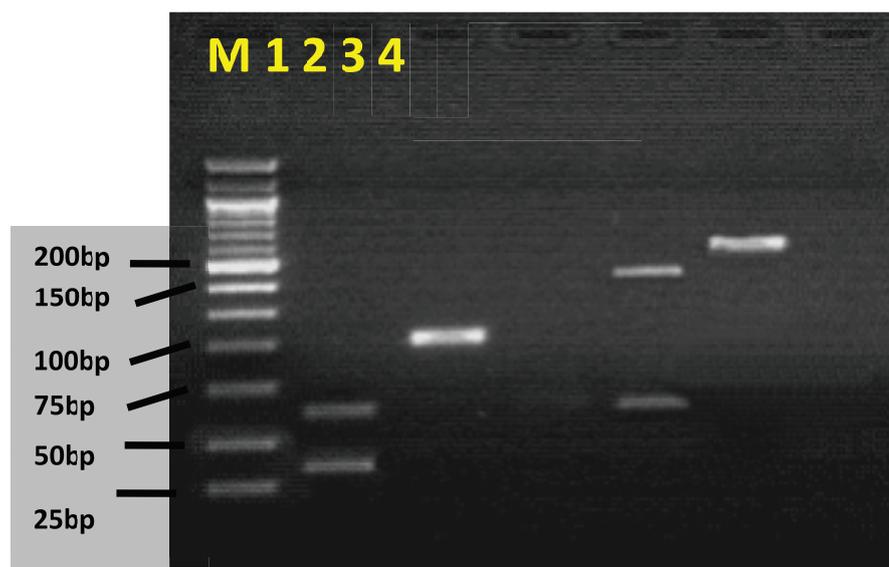


Figure 1: The genotyping and restriction digestion process in which NS1 gene is shown into small segments known as amplicons. *MfeI* and *ApaI* restriction enzymes were used for the amplification of DNA. Two digested segments of NS1 were shown and their size was 67bp and 36bp.

4. Discussion

Parvovirus is a pathogenic virus which is occasionally considered as life-threatening specifically for those individuals who have SCA due to which a risk of transient aplastic crisis increases (Turkeltaub & Tying, 2017). It has an ability to destroy the erythroid progenitor cells in human and cause destruction of these cells specifically in the bone marrow which may result in Erythropoiesis (Eaves, 2015). PV B19 was first identified in 1981 and its association with the disease was reported when a patient of sickle cell anemia went through transient aplastic crisis (Williams & Jarreau, 2012). However, this virus is only associated with those patients who have some hematological disorders such as hemolytic anemia and erythro-cytopenia. Since the detection of erythrovirus, it has been found that PV B19 is also associated with other diseases including: purpuric

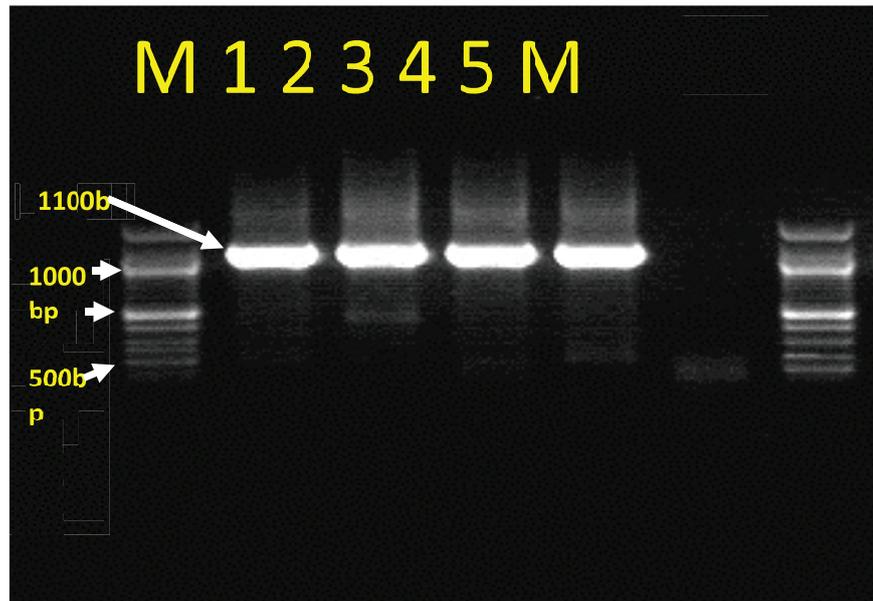


Figure 2: The sequencing process of amplified segments and the sequences were related to genotype 1. The sequencing of amplicons was performed for those patients whose test results found positive to PV B19 by the help of molecular and screening test.

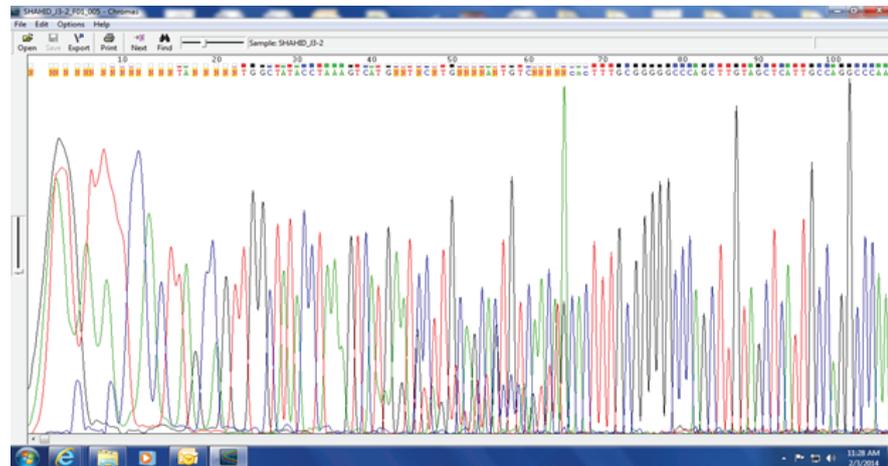


Figure 3: Representative Chromatogram of PV B19 Genotype 1. The figure shows a representative sequence analyzed using the Chromas software.

eruption on hands and feet in adults, erythema infectiosum, and spontaneous abortion in pregnant women (Bello & Lapadula, 2013). Moreover, PV B19 increases the risk of infection in the intrauterine cavity that can cause asymptomatic effects among females and may also cause several fatal complications (Ornoy & Ergaz, 2017).

Chronic anemia was also reported in some immune-compromised patients and aplastic crisis in Sickle cell anemic patients (Al-Najjar, 2013). A study was conducted in the capital of Saudi Arabia at the Armed Forces Hospital (AFH) in March 2001, to find out the exposure of PV B19 among patients with hemolytic disorders, for this purpose, lab records of 73 patient’s serum were taken and sent for the detection of IgG and IgM

by using ELISA technique. The findings revealed that 68% patients showed serological evidence of PV B19 which was due to previous exposure. The study concluded that 68% of PV B19 infected patients could be considered at risk of chronic hemolytic disease (Sener & Afsar, 2012).

Parvovirus can cause interruption in the production of RBCs which could be life-threatening sometimes but not in every case. At the initial stage, it is necessary to transfuse multiple blood bags so that the patients show recovery within two weeks (Hess, 2012). IgG and IgM are the two antibodies found in human body against PV B19 and they are commonly known as the anti-parvovirus immunoglobulin. In the current study, these two antibodies were identified by using ELISA. Furthermore, another molecular method was used for targeting the specific segment of the genome of virus. This molecular method is known as Polymerase chain reaction (Deng & Wu, 2012). In the current study, Neopterin level was also found in the serum samples of patients because it is an inflammatory marker and plays a significant role in the detection of cellular immune response (Parker & Oh, 2013).

According to the research of Gulf Cooperation Council, it is revealed that many countries including Saudi Arabia, Bahrain, and Kuwait showed high prevalence of Sickle cell anemia (Barakat-Haddad, 2013). The current study was conducted in Bahrain where inherited hemoglobin disorders are frequently reported among which two most commonly found are; Sickle cell disease and Thalassemia. According to Tsitsikas and Amos (2014), SCA patients are found to be more susceptible for the recurrent infection of PV B19. The prevalence and complications of PV B19 in SCD and thalassemia patients have been reported around the world and it needs urgent development and strategies which provide the preventive measures to those patients who have hemolytic disorders (Chou & Thompson, 2012). These prevention strategies may also require reducing the burden of life-threatening complications linked with parvovirus infections. Therefore, routine inspection of the blood samples should be performed either by general screening method such as by measuring the Neopterin concentration or molecular method like PCR (Skvarc & Kaasch, 2013).

5. Conclusion

This study reflected the health status of Bahraini population among which high prevalence of PV B19 has been found. This study concluded that 70% SCD patients suffered from vaso-occlusive crisis and 76% patients belonged to non-vaso-occlusive group patients. Further observation revealed that serological indication of parvovirus was

also found in high frequency that is 57% in the control group which consisted of healthy individuals. The current study also observed high frequency of anti-parvovirus immunoglobulin both in the SCD patients and control group. Among the population of Bahrain, the identification of IgM was found to be significantly lower as compared to IgG. Due to the frequency of IgM, the risk of fatal crisis may increase in such anemic patients. After screening of blood donor's sample, it was concluded that only 3% donors have IgM antibody which can prevent them from the infection of PV B19. However, it is observed that just because of inappropriate features of testing, the presence of parvovirus DNA has been found to be high in the SCD and Thalassemia patients. It is concluded from the study that an effective screening test must be performed in the future to reduce the risk of PV B19 infection.

References

- [1] Adamson, L. A. (2013). *Human Parvovirus B19 gene expression in thyroid disease correlates with increased inflammation* (Doctoral dissertation, University of Florida).
- [2] Aebischer, A., Wernike, K., Hoffmann, B., & Beer, M. (2014). Rapid genome detection of Schmallenberg virus and bovine viral diarrhoea virus by use of isothermal amplification methods and high-speed real-time reverse transcriptase PCR. *Journal of clinical microbiology*, 52(6), 1883-1892.
- [3] Al-Najjar, S. A. (2013). *Immunophenotyping markers and cell adhesion molecules in sickle cell anaemia patients in Saudi Arabia* (Doctoral dissertation, King Abdulaziz University, Jeddah).
- [4] Aminu, M., Gwafan, J. Z., Inabo, H. I., Oguntayo, A. O., Ella, E. E., & Koledade, A. K. (2014). Seroprevalence of human papillomavirus immunoglobulin G antibodies among women presenting at the reproductive health clinic of a university teaching hospital in Nigeria. *International journal of women's health*, 6, 479.
- [5] Barakat-Haddad, C. (2013). Prevalence of high blood pressure, heart disease, thalassemia, sickle-cell anemia, and iron-deficiency anemia among the UAE adolescent population. *Journal of environmental and public health*, 2013.
- [6] Bello, S., Fanizzi, R., Bonali, C., Serafino, L., Terlizzi, N., & Lapadula, G. (2013). Papular-purpuric gloves and socks syndrome due to parvovirus B19: a report of two simultaneous cases in cohabitant families. *Reumatismo*, 65(1), 40-45.

- [7] Chou, S. T., Liem, R. I., & Thompson, A. A. (2012). Challenges of alloimmunization in patients with haemoglobinopathies. *British journal of haematology*, 159(4), 394-404.
- [8] Claros, S., Rodríguez-Losada, N., Cruz, E., Guerado, E., Becerra, J., & Andrades, J. A. (2012). Characterization of adult stem/progenitor cell populations from bone marrow in a three-dimensional collagen gel culture system. *Cell transplantation*, 21(9), 2021-2032.
- [9] DeBaun, M. R., Armstrong, F. D., McKinstry, R. C., Ware, R. E., Vichinsky, E., & Kirkham, F. J. (2012). Silent cerebral infarcts: a review on a prevalent and progressive cause of neurologic injury in sickle cell anemia. *Blood*, 119(20), 4587-4596.
- [10] Deng, H., Xu, Y., Liu, Y., Che, Z., Guo, H., Shan, S.,... & Wu, Y. (2012). Gold nanoparticles with asymmetric polymerase chain reaction for colorimetric detection of DNA sequence. *Analytical chemistry*, 84(3), 1253-1258.
- [11] Eaves, C. J. (2015). Hematopoietic stem cells: concepts, definitions, and the new reality. *Blood*, 125(17), 2605-2613.
- [12] Guillaud, C., Loustau, V., & Michel, M. (2012). Hemolytic anemia in adults: main causes and diagnostic procedures. *Expert review of hematology*, 5(2), 229-241.
- [13] Hess, J. R. (2012). Scientific problems in the regulation of red blood cell products. *Transfusion*, 52(8), 1827-1835.
- [14] Koury, M. J. (2014). Abnormal erythropoiesis and the pathophysiology of chronic anemia. *Blood reviews*, 28(2), 49-66.
- [15] Li, X., Du, E., Lei, H., Tang, Y. H., Dao, M., Suresh, S., & Karniadakis, G. E. (2016). Patient-specific blood rheology in sickle-cell anaemia. *Interface focus*, 6(1), 20150065.
- [16] Moschovi, M., Adamaki, M., & Vlahopoulos, S. A. (2016). Progress in treatment of viral infections in children with acute lymphoblastic leukemia. *Oncology Reviews*, 10(1).
- [17] Ornoy, A., & Ergaz, Z. (2017). Parvovirus B19 infection during pregnancy and risks to the fetus. *Birth Defects Research*, 109(5), 311-323.
- [18] Palinski, R. (2016). *The application of metagenomic sequencing to detect and characterize emerging porcine viruses* (Doctoral dissertation, Kansas State University).
- [19] Parker, D. C., Mielke, M. M., Yu, Q., Rosenberg, P. B., Jain, A., Lyketsos, C. G.,... & Oh, E. S. (2013). Plasma neopterin level as a marker of peripheral immune activation in amnesic mild cognitive impairment and Alzheimer's disease. *International journal of geriatric psychiatry*, 28(2), 149-154.

- [20] Rogo, L. D., Mokhtari-Azad, T., Kabir, M. H., & Rezaei, F. (2014). Human parvovirus B19: a review. *Acta Virol*, 58(3), 199-213.
- [21] Sener, A. G., & Afsar, I. (2012). Infection and autoimmune disease. *Rheumatology international*, 32(11), 3331-3338.
- [22] Skvarc, M., Stubljar, D., Rogina, P., & Kaasch, A. J. (2013). Non-culture-based methods to diagnose bloodstream infection: Does it work?.
- [23] Tsitsikas, D. A., Gallinella, G., Patel, S., Seligman, H., Greaves, P., & Amos, R. J. (2014). Bone marrow necrosis and fat embolism syndrome in sickle cell disease: increased susceptibility of patients with non-SS genotypes and a possible association with human parvovirus B19 infection. *Blood reviews*, 28(1), 23-30.
- [24] Turkeltaub, A. E., Kollipara, R., & Tyring, S. (2017). Life-threatening cutaneous viral diseases. *Emergency Dermatology*, 114.
- [25] Williams, E. F., & Jarreau, P. C. (2012). Transfusion-Transmitted Diseases. *Modern Blood Banking and Transfusion Practices*, 403.

Conference Paper

Physiotherapy Services in Bahrain: Are We Ready to Deal with a Disaster?

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Abstract

Background: Mitigating disaster-related disability by medical response is well established, and physiotherapy has been considered in the medium- to long-term care plan of the affected people. **Purpose:** To explore the sufficiency of the physiotherapy services in the Kingdom of Bahrain to meet the demands and needs of the population health and during a disaster, and to examine the relationship between the currently specialized physiotherapists (PTs) and their ability to cope with the cases associated with a disaster. **Methods:** Public data from three different governmental entities were analyzed regarding the population demographics and the number and specialties of the PTs. A market survey was conducted to collect data about the specializations needs. **Results:** There are 1.7 PTs for every 10,000 persons, and only 8% of the licensed PTs are specialized in orthopedics, neurology and pediatrics. About 30% of the PT workforce are non-Bahraini. **Conclusion:** The number of PTs per 10,000 persons in Bahrain is below the world's average, and the current specializations of the licensed PTs may be insufficient to handle the complex cases of a disaster.

Keywords: Physiotherapy, Rehabilitation, Disaster Response, Medical Response, Resilient Health Care

1. Introduction

Natural disasters defined by the World Health Organization (WHO) as “an occurrence disrupting the normal conditions of existence and causing a level of suffering that exceeds the capacity of adjustment of the affected community”, can have a significant impact on the wellbeing and health of the people affected by it (WCPT, 2016; WHO, 2002). Mitigating disaster-related disability by emergency response through local and international agencies is well recognized and documented (DREF, 2018). The modern history of physiotherapy is associated with World War II, when there was a sudden increase in the need for rehabilitating the injured soldiers (Eldar & Jelić, 2003; Moore

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et al., 2013; Shaik & Shemjaz, 2014). The knowledge of physiotherapists in various areas offer a lot in managing and handling a wide range of acute and chronic conditions, and in the past two decades, physiotherapists emerged as an essential part of the medical response team (Khan, Amatya, Gosney, Rathore, & Burkle, 2015; Rathore et al., 2012; WCPT, 2016). Even though the focus during disaster relief is saving lives and reducing the severity of the injuries, physiotherapy have been considered in the medium to long-term care plan of the people affected with disability or injury following a disaster or war (Moore et al., 2013; NPA, 2015; Reinhardt et al., 2011). However, the available literature discussing the role of physiotherapy in disaster relief is limited.

Health human resources policy and planning have been emerging as an essential aspect of reshaping the health care systems worldwide (Birch et al., 2007; Landry et al., 2016). Since physiotherapy has been internationally identified as a vital medical service during a disaster, war or an emergency, more emphasis should be placed on the readiness of the Middle Eastern countries in facing these tragic events. Therefore, the purpose of this study was to (1) explore the sufficiency of the physiotherapy services in the Kingdom of Bahrain to meet the demands and needs of the population health and during a disaster, and to (2) examine the relationship between the currently specialized physiotherapists (PTs) and their ability to cope with the cases associated with a disaster.

2. Research Methodology

2.1. Dataset sources

Local data sources, which are readily available on the internet through multiple governmental authorities of Bahrain, were retrieved and analyzed. The first dataset containing the statistical information about the demographics, education, and the economy was obtained from the General Directorate of Statistic in the Information & eGovernment Authority (IGA) for 2016 (IGA, 2017). Detailed health-related statistics such as the demographics, human resources of the health sector, and the number of allied health professionals per capita were retrieved from the Ministry of Health (MOH) (MOH, 2016a, 2016b, 2016c, 2016d, 2016e). The second dataset was obtained from the National Health Regulatory Authority (NHRA) website containing information about the licensed PTs for 2016 (NHRA, 2016). The PTs were categorized based on sex (male or female), nationality (Bahraini or non-Bahraini), and sector (Public, private, social services, and higher education). The author's qualitative explanation, based on

their expertise and knowledge of the local health care system and services, were considered as supplementary data when quantitative information was not available (Jesus et al., 2016).

2.2. Survey

A questionnaire was designed explicitly for this study. The questionnaire aimed to collect information about the currently licensed PTs (sex, sector, postgraduate degrees), and future requirements of specialized PTs in various areas including orthopedics, neurology, and cardiopulmonary. A convenient sample of public and private health facilities that offer physiotherapy services were identified through personal contacts and based on the following criteria: (1) They represent major public hospitals, smaller primary care health centers, and private clinics, and (2) their willingness to participate in the survey without the need of formal communication to save time. The heads of these facilities were contacted, and data collection and filling out the questionnaire was achieved via telephone calls and emails after obtaining their consent to participate in the survey.

2.3. Data analysis

Demographical information such as population, sex, healthcare sector, and postgraduate degrees was analyzed. More importantly, the number of physiotherapists per 10,000 persons (or capita) was calculated from the available datasets and surveys. Data are expressed as the number of PTs or percentages in the text and tables. All variables were analyzed using IBM SPSS statistics (v23.0 for Windows; SPSS, Chicago, IL).

3. Results

Based on the information obtained from the IGA and MOH, the population of Bahrain was 1.370 million in 2015 and grew by 4% reaching 1.424 million in 2016 (IGA, 2017; MOH, 2016e). There are 132 physiotherapists, occupational therapists and technicians in the public sector only (MOH, 2016b). The demand on outpatient physiotherapy services in the primary health centers was equivalent to 132,514 visits compared to 48,441 visits in Salmaniya Medical Complex, which is considered the most prominent public hospital in the country (MOH, 2016c, 2016d). Further details about the private sector are not

available. Considering the information provided by the NHRA and the IGA datasets of 2016, the ratio of PTs to 10,000 persons is 1.7 (IGA, 2017; NHRA, 2016).

Analysis of the NHRA's dataset did not provide detailed demographics of the physiotherapists such as the age group, highest academic degree, or area of practice. Due to time shortage, further information could not be retrieved. Table 1 shows the characteristics of the licensed physiotherapists ($n=245$) in Bahrain for 2016. About 69% of the licensed PTs according to the NHRA's dataset of 2016 were females ($n=170$), while the male PTs were about 31% ($n=75$). From a nationality perspective, about 70% of the PTs were Bahraini, and the remaining 30% were non-Bahraini of different nationalities. When the PTs were classified according to the sector, about 49% were working in the public sector ($n=120$), with a similar percentage in the private sector ($n=119$). Less than 2% of the PTs were working in societies or higher-education institutes (Total $n=6$) (Table 1).

TABLE 1: Characteristics of the Licensed Physiotherapists (2016).

Parameters		n (%)
Sex	Males	75 (69%)
	Females	170 (31%)
Nationality	Bahraini	171 (70%)
	Non-Bahraini	74 (30%)
Sector	Public	120 (49%)
	Private	119 (49%)
	Societies	3 (1%)
	Higher-Education	3 (1%)
Total (n)		245

Officials from five public hospitals and health centers and seventeen private clinics agreed to participate in the survey, which was completed in February and March 2018. Results of the public sector showed that 95% of the PTs were Bahraini ($n=126$), and 57% were females ($n=76$). On the other hand, the Bahraini PTs (51%, $n=52$) was almost equal to the non-Bahraini PTs (49%, $n=50$) in the private sector. Most of the PTs in the private sector were also females (70%, $n=71$). Overall, the non-Bahraini PTs were 25% of the total PTs currently working in the surveyed facilities ($n=57$) (Table 2).

The respondents from the public hospitals stated that the sector is in need for physiotherapists specialized in neurology (35%, $n=34$), orthopedics (29%, $n=28$), and pediatrics (21%, $n=21$) in the upcoming five to ten years. The remaining specialties including cardiopulmonary, integumentary and women's health formed the remaining 15% ($n=15$). Similarly, the owners of the private sector clinics also indicated a need for physiotherapists specialized in neurology (34%, $n=20$), orthopedics (33%, $n=19$),

pediatrics (26%, $n=15$) and women’s health (7%, $n=4$). However, there was no interest in PTs specialized in the integumentary or cardiopulmonary systems (0%, $n=0$) (Table 2).

TABLE 2: The Characteristics of the Surveyed Physiotherapists and Specializations Needs.

Parameters		Public Sector n (%)	Private sector n (%)
Sex	Males	57 (43%)	31 (30%)
	Females	76 (57%)	71 (70%)
Nationality	Bahraini	126 (95%)	52 (51%)
	Non-Bahraini	7 (5%)	50 (49%)
Total (n)		133	102
Specializations Needs	Orthopedics	28 (29%)	19 (33%)
	Neurology	34 (35%)	20 (34%)
	Pediatrics	21 (21%)	15 (26%)
	Cardiopulmonary	12 (12%)	0 (0%)
	Sports	0 (0%)	0 (0%)
	Women’s Health	1 (1%)	4 (7%)
	Integumentary	2 (2%)	0 (0%)
	Total (n)		98

Further analysis of the data obtained from the licensed PTs in the public and private sectors, supported with the knowledge of the authors, showed that only 8% ($n=22$) of the total licensed PTs hold a postgraduate degree. Most of them hold either a Master’s degree only (26%, $n=6$), or combined with a transitional Doctor of Physical Therapy degree (tDPT) (36%, $n=8$), or a Philosophy degree (Ph.D.) (23%, $n=5$). Furthermore, most of them are specialized in orthopedics (54%, $n=12$), followed by neurology (18%, $n=4$) and pediatrics (9%, $n=2$). Cardiopulmonary, sports and women’s health collectively formed the remaining 19% ($n=4$) (Table 3).

TABLE 3: The Postgraduate Degrees of the Licensed Physiotherapists (2016).

Degree	PTs with PG degrees n (%)	Of all licensed PTs (%)	Specialization	n (%)
MS only	6 (27%)	2%	Orthopedics	12 (54%)
tDPT only	3 (14%)	1%	Neurology	4 (18%)
PhD only	0 (0%)	0%	Pediatrics	2 (9%)
MS and tDPT	8 (36%)	3%	Cardiopulmonary	1 (5%)
MS and PhD	5 (23%)	2%	Sports	2 (9%)
			Women’s Health	1 (5%)
			Integumentary	0 (0%)
Total (n)	22 (100%)	8%		22 (100)

4. Discussion

The present study aimed to investigate if the physiotherapy health care services can meet the demands of the population and if it is resilient to handle the challenges of disasters and emergencies and to explore the data of the currently licensed and specialized physiotherapists in Bahrain.

The constitution of the Kingdom of Bahrain states that every citizen is entitled to health care (IGA, 2002), and the MOH delivers public health care services in Bahrain. On the other hand, privately owned medical establishments support and complete the delivery of these services (MOH, 2018). Like other medical professions, physiotherapy is affected by the demographics and types of medical illnesses of the population (Landry et al., 2016). The increased chronicity of conditions and advancements in the health care system result in an aging population and influences the years lived with disability, which reflects on the needs for more services (Jesus et al., 2016; Vos et al., 2012). The life expectancy of the newborns in Bahrain increased from 76.4 years in 2010 to 77.1 years in 2016. In the same period, the population of Bahrain grew by 19%, reaching 1.424 million persons. If the rapid growth in population continuous at the same pace, it could reach 1.695 million persons by 2021, which will strain the health care system (IGA, 2017). Jesus et al. (2016) compared between physiotherapy demand and supply in four countries. The research group found that Portugal has the highest apparent physiotherapy needs in areas of orthopedic and neurological disorders compared to Bangladesh, Singapore, and the United States. The needs are met with higher physiotherapy supply (7.8 PTs per 10,000 people).

Looking at the number of licensed physiotherapists in Bahrain, there are less than 2 PTs per 10,000 people (NHRA, 2016). Such ratio puts Bahrain far behind the Scandinavian countries (12 to 27 PTs per 10,000 people), Germany (16 PTs per 10,000 people), Australia (11 PTs per 10,000) and the US (6 PTs per 10,000 people). Even though, the status of physiotherapy services supply is still better than other Middle Eastern countries such as KSA (0.88 PTs per 10,000) and Egypt (0.37 PTs per 10,000) (WCPT, 2013). If the average number of 5 PTs per 10,000 persons was considered, the health care system in Bahrain needs a total of 720 PTs to meet the current demands, which results in a shortage of 475 PTs (WCPT, 2013). Assuming 30 new PT graduates will join the market each year, it will take 15 years to meet the current demands without considering the future increase in population and chronicity of conditions. While Physiotherapy and other medical services are regulated by the NHRA (NHRA, 2013), employment in the public sector is monitored and controlled by the Civil Service Bureau (CSB) of Bahrain

(CSB, 2015). The job vacancies and employment, including the healthcare sector, are primarily influenced by the need, the state's treasury and finance, which is discussed next.

From an economic point of view, the Gross Domestic Product (GDP) per capita in Bahrain was recorded at 22K USD in 2017, ranked at 175% of the World's average or the 44th position worldwide (Economics, 2017). Germany (48K USD), Australia (56K USD) and the US (53K USD) have higher ratios of PTs per 10,000 people and a higher GDP per capita. Therefore, it can be assumed that higher GDP results in improved health care systems including the availability of physiotherapy staff, infrastructure, and emergency resources to mitigate disasters and crises (Lange & Vollmer, 2017). Considering the significant shortage of PTs in the context of a disaster or an emergency, it can negatively impact the preparedness of the Bahraini public and private health sectors to cope with any sudden increase in health care service needs.

The percentage of non-Bahraini PTs can also have an impact. Belasen and Polachek (2007) stated that disasters such as hurricanes could result in a 4.76% drop in employment. Moreover, a 3.33% decline in wages can also be seen. Increased unemployment and reduced salaries combined with the economic downfall of a disaster will push the non-Bahraini or foreign PTs away from the region. Thus, the increased shortages in staff will place further pressure on and negatively affect the health care system in mitigating disasters.

The World Confederation for Physical Therapy (WCPT) defines physiotherapy specialty as a defined area of physiotherapy practice, in which the physiotherapist obtains advanced knowledge, skills and competence in a specific area (WCPT, 2017). Currently, there are only 22 specialized PTs in Bahrain, which is equivalent to 8% of the licensed PTs. Most of them are specialized in orthopedics, neurology or pediatrics (Table 3). Moreover, the future needs of specialized PTs are also in these three main scopes of practice (Table 2). When compared to the PTs of the province of British Columbia in Canada, 12% of the 425 surveyed PTs hold postgraduate degrees with similar specializations, and the interests of those who would like to pursue a postgraduate degree are also in the same fields (Sran & Murphy, 2009).

The severe injuries seen in disasters such as earthquakes, hurricanes, and floods go beyond the simple cases seen daily in the public and private hospitals in Bahrain. These injuries include but are not limited to complicated fractures, limb amputations, burns, spinal cord injuries, traumatic brain injuries, and peripheral nerve injuries (WCPT, 2016). The extent of medical pathologies can be broadened to include respiratory complications because of the aspiration of contaminated water or living in unhygienic

environments. Consequently, the emergency medical team, including PTs, should have expertise in managing these cases above and have the required skills to perform splinting, first aid, and orthotics and prosthetics prescription (WCPT, 2016). Currently, there are no PTs specialized in or hold a degree or a professional certificate in treating burn injuries, amputations, prosthetics, and orthotics prescription or are experienced enough to deal with the complexity of these cases.

Many countries have placed emergency strategic planning, preparedness, and disaster management as a top priority (Amatya, Galea, Li, & Khan, 2017). Unfortunately, some disastrous events, such as earthquakes, could occur without prior warnings. Thus, disaster response or plans may be insufficient to cope with it. Some of the nearby countries already faced disasters such as earthquakes in Iran, floods in Saudi Arabia and hurricanes in Oman (Fritz, Blount, Albusaidi, & Al-Harthy, 2010; Pallister et al., 2010; Subyani, 2011). In Bahrain, the National Center for Disaster Management Crisis (NCDMC) was established in 2003 to coordinate with the MOH and other entities to oversee the delivery of healthcare services during disasters and emergencies (MOI, 2016). It is not confirmed if physiotherapy is included in the national disaster management strategy. A review by Khan et al. (2015) emphasized the importance of incorporating rehabilitation with its various areas into disaster management planning. Moreover, investment in physiotherapy and rehabilitation services is essential at this stage to mitigate the effects of future disasters. It is an important issue to consider since most PTs in Bahrain do not have specialized skills and training to deal with the complex cases associated with a disaster.

5. Conclusion

The number of PTs per 10,000 persons in Bahrain is below the world's average, and the current specializations of the licensed PTs may be insufficient to handle the complex cases of a disaster. The issue of how many physiotherapists needed per person or during a disaster requires extensive assessment of the physiotherapy services, infrastructure, human and financial resources. The data of disaster response that occurred in a similar context should be considered when setting the response strategies. Most importantly, physiotherapists should be included in the national disaster planning committees due to their knowledge and expertise.

6. Limitations

The figures obtained from the NHRA, IGA, and MOH are not up to date, and may not reflect the actual needs of the local health sector and the readiness to deal with disasters. Although the health care facilities that were included in the survey represent the public and private sectors, several major public and private hospitals were not included. Therefore, the results may be slightly biased. Also, the lack of quantitative data related to physiotherapy services and staff in Bahrain, and the absence of comparable data from nearby countries may have affected the analysis of the result.

References

- [1] Amatya, B., Galea, M., Li, J., & Khan, F. (2017). Medical rehabilitation in disaster relief: Towards a new perspective. *J Rehabil Med*, 49(8), 620-628. doi: 10.2340/16501977-2250
- [2] Birch, S., Kephart, G., Tomblin-Murphy, G., O'Brien-Pallas, L., Alder, R., & MacKenzie, A. (2007). Human Resources Planning and the Production of Health: A Needs-Based Analytical Framework. *Canadian Public Policy*, 33(Supplement 1), S1-S16. doi: 10.3138/9R62-QoV1-L188-1406
- [3] CSB. (2015). About CSB. Civil Service Bureau (CSB). Retrieved 22 September, 2018, from <https://www.csb.gov.bh/en/civil-service-bureau/about-csb.html>.
- [4] DREF. (2018). Disaster Relief Emergency Fund (DREF). International Federation of Red Cross and Red Crescent Societies (IFRC). Retrieved 21 September, 2018, from <https://media.ifrc.org/ifrc/dref/>.
- [5] Economics, T. (2017, 21 September 2018). Bahrain GDP per Capita. IECONOMICS INC. Retrieved 20 September 2018, from <https://tradingeconomics.com/bahrain/gdp-per-capita>.
- [6] Eldar, R., & Jelić, M. (2003). The association of rehabilitation and war. *Disability and Rehabilitation*, 25(18), 1019-1023. doi: 10.1080/0963828031000137739
- [7] Fritz, H. M., Blount, C. D., Albusaidi, F. B., & Al-Harthy, A. H. M. (2010). Cyclone Gonu storm surge in Oman. *Estuarine, Coastal and Shelf Science*, 86(1), 102-106. doi: <https://doi.org/10.1016/j.ecss.2009.10.019>
- [8] IGA. (2002). Constitution of the Kingdom of Bahrain. Information & eGovernment Authority (IGA). <http://www.wipo.int/edocs/lexdocs/laws/en/bh/bho2oen.pdf>.
- [9] IGA. (2017). Bahrain in Figures. Information & eGovernment Authority (IGA). http://www.iga.gov.bh/Media/Pdf-Section/Bahrain_in_figures_Booklet.pdf.

- [10] Jesus, T. S., Koh, G., Landry, M., Ong, P. H., Lopes, A. M., Green, P. L., & Hoenig, H. (2016). Finding the "Right-Size" Physical Therapy Workforce: International Perspective Across 4 Countries. *Phys Ther*, 96(10), 1597-1609. doi: 10.2522/ptj.20160014
- [11] Khan, F., Amatya, B., Gosney, J., Rathore, F. A., & Burkle, F. M. (2015). Medical Rehabilitation in Natural Disasters: A Review. *Archives of Physical Medicine and Rehabilitation*, 96(9), 1709-1727. doi: <https://doi.org/10.1016/j.apmr.2015.02.007>
- [12] Landry, M. D., Hack, L. M., Coulson, E., Freburger, J., Johnson, M. P., Katz, R., . . . Goldstein, M. (2016). Workforce Projections 2010-2020: Annual Supply and Demand Forecasting Models for Physical Therapists Across the United States. *Phys Ther*, 96(1), 71-80. doi: 10.2522/ptj.20150010
- [13] Lange, S., & Vollmer, S. (2017). The effect of economic development on population health: a review of the empirical evidence. *British Medical Bulletin*, 121(1), 47-60. doi: 10.1093/bmb/ldw052
- [14] MOH. (2016a). Census and Demographic Statistics. Bahrain: Health Information Directorate. Ministry of Health (MOH). Retrieved from https://www.moh.gov.bh/Content/Files/Publications/statistics/HS2015/hs2015_e.htm.
- [15] MOH. (2016b). Human Resources. Bahrain: Health Information Directorate. Ministry of Health (MOH). Retrieved from https://www.moh.gov.bh/Content/Files/Publications/statistics/HS2015/hs2015_e.htm.
- [16] MOH. (2016c). Primary Health Care. Bahrain: Health Information Directorate. Ministry of Health (MOH). Retrieved from https://www.moh.gov.bh/Content/Files/Publications/statistics/HS2015/hs2015_e.htm.
- [17] MOH. (2016d). Salmaniya Medical Complex. Bahrain: Health Information Directorate. Ministry of Health (MOH). Retrieved from https://www.moh.gov.bh/Content/Files/Publications/statistics/HS2015/hs2015_e.htm.
- [18] MOH. (2016e). Summary Statistics. Bahrain: Health Information Directorate. Ministry of Health (MOH). Retrieved from https://www.moh.gov.bh/Content/Files/Publications/statistics/HS2015/hs2015_e.htm.
- [19] MOH. (2018). Ministry of Health Background. Ministry of Health (MOH). 2018, from <https://www.moh.gov.bh/Ministry>.
- [20] MOI. (2016). National Center for Disaster Management Crisis (NCDMC). Ministry of Interior (MOI). Retrieved 21 September, 2018, from <https://www.gdcd.gov.bh/about-gdcd/national-center-for-disaster-management-crisis/>.
- [21] Moore, J. H., Goffar, S. L., Teyhen, D. S., Pendergrass, T. L., Childs, J. D., & Ficke, J. R. (2013). The Role of US Military Physical Therapists During Recent Combat Campaigns. *Phys Ther*, 93(9), 1268-1275. doi: 10.2522/ptj.20120136

- [22] NHRA. (2013). Overview of NHRA. National Health Regulatory Authority (NHRA). Retrieved 22 September, 2018, from <http://www.nhra.bh/SitePages/View.aspx?PagelId=4>.
- [23] NHRA. (2016). Healthcare Professionals Allied List. National Health Regulatory Authority (NHRA). Retrieved 10 February, 2018, from <http://www.nhra.bh/SitePages/View.aspx?PagelId=83>.
- [24] NPA. (2015). The Role of Physical Therapists in the Medical Response Team Following a Natural Disaster: Our Experience in Nepal. *Journal of Orthopaedic & Sports Physical Therapy*, 45(9), 644-646. doi: 10.2519/jospt.2015.0108
- [25] Pallister, J. S., McCausland, W. A., Jónsson, S., Lu, Z., Zahran, H. M., Hadidy, S. E., . . . Moufti, M. R. H. (2010). Broad accommodation of rift-related extension recorded by dyke intrusion in Saudi Arabia. *Nature Geoscience*, 3, 705. doi: 10.1038/ngeo966
- [26] <https://www.nature.com/articles/ngeo966#supplementary-information>
- [27] Rathore, F. A., Gosney, J. E., Reinhardt, J. D., Haig, A. J., Li, J., & DeLisa, J. A. (2012). Medical Rehabilitation After Natural Disasters: Why, When, and How? *Archives of Physical Medicine and Rehabilitation*, 93(10), 1875-1881. doi: <https://doi.org/10.1016/j.apmr.2012.05.018>
- [28] Reinhardt, J. D., Li, J., Gosney, J., Rathore, F. A., Haig, A. J., Marx, M., . . . Rehabilitation Medicine's Sub-Committee on Rehabilitation Disaster, R. (2011). Disability and health-related rehabilitation in international disaster relief. *Global Health Action*, 4, 10.3402/gha.v3404i3400.7191. doi: 10.3402/gha.v4i0.7191
- [29] Shaik, A., & Shemjaz, A. (2014). The rise of physical therapy: A history in footsteps. *Archives of Medicine and Health Sciences*, 2(2), 257-260. doi: 10.4103/2321-4848.144367
- [30] Sran, M. M., & Murphy, S. (2009). Postgraduate physiotherapy training: interest and perceived barriers to participation in a clinical master's degree programme. *Physiother Can*, 61(4), 234-243. doi: 10.3138/physio.61.4.234
- [31] Subyani, A. M. (2011). Hydrologic behavior and flood probability for selected arid basins in Makkah area, western Saudi Arabia. *Arabian Journal of Geosciences*, 4(5-6), 817-824.
- [32] Vos, T., Flaxman, A. D., Naghavi, M., Lozano, R., Michaud, C., Ezzati, M., . . . Memish, Z. A. (2012). Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, 380(9859), 2163-2196. doi: 10.1016/S0140-6736(12)61729-2

- [33] WCPT. (2013, 20 September 2018). Physical therapy: a global profile - Infographic 1. World Confederation for Physical Therapy (WCPT). Retrieved 20 September, 2018, from <https://create.piktochart.com/output/5379562-wcptdatainfographic1>.
- [34] WCPT. (2016). The Role of Physical Therapists in Disaster Management. World Confederation for Physical Therapy (WCPT). Retrieved 21 September, 2018, from https://www.wcpt.org/sites/wcpt.org/files/files/resources/reports/WCPT_DisasterManagementReport_FINAL_March2016.pdf.
- [35] WCPT. (2017). Policy statement: Physical therapist practice specialisation. World Confederation for Physical Therapy (WCPT). Retrieved 20 September, 2018, from <https://www.wcpt.org/policy/ps-specialisation>.
- [36] WHO. (2002). Disasters & Emergencies Definitions. Addis Ababa: World Health Organization (WHO). World Health Organization. Retrieved from <http://apps.who.int/disasters/repo/7656.pdf>.

Conference Paper

Menopause Awareness, Symptoms Assessment and Menqol Among Bahrain Women

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Abstract

Menopause is a normal physiological process of the permanent cessation of ovarian hormone reproduction, thereby offending the regular menstrual cycle. Critical period in women's life occurs 40 to 60 years. Frequently reported symptoms are physiological disturbances, psychological complaints including mood swings and other changes that may impair the overall quality of life. Menopausal symptoms significantly reduce the Quality of Life (QOL) and further worsens with more severity of the condition. The aim of this study was to assess the menopausal awareness and related symptoms that affects the quality of life. **Methods:** A cross-sectional community survey design was adopted among 128 women through convenience sampling by using Menopause awareness scale and MenQol. **Results:** The domain-wise prevalence of symptoms score on vasomotor was 51.5%(66), psychosocial 35.2%(45), 44.5%(57), sexual 25.8%(33) and others 44.5%(57). Overall score was 40.6%(52). In relation to menopause awareness, low 7.8 % (10), Moderate 82.0% (105) and high 10.2%(13). **Conclusion:** Menopause awareness programs need to be initiated at the community level for better health and the Quality of Life.

Keywords: Menopause, Bahraini women, Menopause related QOL, Awareness

1. Introduction

The greatest challenge faced by society in this 21st century is aged population especially women, elderly persons, more number of working-women and prolonged years of life with modern technical advances in medicine. Women are the important person of family health care, the most vital role model for the next generation of educating and motivating healthy living. Even though men and women have more or less related health issues, women are challenged with some precise health problems because of their physical and biological nature.

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Menopause is important and inevitable condition in every woman's life. They face many health issues due to decrease in estrogen level. It is a normal physiological and slow process and there is social transition takes place during this time. Most of the women consider this is because of aging and they face psychosomatic disorders. Women's perception regarding menopause is different based on their age, number of children, family income, educational status of the women and environmental factors. Majority of women attain menopause without adequate information and how to deal with the psycho somatic problems. Due to this, women may not be able to handle this challenges and it may lead to depression and social isolation.

Menopausal transition is highly related with noncommunicable diseases like diabetes, hypertension, osteoporosis, cervical cancer, and breast cancer. Furthermore, the menopausal women experience complex psychosocial problems as depression, mood swings, sleep disorders, loss of social, professional roles, and poor ego integrity. Poor compliance to recommended lifestyle modifications and limited knowledge could impede a better overall health-related quality of life (QOL). The QOL among high proportionate of menopausal phase of women would place a significant burden on public health care in developing countries. Menopausal symptoms have negative impact on QOL among women. Considering the many studies that have been reported, our study is the first of its kind that was carried out in Bahrain about the Menopause awareness, symptom assessment and menqol among Bahraini women.

2. Review of Literature

Varuna Pathak, Neetu Ahirwar, Shruti Ghate (2017) Study findings revealed that, 32.72% of women had knowledge regarding menopausal symptoms. 39.09%, 52.72% and 22.72% of women had information menopause increases risk of cardiovascular disorders, osteoporosis and breast cancer. 4.54% of menopausal women were aware of Hormone replacement Therapy. Nearly 64.55% of women with menopausal symptoms observed menopause as loss of femininity, 67.28% experienced menopausal psychological symptoms affect quality of life, 57.28% think that menopause means end of sexual life, 30% think that menopause is associated with maturity. According to their total score, 48.6% of women had good awareness, 24.1% of them had average awareness, and 27.3% of them had low awareness. 85% of the women had recited or overheard some issues about menopause from their families and relatives (26.8%),

associates (25.5%), health care team members (20%), books and periodicals (10.5%), and mass media or other broadcasting (8.6%).

Reda R. Ali, Sayed. A Mohamed Taha, Manal F. Moustafa Sahar F. et.al., (2015) concluded that, more than one- thirds of women (37.2%) had severe hot flushes, less than one-half (41.2%) were severely depressed, more than one – third (38.4%) had a moderate and less than one- third (29.2%) had affected their sexual relationship, hence there was a statistical significant differences in age, and educational status were independent risk variables envisaging more severe menopausal problems.

Hoda A. E, Mohamed, Sahar M, Lamadah, Luma G H. et.al., (2014) reported in their study findings the most severe symptoms of physical, psychological and sexual issues were hot blooms (29%), live through poor memory (48.3%), being dissatisfied with their personal life (44.8%), muscular skeletal problems(41.9%), and alteration in sexual longing (36.8%). The overall scores of menopausal quality of life for each aspect are indicated that the highest mean score in sexual domain (3.19 ± 1.99), followed by psychosocial (2.94 ± 1.45).

Hassan M. Al-Musa et.al (2017) concluded in their study most of the women expressed joint and muscular problems (96.1%), irritability (94.7%), nervousness (89.0%) and hot flushes and perspiration (80.7%). The mean total score for Menopause Related Symptoms (MRS) scale was 15.25 ± 6.01 . The mean score was 6.36 ± 3.01 for physical symptoms, 6.05 ± 2.54 for emotional symptoms and 2.84 ± 2.25 for urogynecology symptoms. Marital status of the women, lower education level, no of children, lack of physical activity and chronic health issues were significantly associated with higher MRS and poor quality of life.

Karmakar N, Majumdar S, Dasgupta A, Das S (2017) Their study results showed among 100 peri and postmenopausal women (40-60 years) in West Bengal. Incidence of vasomotor symptoms was average with 60% of them reporting hot flushes and 47% sweating. Most prevalent psychosocial symptoms reported were emotion of anxiety and apprehension (94%) and overall depression (88%). Physical symptoms like feeling drained or exhausted decrease in physical power and lack of vigor in 93% of the women to only 5% suffering from growth of facial hair. Overall sexual changes were reported among 49% reported of avoiding relationship with a partner and 26% complained of vaginal dryness.

Aida Al Dughaiter, Hind AlMutairy & Mohammed Al Ateeq (2015) Cross-sectional study was conducted among 119 women aged 45–60 years were interviewed using a questionnaire. Women were divided into three categories: premenopausal (n=31),

perimenopausal (n=49), and postmenopausal (n=39). The Menopause Rating Scale (MRS) assessed the prevalence and severity of eleven menopausal symptoms. Mean scores of menopausal categories were compared for different symptoms. The mean age at menopause was 48.3 ± 3 years (median, 49 years). The symptoms reported to be most prevalent were joint and muscle pain (80.7%), physical and mental exhaustion (64.7%), and hot flushes and sweating (47.1%). Somatic and psychological symptoms were highly prevalent in perimenopausal women compared to other groups. The mean overall quality-of-life score was higher in perimenopausal women, while the total MRS score indicated that the symptoms were mild in severity (MRS <9).

Sudeshna Ray & Aparajita Dasgupta (2012) assessed the QOL among 315 postmenopausal women and the data were collected using the modified menopause quality of life questionnaire of Hilditch. Out of the 315 women who have been interviewed 243 (77%) had poor quality of life.

3. Conceptual Approach

Health promotion model was used to enhance the behavior of the women. The Health Promotion Model (HPM) proposed by Nola J Pender (1982; revised, 1996) was designed to be a "complementary counterpart to models of health protection." And this model is well fitted to our study.

4. Research Methodology

Descriptive, quantitative and non-experimental cross sectional survey was carried out to measure menopause awareness, symptom assessment and effect of menopause on quality of life among Bahraini women. Population consists of Bahraini menopausal females aged between 45 and 55 years old. The sample size was calculated based on the reviews related to similar studies & sample size estimation and it was 128. Based on the following inclusion criteria women who had attained natural pre, peri & post menopause, women whose age ranged between 45 and 55 years old having menopausal symptoms associated with presence of regular or irregular menstrual cycles or absence of menstrual cycles and women were excluded from the study as women who use Hormone Replacement Therapy, women younger than 45 years old, women who had chemotherapy, who had undergone oophorectomy and hysterectomy. Non probability convenience technique was followed to recruit the samples.

The study was carried out in the community settings and the structured survey questionnaire was distributed to the four governorates of Bahrain.

4.1. Ethical considerations

The purpose and significant of the study was explained to participants and it respected the autonomy and dignity of participants. The study maximizes the benefits to research participants and do no harm. An written informed consent form was given to the women to seek their willingness to participate in the study.

4.2. Instruments

Three instruments were used to collect the necessary data: Part I. Sociodemographic & Obstetrics & Gynecological variables, Part II. Menopause specific Quality of Life (MENQOL) & Part III. Menopause awareness scale. The Sociodemographic and Obstetrics & Gynecological variables (OBGYN) which includes age, education, family income, education, marital status, family type, support available for women, diet, occupation & age of menarche, frequency of menstruation, type of menstrual flow, parity, mode of delivery, children, duration of attainment of menopause. MENQOL developed by Hilditch J R, (1996) and added few components to the questionnaire, having 32 survey questionnaires describing quality of life in menopausal women. It consists of 5 domains vasomotor (hot flushes, night sweats and sweating), psychological (anxiousness, poor memory, lowered ability, feeling depressed, impatient, wanting to be alone), physical (flatulence, muscles and joints pain, tiredness, difficulty sleeping, backaches, decreased stamina, lack of energy, dry skin, weight gain, weakness, increased facial hair, change in skin texture, bloating, low back ache, frequent and/or involuntary urination) sexual (changes in sexual desire, vaginal dryness and avoiding intimacy) and others (palpitation, headache, dizziness). In addition, the menopause awareness scale was used, this was designed to assess knowledge on menopause. The scale was consisted of 32 statements that some of them were true and some were false. All the tools were translated from English version into Arabic version and followed by back to back translation was done to ensure the content and meaning of the tool was not altered.

4.3. Reliability and Validity of the tool

The Part I (Sociodemographic & OBGYN variables) was given to medical and nursing experts and having same specialty for the content validity. Item level and content level validity were calculated. A pilot study was carried out among 12% was recruited from the total sample (128) to conduct the pilot study and to assess the usability and ease of administration of tool.

4.4. Data collection procedure

The data collection was carried out in the community setting during community health clinical postings from March to May 2018. Participant information sheet was handed over to the women, which includes researchers qualifications, purpose of the research and contact information. After obtaining the written informed consent, self-administered questionnaire was distributed to all the women with time limit of 15-20 minutes in the presence of research investigator.

4.5. Statistical analysis

Statistical package for the social sciences (SPSS, version 18) was selected for the statistical analysis. A descriptive and inferential statistics were used to analyze the data. The frequency and percentage distribution were applied to analyze the sociodemographic and obstetrics & gynecological variables. Mean, standard deviation, minimum and maximum scores were derived on the prevalence of menopausal symptoms and menopause awareness. Chi square test was used to see the association between level of awareness and demographic variables & OBGYN variables. Karl Pearson correlation coefficient test was used to correlate menopausal awareness and menopausal symptom scores

5. Findings of the Research

5.1. Sample characteristics

Of the 128 women assessed, the mean age of the women was 47.94 ± 2.11 . The largest category belonged to the age group of 45-47 years. More than 45 (35.16%) of women completed their high school education. In regard to family income, 57.81% of

women were having the average income per month. Among the participated women, 108(84.38%) were married, 78(60.94%) were residing as nuclear family, 78(60.94%) were receiving support from relatives and 120 (93.74%) were having non vegetarian dietary pattern. Most of the women 102(79.69%) were housewife. (Refer Table 1)

Regard to the Obstetrics & Gynecological variables, the mean age of menarche was 12.86 ± 1.90 . Most of the women had regular menstrual cycle 98(76.56%). Most of them had 80 (62.5%) scanty menstrual flow, 110 (85.94%) were grand multipara & delivered normally 98(76.56%). Large number of women were having more than two children 99(77.34%) and attained menopause within 2-3 years 85(66.41%). (Refer Table 2)

5.2. Menopause symptoms among Bahraini women

Based on the prevalence of menopause related symptoms, the study results revealed that in the vasomotor domain, sweating was the predominant symptom 88 (68.75%) experienced by most of the women. The most reported symptom in the psychosocial domain was accomplishing the task that was reduced compare to the previous work output 64 (50%) and being impatient with other people 51(39.84%), feeling anxious & feeling wanting to be alone 45(35.16%) & (45.16%) respectively and experiencing poor memory 44(34.38%). In the physical domain most of the women reported feeling tired (or) worn out 85(66.41%), aching in muscles and joints 84(65.63%), flatulence or gas pain 76(59.38%), involuntary urination 73(57.03%) decreases in stamina 63(49.22%), decrease in physical strength and aches in back or neck or head scored the same number and percentage as 62(48.44%). And the woman scored least score in the physical domain was changes in the skin texture or tone 21(16.41%). Almost the scores were similar on feeling bloated 33(25.78%) low back ache 32(25.00%) and frequent urination 32(25.00%). Importantly the sexual domain affected their menopausal life seriously in terms of changes in sexual desire 67(53.34%), vaginal dryness 33(25.78%) and avoiding partners intimacy 32(25.00%) (Refer Table3)

5.3. Aggregate number of menopausal symptoms on different domains:

Among 128 Bahraini women we studied, 66(51.6%) women complained of vasomotor disturbances as highest number followed by 57(44.5%) women experienced physical

TABLE 1: Frequency and percentage distribution of Socio-demographic and Obstetrics & Gynecological variables of the Bahraini women.

Demographic variables		No. of women (n=128)	%
Age in years	45-47	77	60.16%
	48-50	22	17.19%
	51-53	12	9.38%
	54-55	17	13.28%
Education	No formal education	19	14.84%
	Primary	26	20.31%
	Middle	19	14.84%
	High school	45	35.16%
	Intermediate	9	7.03%
	Graduate	10	7.81%
	post graduate	0	0.00%
Family Income	Below average	7	5.47%
	Average	74	57.81%
	Above Average	47	36.72%
Marital status	Married	108	84.38%
	Separated	3	2.34%
	Widow	12	9.38%
	Divorced	5	3.91%
Family type	Joint family	78	60.94%
	Nuclear family	44	34.38%
	Extended family	6	4.69%
Support available for women	Self-help group	19	14.84%
	Friends	27	21.09%
	Relatives	78	60.94%
	Others	4	3.13%
Diet	Vegetarian	8	6.25%
	Non vegetarian	120	93.75%
Occupation	Housewife	102	79.69%
	Working	21	16.41%
	Retired	5	3.91%

changes and 57(44.5%) in others changes such as palpitation, headache & dizziness. And 45(35.2%) women suffered with psychosocial changes, 33(25.8%) reported alteration in their sexual behavior (Refer Figure 1).

TABLE 2: Frequency and percentage distribution of Obstetrics & Gynecological variables of the Bahraini women.

OBGYN variables	Categories	No. of women (n=128)	%
Age of menarche	<11 yrs	2	1.56%
	11-13 yrs	56	43.75%
	14-16 yrs	64	50.00%
	>16 yrs	6	4.69%
Frequency of menstruation	Regular	98	76.56%
	Irregular	30	23.44%
Type of menstrual flow	Normal	21	16.41%
	Scanty	80	62.50%
	Heavy flow	27	21.09%
Parity	Nullipara	5	3.91%
	Primipara	13	10.16%
	Multipara	110	85.94%
	Grand multipara	0	0.00%
Mode of delivery	Normal	98	76.56%
	Assisted	4	3.13%
	Caesarean	17	13.28%
	Combined	9	7.03%
living children	One	10	7.82%
	Two	16	12.50%
	>Two	99	77.34%
	None	3	2.34%
Duration of attainment menopause in years.	1-2	0	0.00%
	>2-3	85	66.41%
	>3-4	27	21.09%
	>4-5	16	12.50%

5.4. Overall prevalence of menopausal symptoms

In nut shell, 40.6% of Bahraini women were experiencing the menopausal symptoms in the 95% confidence interval ranging from 32.1%-49.1%.(Refer table 4)

5.5. Menopause related Quality of Life

The present study showed that the menopause specific quality of life on symptoms of vasomotor, psychosocial, physical and sexual domains. The overall scores of menopausal quality of life for each domain are indicated that the highest mean score

TABLE 3: Frequency and percentage distribution of menopausal symptoms on four domains.

Domains	Symptoms	Responses (n=128)	
		No.	%
Vaso-motor	Hot flashes	46	35.94%
	Night sweats	63	49.22%
	Sweating	88	68.75%
Psycho-social	Being dissatisfied with my personal life	27	21.09%
	Feeling anxious	45	35.16%
	Experiencing poor memory	44	34.38%
	Accomplishing less than I used to	64	50.00%
	Feeling depressed down or blue	40	31.25%
	Being impatient with other people	51	39.84%
	Feeling wanting to be alone	45	35.16%
	Physical	Flatulence or gas pain	76
Aching in muscles and joints		84	65.63%
Feeling tired or worn out		85	66.41%
Difficulty sleeping		56	43.75%
Aches in back or neck or head		62	48.44%
Decrease in physical strength		62	48.44%
Decrease in stamina		63	49.22%
Feeling lack of energy		27	21.09%
Dry skin		51	39.84%
Weight gain		56	43.75%
Increased facial hair		37	28.91%
Changes in skin texture or tone		21	16.41%
Feeling bloated		33	25.78%
Low back ache		32	25.00%
Frequent urination		32	25.00%
Involuntary urination		73	57.03%
Sexual		Changes in sexual desire	67
	Vaginal dryness	33	25.78%
	Avoiding intimacy	32	25.00%
Others	Palpitation	32	25.00%
	Headache	73	57.03%
	Dizziness	67	52.34%

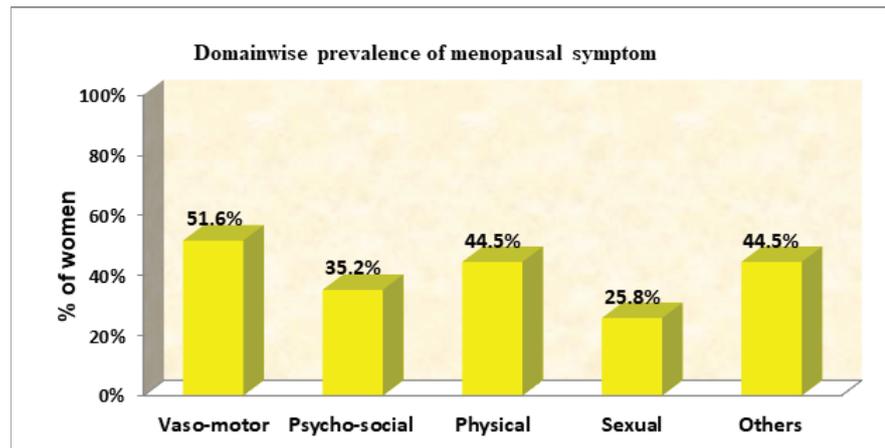


Figure 1: Domain wise prevalence of menopausal symptoms.

TABLE 4: Overall prevalence of menopausal symptoms.

	Average number of women with symptoms	% of women with symptoms	95% confidence interval for symptom score
Overall Scores	52	40.6%	32.1% -49.1%

in Vaso-motor domain (0.51 ± 0.28), followed by sexual domain (0.25 ± 0.33). (Refer table 5)

TABLE 5: Mean and standard deviation of Menqol Items and domain distribution(N=128).

Domain	Mean Scores	SD
Vaso-motor	0.51	0.28
Psycho-social	0.35	0.24
Physical	0.44	0.21
Sexual	0.25	0.33
Others	0.45	0.31
Overall	11.17	4.41

5.6. Menopause awareness

The analysis of level of menopause awareness revealed that there was a moderate level of awareness on menopause but there is less percentage on high level of scores as 10.2%. (Figure 2)

In relation to the awareness of menopause, majority of the women were understood that menopause is a natural and unavoidable truth of life (96%), menopause means end of your monthly period (menses) (82%), at menopause ovaries begin to fail and the production of estrogen falls, Menopause generally occurs at the age of late

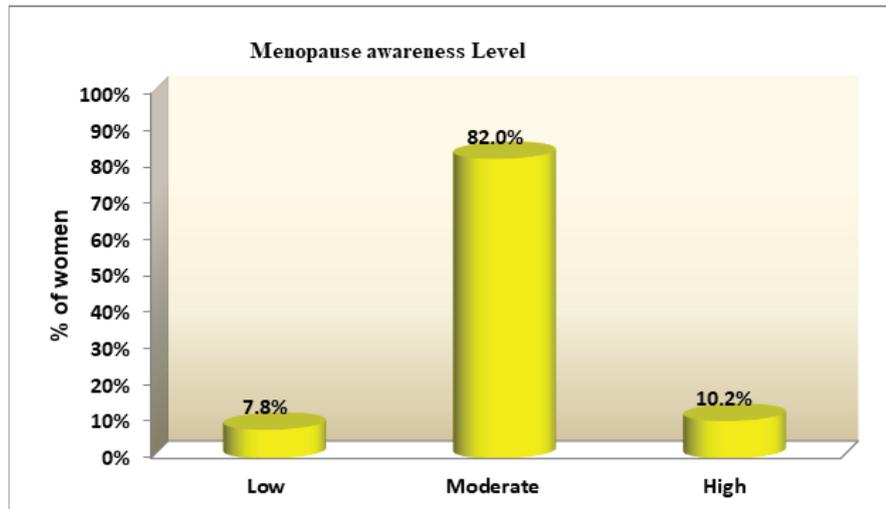


Figure 2: Percentage of distribution of menopause awareness level (n=128).

40s or early 50s (76.5%), Menopause can occur early or late due to various reasons (78.0%). Interestingly most of the women were aware of Menopause causes hormonal changes (80.5%).

5.7. Correlation between menopause awareness and symptoms

There was a significant, positive, moderate correlation between menopause specific quality of life and menopause awareness scores (Table 6)

TABLE 6: Correlation between Menopause awareness and symptom score among Bahraini women.

Correlation	Mean score Vs \pm SD	Karl Pearson correlation coefficient & P-value
Menopause awareness score Vs Symptom score	M45.32 \pm 6.96 Vs 211.17 \pm 4.41	R r=0.55 P<0.001

5.8. Association of awareness with socio demographic and OBGYN variables

There was significant association found on awareness and age(p=0.01), family income (p=0.03) marital status (p=0.02), frequency of menstruation (p=0.02, type of menstrual flow (p=0.02) and type of delivery (p=0.01). There was no significant association with other variables such as education, family type, support, diet, occupation, age at menarche, parity, living children and duration of menopause.

6. Discussion of Findings and Conclusion

Menopause is a critical transition period in the life of women which affects quality of life (Chedraui P et.al, 2009). It affects all the spheres of life in a women and its associated with physical changes, psychological changes, vasomotor changes and altered sexual activity. We recruited 128 Bahraini women aged between 45 to 55 years with menopausal symptoms. Our study results revealed that women entering into the menopausal life were undergoing lot of changes especially muscle and joint pain, feeling tired or worn out, sweating, reduced work output, flatulence or gas pain, decreased stamina, irritability, sleep problems, weight gain, head ache & dizziness there by it affects their quality of life. These study results are consistent with other international studies and reported the same symptoms as sweating and depression, dry skin and changes in sexual desire or worse sexual function related to menopause specific symptoms in diverse population among Latin Americans, Chinese and Spanish women (Chedraui P. et.al.,2007; Chou M F, et.al., 2014; Blumei J E.et.al., 2011; Pérez-López F R.et.al., 2012; Olaolorun FM.et.al., 2009;). A recent study conducted among Saudi women on reported menopausal symptoms revealed that joint and muscle pain (80.7%), physical and mental exhaustion (64.7%), and hot flushes and sweating (47.1%). Moreover, (Zain A. Al-Safi, MD, 2015) stated that the Weight was the most reported symptom among midlife women.

Somatic and psychological symptoms were highly prevalent in perimenopausal women which affect their quality of life (Aida Al Dughaiter.et.al., 2015). These findings are very relevant to our study findings may be due to the same geographical location as Bahrain and Saudi are neighboring countries. The characteristics of population and climatic condition also play a key factor in exhibiting the symptoms related to menopause reported by Sievert L.et.al., (2005).

In regard to menopause specific quality of life, our study revealed vasomotor domain gained the highest score (Mean=0.51,SD=0.28), physical & other symptoms scored equal(Mean =0.44, SD =.21) & (Mean=0.45, SD=0.31), psychological domain scored fairly (Mean =0.35, SD=0.24) and finally the sexual domain scored less (Mean =0.25, SD=0.33). These findings are in line with other study findings done by Aida Al Dughaiter.et.al., (2015) reported that physical and vasomotor domains were the most prevalent symptoms among Muslim population. Further, the study results are supported by William R. et.al.,(2009), Waidysakera H.et.al.,(2009) & Hoda A.et.al., (2014) stated as the presence of menopausal symptoms significantly reduces quality

of life and further worsened with more severity of condition. According to Nanette Santoro et.al, (2016)) stated that Vasomotor symptoms badly affects the women during menopausal transition, but their severity, frequency, and duration differ between women. In contrast a study done by Chedraui P. et.al., (2010) found that psychological menopausal symptoms were the most frequent symptoms experienced by the perimenopausal women associated with parity.

In relation to menopause awareness, Bahraini population was having good percentage on moderate level of awareness, less percentage on low and high level of awareness. Our study results were supported by Fatemeh Bakouei (2013) reported 48.6% of women had good, 24.1% of them had average, and 27.3% of them had low awareness among Iranian women. The correlation between menopausal symptoms and awareness had moderate level of correlation.

6.1. Implications for practice

Our study results recommend that menopausal transition is an unavoidable condition yet manageable with proper support and education. Educational programs can be organized to create an awareness among women who are in need of knowledge to overcome the menopausal symptoms. Mass media also can serve as an important tool to reach the women and this was proved by Fatemeh Bakouei (2013) on the impact of mass media (television, radio, journals, newspaper, medical doctors, and medical team) among menopausal women to create an awareness, to manage the condition and thereby increasing their quality of life. Nurses and other healthcare team members can utilize each and every opportunity to counsel the menopausal woman to cope up with the condition to achieve high-level functioning.

6.2. Conclusion

Menopausal awareness program need to be initiated at the community level to create an awareness on menopause, better health and quality of life. Thereby reducing future complications related to menopausal symptoms.

References

[1] Aida Al Dughaiter, Hind Al Mutairy, Mohammed Al Ateeq. (2015) Menopausal

- symptoms and quality of life among Saudi women visiting primary care clinics in Riyadh, Saudi Arabia. *International Journal of Women's Health*, Vol. 7, 645-53. <https://doi.org/10.2147/IJWH.S84709>.
- [2] Blümel J.E., Chedraui P, Baron G, Belzares E, Bencosme A, et.al.,(2011) Collaborative Group for Research of the Climacteric in Latin America (REDLINC). A large multinational study of vasomotor symptom prevalence, duration, and impact on quality of life in middle-aged women., 18(7):778-85. doi: 10.1097/gme.obo13e318207851d.
- [3] Chedraui P, San Miguel G, Avila C.(2009) Quality of life impairment during female menopausal transition is related to personal and partner factors. *Gynecol Endocrinol*, 25(2):130-135
- [4] Chedraui P1, Hidalgo L, Chavez D, Morocho N, Alvarado M.(2007) Menopausal symptoms and associated risk factors among postmenopausal women screened for the metabolic syndrome, 275(3):161-8.
- [5] Chedraui P, Pérez-López FR, Mendoza M, Morales B, Martinez MA et.al.,(2010) Severe menopausal symptoms in middle-aged women are associated to female and male factors, 281(5):879-85. doi: 10.1007/s00404-009-1204-z.
- [6] Chou M.F., Wun Y.T., Pang S.M.,(2014) Menopausal symptoms and the menopausal rating scale among midlife Chinese women in Macau, China. *Women Health*, 54(2):115-26. doi: 10.1080/03630242.2013.871767.
- [7] Fatemeh Bakouei, Zahra Basirat, Hajar Salmalian, Shabnam Sareh Bakouei (2013).Assessment of women's awareness level about symptoms and complications of menopause and methods to their prevention. *Journal of local, global Health Science*,:6. <http://dx.doi.org/10.5339/jlghs.2013.6>
- [8] Hassan M. A I-Musa. et al. (2017) The prevalence of symptoms experienced during menopause, influence of socio-demographic variables on symptoms and quality of life among women at Abha, Saudi Arabia, *Research Article - Biomedical Research*, 28, Issue 6.
- [9] Hilditch JR, Lewis J, Peter A, Maris B, Ross A. et.al.,(1996). A Menopause-specific Quality of life questionnaire: development and psychometric properties. *Maturitas*,24: 161-75.
- [10] Hoda A. E. Mohamed, Sahar M, Lamadah, Luma Gh. Al. Zamil. (2014) Quality of Life among of Menopausal Women in Saudi Arabia. *Int J Reprod Contracept Obstet Gynecol*, 3(3):552-561 www.ijrcog.org
- [11] Karmakar N, Majumdar S, Dasgupta A, Das S. (2017) Quality of life among menopausal women: A community-based study in a rural area of West Bengal. *J*

- Midlife Health. 8(1):21-27. doi: 10.4103/jmh.JMH_78_16.
- [12] Nanette Santoro, C. Neill Epperson, Sarah B. Mathews.(2016) Menopausal Symptoms and Their Management. *Endocrinol Metab Clin North Am.*, 44(3): 497-515. doi: 10.1016/j.ecl.2015.05.001
- [13] Olaolorun F.M, Lawoyin T.O.(2009) Experience of menopausal symptoms by women in an urban community in Ibadan, Nigeria. *Menopause*, 16(4):822-30. doi: 10.1097/gme.obo13e318198d6e7.
- [14] Pérez-López FR1, Fernández-Alonso AM, Trabalón-Pastor M, Vara C, Chedraui P. (2012).MenopAuse Risk Assessment (MARIA) Research GroupAssessment of sexual function and related factors in mid-aged sexually active Spanish women with the six-item Female Sex Function Index. *Menopause*. 19(11):1224-30. doi:10.1097/gme.obo13e3182546242.
- [15] Reda R. Ali, Sayed. A Mohamed Taha, Manal F. MoustafaSahar F.El saied (2015) Assessment the Menopausal Symptoms of Women by Using the Menopausal Rating Scale In Qena City *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 4(2): 79-88.
- [16] Sievert L.L, Flanagan E.K.(2005) Geographical distribution of hot flash frequencies: considering climatic influences. *Am J Phys Anthropol*.128(2):437-443. [PubMed]
- [17] Solues M.R, Sherman S, Parrott E, Rebar R, Santoro N.(2001) Executive summary, stages of reproductive aging workshop (STRAW). *Fertil Steril*. 8:874-878.
- [18] Sudeshna Ray. (2012) An assessment of QOL and its determining factors of post menopausal women in a rural area of West Bengal, India: A multivariate analysis. *International Journal of Medicine and Public Health*. 2 (4).
- [19] Varuna Pathak, Neetu Ahirwar, Shruti Ghate. (2017) Study to assess knowledge, attitude and practice regarding menopause among menopausal women attending outdoor in tertiary care centre. *Int J Reprod Contracept Obstet Gynecol*, 6(5):1848-1853 www.ijrcog.org.
- [20] William R, Levine K, Kalini L, Lewis J, Clark R. Res. 200;9 *Menopause –Specific Questionnaire assessment in US population-based study shows negative impact on Health related Quality of life.Maturitas*, 62(2):153-159.
- [21] Waidysakera H, Wijewardena K, Linmark G, Naessen T. (2009) Menopausal symptoms and Quality of Life during the menopausal transition in Sri Lankan women. *Menopause*, 16(1): 164-170.

- [22] World Health Organization. Research on Menopause in the 1990s: Report of WHO Scientific Group. WHO Technical Report Series 866. Geneva: World Health Organization; 1996.
- [23] Zain A. Al-Safi, Nanette Santoro. (2014). Menopausal hormone therapy and menopausal symptoms. *Fertility and Sterility*[®], 101(4), Copyright ©2014 American Society for Reproductive Medicine, <http://dx.doi.org/10.1016/j.fertnstert.2014.02.032>.

Conference Paper

Institutional Logics Shaping E-health Projects: A Case Study of the EMR System in Dubai

Noora Alghatam

Abstract

This is a research-in-progress article that aims to explore the extent emergent formats for public health sector as new projects for EMR systems are launched and negotiated locally. The article adopts institutional theory and the concept of institutional logics to explore ICTs projects in Dubai's public health organizations. To set the scene for this study, the article traces temporal developments and trends of health ICT projects, through an institutional analysis of associated discourses, over the course of almost a decade.

The article identifies three institutional influences during consecutive periods of time that shaped how ICT projects are depicted and approached. The aim is to explore how these new formats for health projects are enacted by healthcare workers and their implications for public health organizations.

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1. Introduction

National across the world are actively engaged in the development of health information systems and particularly electronic health records (EHR), which are considered a means to modernize and resolve inefficiencies in the health sector domain. These large-scale and integrated systems are relatively new even in the context of countries that were pioneers in the adoption of these technologies such as the US and the UK and their experience of the National Program for IT (NPfIT). Similarly, countries in the Middle East and particularly the GCC nations, which are the focus of this study, are in the early years of implementation for EHR. And it is up to the healthcare professionals to enact these systems and attain these benefits.

With such high hopes on transforming the public healthcare systems, some academics argue that the focus should be directed to perceptions and experiences of the healthcare professionals who are at the heart of these large-scale projects. For instance, explore how healthcare professionals act as institutional agents who can

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either promote and embed new managerial practices or defend aspects of clinical professionalism at work. In Lockett et. al's (2014) study, health care staff are conceptualized as institutional entrepreneurs who are part of the NHS collaboratives (health institutions and universities) and play a role in translating or enacting policies and research (evidence-based studies) into the practice as ICTs are introduced. These actors were found to enact different type of work that is undertaken by these actors that include envisaging change; engaging in change; embedding and reflecting on past decisions to learn from them. These actors were significant in reshaping institutional practices to sustain the translation of evidence- based innovations into clinical practice. In another study, Jensen et. al (2009) present a case study of introducing electronic prescribing into public health institutions in Denmark as part of a government initiative to reform and modernize the health sector. The physicians found that the data entry process was time-consuming. In addition to this, the physicians' authority was challenged by the new system. Thus, they questioned the work responsibilities at times and refused to accept the logic inscribed in the system. The physicians created workarounds since elements of the system did not make sense.

In what ways are institutions shaping public e-health projects in the GCC?

2. Institutional Theory

Institutional theory focuses on the role of institutions, which according to Scott (2001) represent durable structures that influence actions of people in organizations and society.

Institutional ideas arrive into various contexts through institutional carriers (Avgerou 2002), which may take the form of human actors or even technological artifacts. Thornton and Ocasio (1999) define institutional logic as socially constructed patterns of practices and values and rules, which are reproduced by agents. The concept is used to emphasize the multiplicity of logics at the same time organizations (Greenwood et. al 2010).

The concept of institutional logics is often employed to show contradictory elements of institutions that can at times be aligned or conflict. The paper examines the Amazon monitoring system for around 4 decades using primary and secondary data to show the different dominating institutional logics over periods of time and how this is reflected in the design of the systems.

The concept has been employed in various studies of health information systems such as the implementation of the NHS project (Currie and Spyridonidis 2016), the

conflicts of institutional logics and their resolution in the Nigerian healthcare context (Asangansi 2012); institutional logics and changes to pharmacist's professional work (Goodrick and Reay 2011).

The concept has been employed in studies of GIS system implementation and ICT projects in healthcare. Sahay et. al (2010) employed the concept to explore challenges in setting up a decentralized HMIS system in the context of Tajikistan. The findings suggest that the conflicting institutional logics were irreconcilable and challenged the implementation of such a system in a decentralized and flexible approach.

3. Case study

For more than a decade, the development of an integrated electronic medical record (EMR) system in Dubai's healthcare sector has been a significant objective of the state and the Health Authority. As such, the aim is to go beyond existing legacy systems and associated practices to build a center of excellence in healthcare (<http://www.govhealthit.com>). This has been a central theme in the discourse on administrative reform and modernization of healthcare in the emirate as presented in conferences, policy documents, media coverage and publications.

Following the successful implementation of e-government systems in Dubai for nearly a decade, there has been an interest in improving e-services in the health sector. In 2005, there have been early efforts to transform the existing systems and set up databases for all paper medical records and to train staff to use them (Khaleej Times, AMEinfo 2005). This coincided with the establishment of the Dubai Health Authority (DHA) in 2006, which took over the role of the Ministry of Health. In the following year, the health sector also officially launched HIRAS (healthcare information reporting and analysis system), which collects medical information and codes it based on international standards. HIRAS was locally developed and used in Dubai's healthcare city, which includes many of the state's private healthcare institutions. All these efforts led to an important milestone of the public healthcare project in January 2008, where the clinical information systems were upgraded to EMR systems.

A number of significant developments occurred in 2012 and 2013. One important milestone was conducting an evaluative study of electronic medical records in 2012, by using the electronic medical record adoption model (EMRAM) survey. This was one of the first surveys of its kind in the Middle East region. The findings suggest that 70% of health information systems are still in the early stages and need some time to reach the stage of robust clinical intelligence and clinical information exchange. In

2013 a taskforce was established which consisted of members from public and private healthcare institutions to oversee plans and policies, and their role is expected to become bigger and more significant as the initiative progresses over time. One of the significant developments includes the set up of the Smart Healthcare Model, which was unveiled in October 2013.

4. Methodology

The methodology for this research-in-progress paper is based on a combination of coding methods and discourse analysis to explore various policy documents, newspaper articles and WebPages that include objectives presented in ministry of health websites in Dubai.

The first stage of the analysis included examining online newspaper articles and journal papers to build a narrative on how the EMR systems were set up and developed for the period of 2004-2016. This narrative was later classified into three main periods: health ICT prior to we-based services, health ICT in parallel to e-government, health ICT during economic restructuring.

The second stage of analysis drew on some ideas from grounded theory and discourse analysis. The process involved creating two tables to analyze the main statements from policy documents and official health IT webpage from Dubai's health authority. For Dubai this included the UAE's 2021 vision, Dubai ERM model, current health mission and vision, and standardization documents. The statements were selected based on three categorizations: managerial/technical, economic and professional/scientific, institutional logics.

The coding process became more detailed for each of the theoretical categories. The managerial logic included ideas such as: internal collaboration, integration, standardization, convenience and efficiency. The economic logic included ideas such as: cost saving, private sector collaboration. The professional scientific logic included concepts such as evidence-based medicine and healthcare professional values and needs. As analysis progressed, the process of coding an additional category emerged which is context-specific issues for healthcare in each case and cultural aspects. This was especially relevant to challenges in implementation of e-health systems.

The third stage involved a series of narrative construction. First, one was developed based on the three time periods related to ICT use. Second a narrative was constructed between based on the three institutional logics: scientific, managerial and economic-

restructuring logics. Finally, a narrative was constructed which identifies alignment and conflict between institutional logics was constructed.

The research will also include a pilot study and interviews with a number of managers in the department of health and healthcare professionals in hospitals. The aim is to explore what elements of the various ideas are enacted in their daily activities and how this contributes to the formation of a socio-technical assemblage for EMR systems in the public health sector.

5. Analysis

5.1. The web-based technologies period and the managerial logic

A decade of e-government projects in the UAE that were underpinned by notions of new public management and particularly customer-orientation. The speed in developments and internationally acclaimed outcomes shaped some initiatives in healthcare and the expectations of the public. The managerial logic consisted of two strands. First, the standardization of ICT development through the formalization of institutional structures such as section Dubai's health authority for e-health and Dubai's e-government central organization in the early 2000s. Second, the logic involved a change in conceptualizing ICTs, which moved from being tools for internal administration to citizen facing systems that supported service delivery and access to information. This was evident in 2004 as e-health services were promoted. Third, the managerial logic also consisted of a drive for innovation in healthcare as smart applications were introduced to assist patients in obtaining services and information. These systems, which included smart beds for patients, collected data that supported the decisions of healthcare staff. Such innovations generated large amounts of data and are currently considered a means of big data analytics. The arrival of the managerial logic came to support existing scientific logics for EMR development, which continued to dominate practices and expected outcomes from ICT use.

5.2. EMR developments and the economic-restructuring logic

Discourses on healthcare in the GCC were increasingly focusing on the economic sustainability of the existing healthcare model and exploring new options for the future.

This introduced a hybrid economic and restructuring logic in public healthcare. This hybrid logic consisted of three elements. First, ICTs were enablers of public sector

policies such as the national healthcare insurance initiative that required data to be shared between public healthcare organizations and insurance companies. Second, the new systems were to be employed to support significant organizational restructuring as public and private collaboration initiatives for healthcare insurance were taking place. Third, the ICTs were supporting a new vision for healthcare which shifted from an organizational focus to the notion of a wider health ecosystem. This networked view of healthcare was aligned with the notion of smart cities and smart living as noted in the Dubai 2021 national agenda. The changes in the healthcare sector was also accompanied by a resurfacing of EBM ideas and the use of EMR systems. For instance, there was the set up of the EMR committee in 2015. Thus, the regulative measures came to support the institutionalization of the EMR systems and the scientific logic more than replace them with economic-restructuring logics.

6. Discussion and Conclusion

6.1. The EMR system as both an institutional carrier and institutional enactment

Studies of ICTs in the public sector often emphasize that institutional logics are multiple and vary across time depending on the social context. The changing institutional logics illustrated in this study supports Rajao and Hayes's (2011) work on how different logics exist and shape the way GIS systems are introduced and used. One of the contributions of this study is the argument that the EMR system are not only responding to shifts in institutional dynamics but also acts a carrier of institutional logics over time. As noted earlier the EMR system carried with it managerial, scientific and economic institutional logics during the period from the 1998 to 2016.

Studies of ICTs as institutional carriers often focus on the transmission of new ideas and values in a particular context as a single event. In contrast, I argue that institutional carrier can be conceptualized from a processual view as an artefact which can have different ideas and values inscribed over time. This is illustrated in the longitudinal study of healthcare in Dubai as the same EMR system came to be a carrier multiple times with numerous logics.

The introduction of institutional logics was enabled by the enhancement in functions and features of the EMR system which was inscribed with scientific and collaborative values and practices. As noted in Dunleavy et. al's (2006) work, ICTs in public sector organizations, and within the sector of public health, reflect the concept of digital

era governance as they are moving towards centralization after decades of NPM and decentralization. This trend is evident in our study as the EMR system which shifted from databases in individual healthcare institutions towards standardization of practices and terms that formed the foundation for citizen-facing services that are part of the e-health and e-government period. Later, the EMR systems were introduced to support a wider network approach that integrates the public and private sector to enact the national health insurance laws. The case illustrates that the dual role of the EMR system as both a carrier of multiple institutional logics and a technology enactment (Fountain 2001) in itself. For instance, events and policies related to Dubai's e-health and e-government initiatives and economic changes all contributed in legitimizing the adoption and use of the EMR systems.

6.2. The EMR system's enactment and future use

Institutional studies of IS in healthcare often focus on how institutions overlap and are negotiated by various actors involved. This theme is illustrated in Miscione's (2007) study of tele-health in the Upper Amazon region as the ICTs were shaped by an institutional alliances between scientific and sociocultural institutions. Our study supports work on institutional alliances as the EMR was introduced and legitimized by the alliance between e-government and medical professionalism that promotes the use of EMR systems to serve e-health initiatives for patient empowerment and convenience. Later, the institutional alliance between managerial institution and medical professionalism shifted the use of ICTs for organizational purposes towards a networked ecosystems for healthcare to integrate public and private sector healthcare institutions. This is particularly the case as healthcare systems in general are extended with smart applications such as the "Sehaty" program, and the potential to employ big data analytics to support decisions across public and private sectors.

Studies of IS in healthcare often discuss the persistence of professional and scientific institutions. This has been evident in this study as the scientific institutional logic was present throughout the three main periods for ICT use. The question that is raised here is related to prospective use of the EMR system and the extent in which it is shaped by the scientific institutional logic or if other logics will dominate the enactments of healthcare professionals. This supports Faraj and Azad (2009) argument that e-government projects consist of multiple enactments by different actors which may shift towards one groups' values over the others. The regulative aspects of healthcare supports a move towards being customer-oriented in service delivery and moving

towards an ecosystem view and approach to ICT use in health. However, prospective use by healthcare professionals will determine the organizational and institutional outcomes of the EMR systems. As noted in studies of e-government and public value (Cordella and Bonina 2010), it is the middle managers or in this case the healthcare staff who interact with people and enact ICT policies that negotiate an overarching public value for systems. One area for future research is to explore the dynamics between the scientific, professional and socio-cultural institutions that are played out by healthcare professionals' practices as they incorporate EMR systems in daily activities.

References

- [1] Asangansi I, Braa K. The emergence of mobile-supported national health information systems in developing countries. *Studies in Health Technology and Informatics Journal*. 2010;160(1):540.
- [2] Avgerou, C. (2002). The Institutional Nature of I.C.T. and Organizational Change. In *Information Systems and Global Diversity C.* (Avgerou, C. Ed.), p. 23, Oxford University Press. New York.
- [3] Azad, B. & Faraj, S., 2009. E-Government institutionalizing practices of a land registration mapping system. *Government Information Quarterly*, 26(1), pp.5-14.
- [4] Cordella, A., & Bonina, C. M. (2012). A public value perspective for ICT enabled public sector reforms: A theoretical reflection. *Government Information Quarterly*, 29(4), 512-520. *Journal of Public Administration Research and Theory*, 16(3), pp.467- 494.
- [5] Currie, G., & Spyridonidis, D. (2016). Interpretation of multiple institutional logics on the ground: Actors' position, their agency and situational constraints in professionalised contexts. *Organization Studies*, 37, 77-98.
- [6] Fountain, J., 2001. *Building the Virtual State: Information Technology and Institutional Change*, Washington, DC: Brookings Institution Press.
- [7] Goodrick, E. and T. Reay. 2011. 'Constellations of Institutional Logics: Changes in the Professional Work of Pharmacists', *Work and Occupations*, 38, 3, 372-416.
- [8] Greenwood, R., Diaz, A. M., Li, S. X., & Lorente, J. C. 2010. The multiplicity of institutional logics and the heterogeneity of organizational responses. *Organization Science*, 21: 521-539.
- [9] Jensen, T.B., Kj\aaergaard, A. & Svejvig, P., 2009. Using institutional theory with sensemaking theory: a case study of information system implementation in healthcare. *Journal of Information Technology*, 24(4), pp.343-353.

- [10] Lockett A, El Enany N, Currie G, et al. A formative evaluation of Collaboration for Leadership in Applied Health Research and Care (CLAHRC): institutional entrepreneurship for service innovation. *Health Serv Deliv Res* 2014; 2: 31.
- [11] McGivern, G., G. Currie, E. Ferlie, L. Fitzgerald, and J. Waring 2015. "Hybrid manager-professionals" identity work, the maintenance and hybridization of professionalism in managerial contexts', *Public Administration*
- [12] Miscione, G., 2007. Telemedicine in the Upper Amazon: Interplay with local health care practices. *MIS quarterly*, 31(2), pp.403-425.
- [13] Rajão, R., and N. Hayes. 2009. Conceptions of control and IT artefacts: an institutional account of the Amazon rainforest monitoring system. *Journal of Information Technology* 24:320-331.
- [14] Sahay, S., Sæbø, J.I., Mekonnen, S.M. and Gizaw, A.A. (2010), "Interplay of institutional logics and implications for deinstitutionalization: Case study of HMIS implementation in Tajikistan", *Information Technologies & International Development*, Vol. 6 No. 3, pp. 19-32.
- [15] Scott, W.R., 2001. *Institutions and Organizations*, Sage Publications.
- [16] Thornton, P. H., & Ocasio, W. 1999. Institutional logics and the historical contingency of power in organizations: Executive succession in the higher education publishing industry, 1958-1990. *American Journal of Sociology*, 105: 801-843.

Conference Paper

Perceptions and Attitudes Towards HIV/AIDS Patients among General Public in Bahrain

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Abstract

Introduction: HIV/AIDS is a major global health problem. In Bahrain, although the prevalence of HIV is low, awareness programs are of high importance for controlling and preventing the distribution of HIV infection. The aim of this study is to determine the attitudes and risk perceptions toward HIV/AIDS in Bahrain. Results of this study will provide background knowledge to inform existing and new educational and preventive programs.

Methodology: A self-administered questionnaire-based survey was conducted among 1038 Bahraini adults.

Results: The study showed varied attitudes toward HIV/AIDS, but mostly were negative, as 60% of participants agreed to isolate HIV/AIDS patients in workplaces and schools, and 52.4% of them believed that HIV is a divine punishment. A high proportion of respondents (84.4%) believed that religion plays an important role in minimizing the spread of the disease.

Conclusions: The Bahraini public negative attitudes toward HIV/AIDS was a major finding of this study. Successful control programs of HIV infection require limiting the negative attitudes toward HIV patients and the disease. Those negative attitudes found in this study need to be addressed through new and the currently existing education and health awareness programs in Bahrain.

Keywords: HIV/AIDS, Public Attitudes, Stigmatization, Bahrain

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1. Introduction

One of the most serious health problems around the world is the infection with Human Immunodeficiency Virus (HIV) which causes Acquired Immunodeficiency Syndrome (AIDS), the fourth leading cause of death worldwide [1–3]. Millions of new cases are

emerging since it was first discovered in 1980s, and many efforts are being done to lower the risk of infection and mortality rates, through development of antiviral drugs and modern genetic technologies to eliminate the virus from infected bodies [4].

Once HIV infects the human body, it attacks the CD4 cells, damaging the immune system and developing a combination of serious diseases, collectively form AIDS, including several opportunistic infections and cancers, such as pneumonia, lymphoma, Kaposi's sarcoma, and AIDS dementia [1]. The main modes of HIV transmission are still the sexual and drug-related methods among the recent infections. In many developing countries, vertical HIV transmission from mother to child is noticeably reduced with the use of antiretroviral therapy [5]. Health care associated transmission of HIV, including blood transfusion, accidental health care procedures by health workers, and unsafe injections, is another mode of the virus transmission, mainly because of the inadequate awareness about the safe practices that prevent the virus distribution, specifically in the developing countries in the first decades of the epidemic, where the injection equipment and blood contaminated stuff were commonly and unsafely reused [3].

In the regions of Middle East and North Africa, UNAIDS estimations of HIV positive cases reached 500000, with steady increase in number [5]. In kingdom of Bahrain, although there is shortage in data on HIV, the prevalence is considered very low, from less than 0.1% among general population at low risk (blood donors and antenatal care women), to 3.3-4.6% among population groups at high risk (drug users), with increase in cases from heterosexual transmission, indicating the spread of the epidemic among the community [6].

One of the key instrumental methods to control the spread of the disease is the education and awareness programs regarding HIV/AIDS [7, 8]. They are important to lower the excessive concerns and fear from the disease specifically in low prevalence regions such as Bahrain [9, 10]. Successful efforts of disease control requires understanding the distribution of the different health behaviors among the population, and measuring the knowledge and attitudes of the public in regards to HIV infection and patients [11-15]. Therefore, the aim of this study is to determine the practices and preventive behaviors, their risk perceptions and attitudes towards HIV/AIDS, in association with socio-demographic factors. The study findings would help in providing information for the awareness programs carried out for controlling HIV/AIDS.

2. Methodology

2.1. Study design, population and data collection

A cross sectional survey was held in the period from September 2014 to December 2014 in the Kingdom of Bahrain. Based on a literature review, a self-administered 50-items questionnaire was prepared by authors. The study population was Bahraini adults aged 18 or older, with no foreign population included in the study. A pilot survey was run on a 50 participant's sample. Some questions were rephrased and modified according to the pilot survey results. Cronbach alpha coefficient was used for computing the questionnaire internal consistency. Results ranged from 0.72 to 0.83 with an average of 0.78.

The questionnaire involved the participants' general socio-demographic characteristics and questions about perceptions and concerns towards HIV/AIDS, and perceptions of the Bahraini Government agencies and organizations efforts regarding HIV/AIDS. A five point Likert scale was used to indicate the answers of the participants (1= I do not know, 2= strongly disagree, 3= disagree, 4= agree and 5= strongly agree).

Both English and Arabic versions of the questionnaire were used for a total of 1630 participants. This sample size (1630 participants) was calculated according to the 2010 Bahrain's census data [16] with 95% confidence level and $\pm 3\%$ sampling error, considering the total Bahraini population size is 568,399. To ensure the demographical representation of the respondents to the general population, a systematic proportional quota sampling was applied, with quotas based on age, sex, and education level. The distribution of the hard copy of the questionnaire was done in public places in different regions of Kingdom of Bahrain, as well as a soft copy, which was sent by emails. The instructions of filling the questionnaire and the purpose of the study was clarified for the participants, in addition, they were advised not to ask for external help in order to get a more accurate idea about the degree of public awareness.

2.2. Statistical analysis

Data cleaning was performed by excluding the questionnaires done by non-Bahraini respondents and the incomplete questionnaires, those of more than three unanswered statements. Data then were analyzed using SPSS (version 21). Descriptive statistics (N, % and mean \pm Standard Deviation [SD]) were carried out to determine the attitudes and practices of the sample. T-test or ANOVA were used for continuous variables, and

chi square test for categorical variables, to analyze the association of these factors with gender, age, marital status, educational level, and employment status.

2.3. Ethical issues

This study was approved by University of Bahrain, head of Department of Biology and selected ethical committee. It conformed to the provisions of the Declaration of Helsinki in 1995 (and revised in Edinburgh 2000). All respondents signed the approval form before participation.

3. Results

3.1. Response rate

A total of 1286 questionnaires were returned out of the 1630 questionnaires distributed, (response rate = 78.9%), and out of which 1038 were complete (complete response rate = 80.71%).

3.2. The socio-demographic characteristics of the participants

The mean age of the study population was of 31 years, involving 43% males and 57% females. From the participants, 38.3% had a bachelor degree, 37.9% had school certificates, and the post-graduate education had a lower percentage (Table 1). In terms of age, gender, and educational level, there were no statistically significant difference between the study population and Bahrain's recent census data [16].

3.3. Participants' attitudes, opinions, and risk perception about HIV/AIDS

In general, mostly negative attitudes towards HIV/AIDS were expressed by the participants. For example, 77.5% of the participants agreed that they would avoid eating food if it was made by an HIV patient, more than 50% said that they won't shake hands or sit close to the patient. In addition, 82.9% of the participants believed that HIV patients should inform their colleagues about their illness, and 60.1% approved isolating them in schools and workplaces. Furthermore, 52.4% of the participants believed that HIV infection is considered a divine punishment. However, 65.8% of the participants felt

TABLE 1: *The Participants' socio-demographic characteristics.*

Variables		Frequency	Percentage (%)
Gender			
	Male	446	43
	Female	592	57
Age			
	< 20	198	19.1
	21-30	422	40.7
	31-40	238	22.9
	41-50	126	12.1
	>51	54	5.2
Marital status			
	Single	465	44.8
	Married	573	55.2
Educational level			
	School level	393	37.9
	Diploma	176	17
	Bachelors	398	38.3
	Post graduates	71	6.8
Employment status			
	Employed	572	55.1
	Unemployed	182	17.5
	Students	284	27.4

compassionate toward HIV patients, in addition of other feelings reported like hatred, apathy fear, sadness, and cautiousness. In addition, more than 50% agreed that HIV patients deserve a similar support and deserve as other diseases patients. More positive attitudes were expressed by married participants with only school level education than those of higher education levels and singles ($P < 0.05$). No statistically significant differences of attitudes between genders and different age categories were found (Table 2, Figure 1).

TABLE 2: *P-values of participants' attitudes and opinions towards HIV patients and the disease.*

Variables	P value of the participants attitudes towards HIV patients	P value of the participants attitudes towards HIV disease
Gender	0.470	0.000
Age	0.609	0.048
Marital status	0.000	0.005
Educational level	0.012	0.381
Employment status	0.103	0.001

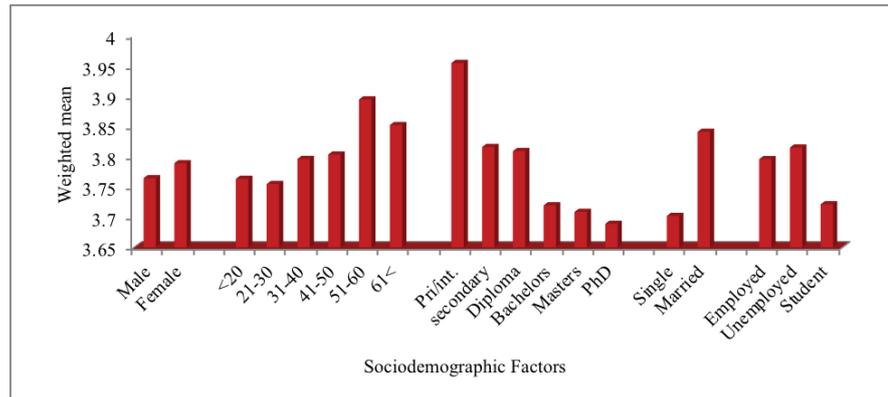


Figure 1: Participants' attitudes and opinions towards HIV/AIDS patients.

Regarding the participants' worries and threat perceptions toward HIV/AIDS epidemic, more than 59.1% of the participants believed that in the next 10 years, the number of HIV cases in Bahrain will have a sharp increase, and about 80.2% of them agreed that AIDS could become a threat to Bahraini society. More than half of the participants (54.5%) appropriately identified that the incidence of HIV in Bahrain is low, and that the drug users cover half of cases. About 77% of the participants informed they were never tested HIV, and 68.6% of them showed no concern from getting HIV. Compared to other groups, married, male and employed participants who are aged above 50 showed a considerably higher concern of contracting HIV/AIDS (Table 2, Figure 2).

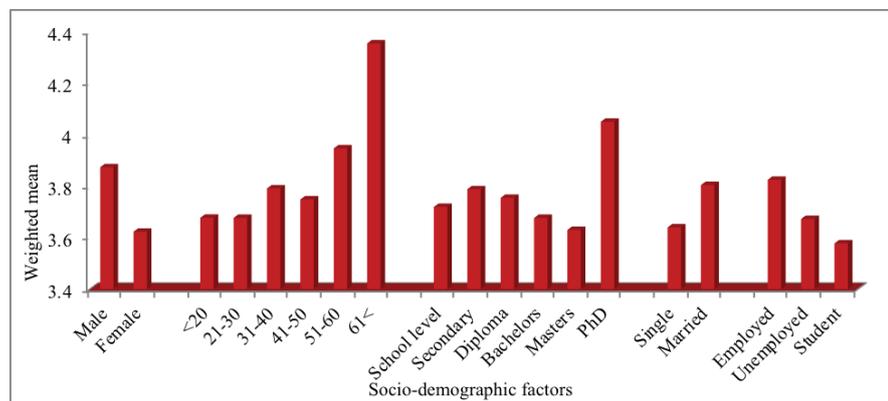


Figure 2: Participants' attitudes and opinions towards HIV disease.

Most of the participants (84.4%) thought that following the Islamic doctrines through avoiding homosexuality, drug abuse and premarital sex will lower the distribution of HIV infection. Of all participants, about 49.9% were distrustful about whether male circumcision would play a role in reduction of HIV transmission. Comparing to other groups in regards to religious beliefs; married, male and employed participants who are aged between 41 and 50 strongly believed in the role of religious beliefs

($P < 0.05$), although in terms of educational level, there was no statistical difference (Table 3).

TABLE 3: *Participants' opinion on religious beliefs about HIV/AIDS.*

Variables		Mean	SD	95% CI	P value
Gender	Male	4.00	0.91	3.91 - 4.08	0.000
	Female	3.79	0.94	3.71 - 3.86	
Age	< 20	3.75	0.98	3.61 - 3.89	0.001
	21-30	3.78	0.95	3.69 - 3.88	
	31-40	3.98	0.87	3.87 - 4.09	
	41-50	4.10	0.87	3.94 - 4.25	
	> 51	4.07	0.92	3.63 - 4.51	
Marital status	Single	3.78	0.96	3.69 - 3.87	0.003
	Married	3.95	0.90	3.88 - 4.03	
Educational level	School level	3.97	0.93	3.80 - 4.13	0.114
	Diploma	3.85	0.96	3.71 - 4.00	
	Bachelors	3.88	0.90	3.80 - 3.97	
	Post graduates	4.02	0.80	3.71 - 4.33	
Employment status	Employed	3.94	0.89	3.87 - 4.01	0.027
	Unemployed	3.86	0.96	3.72 - 4.00	
	Students	3.76	1.00	3.64 - 3.87	

4. Discussion

One of the key measures to control HIV/AIDS epidemic is to provide educational awareness programs to the public, as they advocate maintaining the healthy behaviors in the general public [15, 17, 18]. The present study is the first study in kingdom of Bahrain to determine the attitudes of the general Bahraini public towards HIV/AIDS, which may help in positive contribution to the clarification of the HIV prevention plans and regulation programs in Bahrain.

Negative attitudes towards HIV/AIDS patients were evident among the participants, through avoid shaking hands, sharing meals, or sitting near HIV/AIDS patients, and through thinking that HIV patients should inform their colleagues about their medical condition and believing to isolate them in work areas and schools. Many other studies conducted in several countries showed similar results [10, 19, 20]. Taher and Abdelhai (2011) showed in their study that 75.7% of the respondents marked uncomfortable feeling if they would work with HIV/AIDS patients in the same office [21]. However, another study showed that 52.3% of the respondents agreed that HIV/AIDS patients

deserve having equal rights in study and work as healthy people [22]. Another study also showed that 25% of participants agreed that HIV/AIDS patients have the right to keep their medical condition confidential [23].

Feelings of anger and lack of sympathy leads to generation of the negative attitudes toward HIV/AIDS patients [24]. In our study, the case was opposite. Although negative attitudes were common, many participants reported their feelings towards HIV patients to be compassionate. This suggests that those negative attitudes are due to feeling of fear from getting infected with the disease, which was conspicuous through the other responses, such as a high proportion of the participants strongly agreed to have HIV test among the regular medical checkup, and many agreed that AIDS could be a threat in the future to Bahraini society. In addition, the strong agreement of a high proportion of the respondents that HIV patients should receive a similar support and respect as other diseases patients is another evidence of the compassionate feeling.

Similar to the results of some studies, [14, 24], a big proportion of the participants believed that HIV infection is a divine punishment. In contradictory, studies from USA, Kenya, South Africa and Tanzania didn't show that [25]. Generally, in Islamic countries, the idea that HIV can be a punishment from God is more common, believing that it can be a result of not following the Islamic rules, since the major modes of HIV transmission, such as drug abuse, homosexual behaviors, and sexual relations outside marriage are forbidden in Islam [18, 26]. In addition, a high proportion of the participants thought that following Islamic rules can reduce the spread of HIV infection. A study suggested that the attitudes towards HIV/AIDS are one of the aspects in life that is controlled by culture and religion [18]. Those findings were expected, as Bahrain society is diverse in terms of ethnic, culture, and religion, with Muslim population of about 99.8% of the total population [16].

The negative attitudes towards HIV/AIDS patients, whether it was due to feeling of fear, or religious beliefs, or even due to lack of knowledge; it cause stigmatization against those patients, which forms a difficulty in prevention of the disease [19, 24]. Successful prevention programs need to reduce or eliminate the stigmatization, by introducing legislations to reduce HIV/AIDS discrimination, and development of informative campaigns [27-28].

5. Conclusions

In conclusion, this study gives a general idea of the Bahraini population's attitudes towards HIV/AIDS. The negative attitudes towards HIV/AIDS patients were the major

finding of this study. The public health education and awareness campaign need to be revised by the Bahraini authorities in cooperation with the local media and Ministry of Education. Reducing those negative attitudes by such programs is important to step in the control of HIV/AIDS.

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References

- [1] Fan H, Conner RF, Villarreal LP (2011) AIDS: Science and Society, 6th edition. London: Jones & Bartlett Publishers 240 p.
- [2] Kartikeyan S, Bharmal RN, Tiwari RP, Bisen PS (2007) HIV and AIDS: Basic Elements and Priorities. Netherlands: Springer 418 p.
- [3] Knipe DM, Howley P (2013) Fields Virology. Wolters Kluwer Health/Lippincott Williams & Wilkins. USA.
- [4] Cock KM, Crowley SP, LO Y, Granich RM, Williams BG (2009) Preventing HIV transmission with antiretrovirals. Bulletin of the World Health Organization 87: 488-488
- [5] UNAIDS (2011) Middle East and North Africa Regional Report on AIDS. Available: http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/JC2257_UNAIDS-MENA-report-2011_en.pdf Accessed November 2014.
- [6] UNGASS Country Progress Report (2014) Available: http://www.unaids.org/sites/default/files/country/documents//BHR_narrative_report_2014.pdf Accessed November 2014
- [7] Islam MT, Mostafa G, Bhuiya AU, Hawkes S, Fransisco A. (2002) Knowledge on, and Attitude Toward, HIV/AIDS among Staff of an International Organization in Bangladesh. J Health Popul Nutr 20: 271-278.
- [8] Andsoy II, Gungor T, Sahin AO, Kar G, Ergil P, Inanmaz N (2013) HIV infection and the Turkish people: A cross-sectional study on the perceptions of Safranbolu inhabitants. Acta Medica Mediterranea 29: 603-610.

- [9] Mann JM, Tarantola D, Netter TW (1992) AIDS in the World. USA:Harvard University Press 1037 p
- [10] Khan MA (2002) Knowledge on AIDS among female adolescents in Bangladesh: Evidence from the Bangladesh demographic and health survey data. *J Health Popul Nutr* 20: 130-137.
- [11] Bin Briek AS (2009) Knowledge and attitudes of prisons in Mukalla City, Republic of Yemen towards HIV/AIDS. *Alandalus For Social and Applied Sciences* 2: 18-39
- [12] Ghabili K, Shja MM, Kamran P (2008) The Iranian female high school students' attitude towards people with HIV/AIDS: a cross-sectional study. *AIDS Research and Therapy* 5: 1-5
- [13] Nur N (2012) Turkish school teachers' knowledge and attitudes toward HIV/AIDS. *Croat Med J* 53: 271-7
- [14] Fraim NL (2012) Knowledge levels and misconceptions about HIV/AIDS: What do University Students in Turkey Really Know? *International Journal of Humanities and Social Science* 2: 50-58
- [15] Torabi MR (2000) Family physicians' knowledge and attitudes and practices regarding HIV/AIDS Prevention. *The Health Education Monograph Series* 18: 51-58
- [16] Ministry of Cabinet Affairs, Kingdom of Bahrain (2010) Basic Results Population, Housing, Buildings and Establishment Census. Available: http://www.cio.gov.bh/cio_ara/English/Publications/Census/Population/6.pdf Accessed November 2014
- [17] Hasani L, Aghamolaei T, Tavafian SS, Sabili A (2010) Knowledge of Iranian nurses about HIV/AIDS: A cross sectional study from Bandar Abbas. *Iranian Journal of Clinical Infectious Diseases* 5: 161-165
- [18] Hasanain M (2005) Cultural Approach to HIV/AIDS Harm Reduction in Muslim Countries. *Harm Reduction Journal* 2: 23-31
- [19] Badahdah AM, Sayem N (2010) HIV-related knowledge and AIDS stigma among college students in Yemen. *Eastern Mediterranean Health Journal* 16: 901-906
- [20] Taher E, Abdelhai R (2011) Nurses' knowledge, perceptions, and attitudes towards HIV/AIDS: Effects of a health education intervention on two nursing groups in Cairo University, Egypt. *Journal of Public Health and Epidemiology* 3: 144-154
- [21] Montazeri A (2005) AIDS knowledge and attitudes in Iran: results from a population-based survey in Tehran. *Patient Educ Couns* 57: 199-203
- [22] Celik M, Arican O, Celikoz-Ozkan D (2007) Turkish Internet users' awareness of and attitudes toward HIV/AIDS and other STDs. *Acta Dermatoven APA* 16: 13-20

- [23] Bhosale SB, Jadhav SL, Singru SA, Banerjee A (2010) Behavioral surveillance survey regarding human immunodeficiency virus/acquired immunodeficiency syndrome among high school and junior college students. *Indian J Dermatol Ve* 76: 33-37
- [24] Abolfotouh MA, Al Saleh SA, Mahfouz AA, Abdulfotouh SM, Al Fozan HM (2013) Attitudes of Saudi Nursing Students on AIDS and Predictors of Willingness to Provide Care for Patients in Central Saudi Arabia. *SAGE Open* 3: 1-11
- [25] Wang G, Wada K, Hoshi K, Sasaki N, Ezoe S, Satoh T (2013) Association of Knowledge of HIV and Other Factors with Individuals' Attitudes toward HIV Infection: A National Cross-Sectional Survey among the Japanese Non Medical Working Population. *PloS one* 8: 1-8
- [26] Al-Ghanim SA (2005) Exploring public knowledge and attitudes towards HIV/AIDS in Saudi Arabia: A survey of primary health care users. *Saudi Med J* 26: 812-818
- [27] Ouzouni C, Nakakis K (2012) HIV / AIDS knowledge, attitudes and behaviours of student nurses. *Health Science Journal* 6: 129-150
- [28] Mwamwenda TS (2013) Human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) as God's directive. *Journal of AIDS and HIV Research* 5: 366-369
- [29] Hassan ZM, Wahsheh MA (2011) Knowledge and Attitudes of Jordanian Nurses towards Patients with HIV/AIDS: Findings from a Nationwide Survey. *Issues in Mental Health Nursing* 32: 774-784
- [30] Fahimi FR (2007) Time to intervene: Preventing the spread of HIV/AIDS in the Middle East and North Africa. Population Reference Bureau Available: <http://www.prb.org/pdf07/hivaidsinmena.pdf> Accessed November 2014.
- [31] Mahajan AP, Sayles JN, Patel VA, et al (2008) Stigma in the HIV/AIDS epidemic: A review of the literature and recommendations for the way forward. *AIDS* 22 Suppl 2:67-79.doi:10.1097/01.aids.0000327438.13291.62

Conference Paper

Middle East Respiratory Syndrome Corona Virus (MERS-CoV): Levels of Knowledge and Awareness in Bahrain

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Abstract

The Middle East respiratory syndrome coronavirus (MERS–CoV) was first identified in the Kingdom of Saudi Arabia (KSA) in 2012 that accounts 80% of the global cases. On 10th of April 2016, Bahrain notified WHO of a first fatal case. Hence, as a public health research and practice, the authors sought to assess the knowledge and awareness of MERS-CoV in Bahrain. A cross-sectional, conveniently sampled study was carried out through face-to-face interviews using a structured Arabic questionnaire among 498 Bahraini adults. While, 95% had a travel history to KSA, around 50% had the knowledge and awareness of MERS CoV being a viral lethal disease and its associated symptoms. Stratifying by socio-demographics, the authors found that the levels of education, occupation, history of travel to KSA were significantly associated with the knowledge and awareness of MERS CoV ($p < 0.05$). On the preventive measures of MERS CoV, occupation and history of travel to KSA were significantly associated ($p < 0.05$). Considering the first notified case from Bahrain, proximity and travel history to KSA of 95% of the Bahrainis, the knowledge and awareness of MERS CoV is found to be inadequate. Therefore, the knowledge and awareness campaign on MERS CoV is pivotal as a good public health practice.

Keywords: MERS-CoV, Knowledge, Awareness, Bahrain

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1. Introduction

The novel lineage C beta corona virus (Middle East respiratory syndrome coronavirus, or MERS–CoV) was first identified in the Kingdom of Saudi Arabia in 2012¹. Although, current evidence suggests that insectivorous bats are likely to be the original source², dromedary camels (*Camelus dromedarius*) are a natural host and likely source of human MERS-CoV infection that can cause fatal respiratory disease in humans³.

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Notably, Arabian Peninsula, Pakistan and North, West, and East Africa harbor MERS-CoV-infected camels, and camel trade promotes the movement of infected hosts^{4,5,6}. Despite, 80% of human MERS cases have been reported from Saudi Arabia, the disease has spread globally; 27 countries in four continents have reported cases of MERS and approximately 35% of reported MERS patients have died. By June 2018, 2229 cases of laboratory confirmed cases and 791 associated deaths were reported globally^{7,8}. Of importance, the first MERS-CoV outbreak of 185 cases occurred in South Korea in 2015 from a single imported case from the Kingdom of Saudi Arabia, signaling the propensity to spread in new geographic locations. Due to delayed diagnosis of index patients, the reproductive number (Ro) greatly exceeded 1 in the early stages of the outbreak^{9,10}. Recently, the global seasonal occurrence of MERS-CoV outbreak cases were estimated with the available data between 2012 and 2017. It was found that the highest occurrences were found in the month of June, while the lowest was found in the month of January, further, seasonal variations were also observed¹¹.

The Kingdom of Bahrain in the Arabian Gulf is made up of 33 islands with a population of 1.3 million, which includes Bahrainis (48%) and multi-ethnic expatriates (52%)¹². The 25-km causeway, launched in 1986, links Bahrain to the eastern region of the Kingdom of Saudi Arabia (epicenter of MERS-CoV). It is reckoned to be a busiest bridge in the region. Based on 2013 data, the traffic flow is estimated to be of 20 million passengers both ways. Mainly during the Haj season, but also at other times, many international pilgrims transit Bahrain to visit the holy cities of Mecca and Medina in the Kingdom of Saudi Arabia. MERS-CoV-specific antibodies have been detected in the serum of dromedary camels across Northern Africa and across the Arabian Peninsula¹³, therefore, Bahrain's geographic location places itself at risk for MERS-CoV infection. After a gap of four years since the first case reported in 2012 from neighboring Kingdom of Saudi Arabia, on 10th of April 2016, the National IHR focal point of Bahrain notified WHO of a first fatal case of MERS-CoV¹⁴. This notification of the first case was puzzling particularly Bahrain's close proximity to the Kingdom of Saudi Arabia and considering the heavy traffic in the causeway. However, no serological tests have been performed on camels or humans in Bahrain, to evaluate the genetic susceptibility, antibodies, or possible carrier state and presence of undetected cases, if any, while the burden of MERS-CoV infection in the Bahraini population is unknown.

It is evident that there is a large MERS-CoV camel reservoir, and there is no specific treatment or vaccine, therefore, the potential risk of global spread is ever present¹⁵. Given the enigmatic first case reported from Bahrain, the rapid mass mobility of people through causeway on both ways of Bahrain and the Kingdom of Saudi Arabia and

the international pilgrims transiting through Bahrain to visit the holy places in the Kingdom of Saudi Arabia, the potential risk of MERS CoV in Bahrain cannot be underestimated. Hence, as an early stage in public health research and practice, we sought to assess the knowledge and awareness of MERS-CoV in the Bahraini community.

2. Literature Review

Current evidence suggests that MERS-CoV is a zoonotic virus. MERS-CoV is genetically related to bat β CoV¹ and bats were also found to be susceptible to MERS-CoV infection. Preliminary reports on the role of camels as a MERS-CoV reservoir were evident by the prevalence of MERS antibodies in camels from Oman, Egypt and the Kingdom of Saudi Arabia. Further, dromedary camels from African countries such as: Algeria, Ethiopia, Kenya, Nigeria, Sudan and Tunisia, and Arabian Peninsula such as: Jordan, Oman, Qatar and the United Arab Emirates were seropositive with high titers of MERS-CoV antibodies. These mounting evidence suggests on the zoonotic transmission potential and dromedary camels are a reservoir for MERS-CoV^{16,17}. Other than Bahrain and the countries in or near the Arabian peninsula with MERS cases, countries outside of the Arabian Peninsula or Africa with travel-associated MERS cases include: Austria, China, France, Germany, Greece, Italy, Malaysia, Netherlands, Philippines, Republic of Korea, Thailand, Turkey, United Kingdom (UK), and United States of America (USA)¹⁸.

The incubation period for MERS is usually about 5 or 6 days (range: 2 to 14 days). People confirmed with MERS-CoV infection have had severe acute respiratory illness with symptoms of fever, cough and shortness of breath. Gastrointestinal symptoms including diarrhea and nausea/vomiting were found in some, and many had more severe complications such as pneumonia and kidney failure. The mortality rate is about 30-40%. Most who died had an underlying medical condition. Some had mild flu-like symptoms or no symptoms at all and they recovered. Research evidence suggests that people with comorbidities may be more likely to become infected with MERS-CoV, or have a severe disease. The comorbidities included diabetes; cancer; chronic lung disease, heart, and kidney disease. Individuals with weakened immune systems are also at higher risk for MERS-CoV or acquiring a severe disease¹⁹. A Saudi gentleman, who was admitted for an elective coronary bypass surgery developed an acute respiratory illness, postoperatively. The patient was found positive for MERS-CoV and incidentally became the first confirmed case of MERS-CoV infection in the Kingdom of Bahrain. Contact tracing was made on 40 close contacts and all healthcare workers

who had been with the index case and were followed up. There were no secondary cases detected¹⁴.

During Ramadan, 2015 in the holy mosque in Makkah, Kingdom of Saudi Arabia, a cross-sectional study²⁰ was carried out on 417 Arab participants at King Fahad extension, King Abdullah Prayer extension and, King Abdullah Piazza extension after prayers. The mean knowledge score on MERS-CoV was 52.56. Majority (91.3%) was familiar with MERS-CoV and the Saudi nationals had significantly higher knowledge of MERS-CoV than non-Saudis. Those who had received health advice on MERS-CoV had significantly higher average knowledge. Likewise, among the Australian Hajj pilgrims who attended Hajj in 2015, a forward looking cohort study²¹ identified the relationship between travelers' awareness of MERS-CoV, and compliance with preventive measures and exposure to camels. Only 28% of Australian Hajj pilgrims were aware of MERS-CoV in the Kingdom of Saudi Arabia. In a similar fashion, following an outbreak of MERS-CoV in an University community of the Kingdom of Saudi Arabia²², 1541 participants completed a survey on the knowledge on MERS-CoV. The overall knowledge score was 43.2% and participants from medical college had significantly higher scores. While the majority (78.9%) of the respondents recognized the typical symptoms of MERS-CoV but only 67.1% were aware of the recommendations.

3. Research Methodology

A cross-sectional study using a convenience sampling approach by face-to-face interviews in the community of Bahrain was conducted by the fourth year students enrolled in Bachelor of Science in Nursing at the College of Health Sciences, University of Bahrain, Kingdom of Bahrain. The sample size was estimated using the following conservative parameters for prevalence: expected population proportion of 50%, 95% confidence interval, and a 5% precision estimate on two sides of the true population proportion. These parameters indicated a required sample size of 385. The required sample was increased to 400 participants (a level of precision of 4.9% either side) to account for potential invalid or incomplete responses. An estimated sample size of 400 was considered adequate.

Based on an in-depth literature review of MERS-CoV infection, we chose to use the structured Arabic questionnaire of Alotaibi MS et al.²³ after obtaining the approval from the primary author. The chosen questionnaire was more suitable and compatible with the Bahraini society regarding demographic, economic, and socio-cultural aspects. The

questionnaire was found to be reliable with a Cronbach's alpha of 0.875. The questionnaire had two main sections. The first section involved the sociodemographic characteristics, time of visiting Makkah, any health advice about the disease received, awareness of the seriousness of MERS-CoV, familiarity with MERS-CoV, and whether he/she had ever caught MERS-CoV. The second section contained 31 structured questions, eliciting "Yes", "No", and "I do not know" responses, which dealt with knowledge about the disease in terms of symptomatology of MERS-CoV's modes of transmission, complications, and measures for preventing the transmission of the disease.

The study had a standard approval from the institutional scientific research committee of the College of Health Sciences, University of Bahrain, Bahrain. Before gathering the data, the interviewer explained the study purpose to the participants and without persuasion informed consent was obtained. The participants' information was de-identified and kept confidential for ensuring protection of the data gathered during the study and thereafter. The data from the questionnaires were cleaned, coded, and entered in Excel (Microsoft, Redmond, WA, USA) and then exported to SPSS version 21 (SPSS Inc, Chicago, Illinois, USA) for statistical analysis. Twenty percent of the survey was randomly selected for a quality control check using random generated numbers²⁴.

4. Findings

A survey was conducted in Bahrain to estimate the knowledge and awareness of MERS -CoV. There were 498 participants who completed the survey, of which, 57% were males. Majority of the participants were between the age group of 20-39 years (67.5%) with a minimum qualification of university degree (45.4%). While 39.4% were employed, 47.2 % of the study participants hold student status (Table-1). Health status was summarized in Table 2: chronic disease was reported among 13.8% of the individuals. We ranked the order of the chronic diseases with diabetic mellitus being first followed by the hypertension, asthma and others.

A total of 469 (94.2 %) of them have visited the Kingdom of Saudi Arabia in the past (Table-3); a major reason for having undertaken the travel was reported to be pilgrimage - 326 (65.4%), followed by tourism, and less than 10% of them travel either for their higher studies and business. Merely, one fifth of the participants seek some travel health advice prior to their travel. Seeking the general physician's advice or browsing the internet was their major source of travel health advice; 14.6% of them protect themselves by taking travel associated vaccinations prior undertaking a pilgrimage.

TABLE 1: Socio-demographics of the study participants (n=498).

Socio-Demographics			
		n=498	Percentage
Gender	Male	284	57.0%
	Female	214	43.0%
Age	Younger than 20	79	15.8%
	20-39	336	67.4%
	40 - 60	81	16.4%
	Older Than 60	2	0.4%
Educational levels attained:	Illiterate	7	1.4%
	Less than High School	33	6.6%
	High School	146	29.4%
	Diploma	32	6.4%
	University	226	45.4%
	Master/PHD	54	10.8%
Occupational level:	Employed	198	39.8%
	Currently a Student	235	47.2%
	Business	46	9.2%
	Retired	19	3.8%

TABLE 2: Health status of the study participants (n=498).

Health conditions	Status	n=498	Percentage
Do you have any chronic disease?	No	429	86.2%
	Yes	69	13.8%
What are the chronic disease(s) that you have			
Diabetes Mellitus	No	477	95.8%
	Yes	21	4.2%
Asthma	No	489	98.2%
	Yes	9	1.8%
Heart Disease/High Blood Pressure	No	484	97.2%
	Yes	14	2.8%
Cancer	No	490	98.4%
	Yes	8	1.6%
Kidney Disease	No	498	100 %
	Yes	0	0 %

Awareness of MERS-CoV is summarized in Table-4. A set of five questions formed the awareness domain. More than half of them (57.8%) have at least heard of MERS-CoV ($p < 0.05$). However, 3/498 (0.6%) of them were the victims of the MERS-CoV. Majority of the participants, (262/498) 52.8% in general have said that they don't know

TABLE 3: Travel history and travel health advice status of the study participants (n=498).

Have you ever travelled to KSA?	No	29	5.8%
	Yes	469	94.2%
Pilgrimage	No	172	34.6%
	Yes	326	65.4%
Business	No	457	91.8%
	Yes	41	8.2%
Tourism	No	296	59.4%
	Yes	202	40.6%
Study	No	482	96.8%
	Yes	16	3.2%
Have you ever travelled to GCC countries?	No	88	17.6%
	Yes	410	82.4%
The number of times you travelled to Mecca:			
	Once	69	32.4%
	Twice	36	16.7%
	Three Times	27	12.5%
	Four Times	20	9.3%
	More	62	29.2%
Did you receive any travel health advice before undertaking the pilgrimage?	No	399	80.0%
	Yes	99	20.0%
What were the sources of this advice			
Travel agency	No	485	97.4%
	Yes	13	2.6%
General Physician	No	459	92.2%
	Yes	39	7.8%
Internet	No	466	93.6%
	Yes	32	6.4%
Friends or Relatives	No	486	97.6%
	Yes	12	2.4%
Others	No	496	99.6%
	Yes	2	0.4%
Did you get vaccinated before undertaking the pilgrimage?	No	425	85.4%
	Yes	73	14.6%

the cause of the disease ($p < 0.05$). Among the 288 participants who reported that they have heard about this virus, 186/288 (64.7%) were able to correctly classify it as a viral

disease indicating that the remaining 35% of them are still lacking the awareness of MERS- CoV ($p < 0.05$). We observed similar estimates of more than 50% on the organ systems to which MERS-CoV has predilection to ($p < 0.05$).

TABLE 4: Awareness of MERS –CoV of the study participants (n=498).

		n=498	Percentage	p-Value
Have you ever heard of MERS-CoV?	No	210	42.2%	<0.05
	Yes	288	57.8%	
Have you ever contracted this disease?	No	495	99.4%	<0.05
	Yes	3	0.6%	
MERS-CoV is a	I don't Know	262	52.8%	<0.05
	Bacterial disease	16	3.2%	
	Viral Disease	214	43.2%	
	Fungal Disease	2	0.4%	
	A parasite	2	0.4%	
MERS-CoV affects which system				
Respiratory system	No	292	58.6%	<0.05
	Yes	206	41.4%	
Circulatory system	No	470	94.4%	
	Yes	28	5.6%	
Urinary system	No	491	98.6%	
	Yes	7	1.4%	
Digestive system	No	476	95.6%	
	Yes	22	4.4%	
Neurological system	No	482	96.8%	
	Yes	16	3.2%	
I don't know	No	228	45.8%	
	Yes	270	54.2%	
Do you think that contracting the MERS corona is:	Not stated	73	14.6%	
	very lethal	148	29.8%	
	Kind of lethal	242	48.6%	
	Not lethal	35	7.0%	

Knowledge of MERS-CoV is summarized in Table-5: Knowledge was evaluated on four major domains such as signs and symptoms, transmission, complication and prevention. For each domain there were multiple questions with option to choose the correct response. We observed an equal proportion of participants were able to correctly classify the signs and symptoms except for vomiting, diarrhea, and joint and muscle pain. More than 65% of them correctly classified the mode of transmission of the

diseases: we observed a similar pattern of 50% of them who correctly identified the transmission mode of MERS- CoV and over 60% of them were able to correctly classify the complications of MERS-CoV ($p < 0.05$). On the prevention aspects, more than 50% of them incorrectly classified the prevention strategy ($p < 0.05$). There were a lack of knowledge in identifying the signs and the symptoms, transmission and prevention of MERS-CoV. Complication is the only domain in which the participants were able to respond with the correct answers.

Bivariate analysis (Table-6): we have computed the bivariate analysis comparing each outcome questions against the socio-demographic variables. We found a statistically significant associations between the education, occupation and previous travel history to the Kingdom of Saudi Arabia with respect to the awareness and knowledge domains ($p < 0.05$).

5. Discussion of Findings

This study on exploring the levels of knowledge and awareness on MERS -CoV in Bahrain was necessitated on the bases that: i. the origins of the virus are not clearly understood, but, believed to have originated in bats and was transmitted to camels sometime in the distant past⁸, ii. the enigmatic first case reported from Bahrain, the closest neighbor to the Kingdom of Saudi Arabia- the epicenter for MERS-CoV, iii. rapid mass mobility of people through causeway on both ways of Bahrain and the Kingdom of Saudi Arabia, iv. increase in the number of countries notifying MERS-CoV regionally and globally, v. MERS-CoV continues to be an endemic public health threat and vi. possibility of the virus to mutate and exhibit increased inter-human transmissibility with accentuated pandemic potential^{25,26}.

This community based study had majority of the participants between the age group of 20-39 years with a minimum qualification of university degree. Half of the study participants hold student status and younger, therefore, the chronic disease reported was less than 15%. Almost 95% of the responders have visited the Kingdom of Saudi Arabia in the past: two thirds were for pilgrimage and others for tourism, higher studies or business. It has been documented that MERS cases reported from outside the Kingdom of Saudi Arabia invariably have a history of recent travel from the Arabian Peninsula or were a close contact of a primary case²⁰. However, only 20% of the participants sought travel health advice prior to their travel from a general physician or browsing the internet was their major source of travel health advice and 15% had travel associated vaccination coverage (Table-3), whereas, Australian Hajj pilgrims

TABLE 5: Knowledge of MERS –CoV of the study participants (n=498).

	Yes	No	I don't know
1-Signs and Symptoms of MERS-CoV are:			
Cough	259(52%)	23(4.6%)	216(43.4%)
Fever	234(47%)	21(4.2%)	243(48.8%)
Shortness of breath	245(49.2%)	17(3.4%)	236(47.4%)
Nasal and throat congestion	270(54.2%)	28(5.6%)	200(40.2%)
Vomiting and diarrhea	324(65%)	79(15.8%)	95(19.2%)
Joint and muscle pain	341(68.6%)	75(15%)	82(16.4%)
2- It can be transmitted by			
Droplet like coughing and sneezing	227(45.6%)	22(4.4%)	249(50%)
Blood transfusion	287(57.6%)	58(11.6%)	153(30.8%)
Shaving equipment	320(64.2%)	73(14.6%)	105(21.2%)
Contacting an infected individual	266(53.4%)	48(9.6%)	184(37%)
Eating and drinking	320(64.2%)	73(14.6%)	105(21.2%)
Animals(camels)	301(60.4%)	41(8.2%)	156(31.4%)
Sex	341(68.6%)	66(13.2%)	91(18.2%)
3- Complications of MERS-CoV are:			
There are no complications (move to Q4 if answered yes)	348(70%)	80(16%)	70(14%)
Sepsis	361(72.6%)	49(9.8%)	88(17.6%)
Organ failure(liver and kidney)	354(71.2%)	35(7%)	109(21.8%)
Death	309(62%)	23(4.6%)	166(33.4%)
Severe shortness of breath and infection	296(59.4%)	15(3%)	187(37.6%)
4-Methods of Prevention of MERS-CoV:			
Wearing a face mask	314(63%)	6(1.2%)	178(35.8%)
Washing hands with soap and water	203(40.8%)	13(2.6%)	282(56.6%)
Using sanitizer	212(42.6%)	19(3.8%)	267(53.6%)
Avoiding an infected individual	208(41.8%)	18(3.6%)	272(54.6%)
Using a tissue or a napkin to cover the mouth and nose when sneezing	204(41%)	13(2.6%)	281(56.4%)
Avoiding to touch the mouth, nose and eyes as much as possible	235(47.2%)	21(4.2%)	242(48.6%)
Avoid contact with animals and consuming their products (camels)	286(57.4%)	26(5.2%)	186(37.4%)
* Numbers in bold indicate p<0.05			

who were aware of MERS-CoV in Saudi Arabia and were more likely to receive travel associated vaccines²⁰. More than half of the participants have heard of MERS-CoV but do not know the cause of the disease (60%). About half were able to respond on the organs of predilection to MERS-CoV. Al-Mohrej et al.²¹ found that female participants, married participants, and participants aged >60 years were more aware about MERS-CoV than other participants. Similarly, a cross-sectional survey on awareness of MERS-CoV among the Saudi population was found to be generally good²². Our findings in Bahrain reflect that the levels of awareness (Table-4) are not adequate, probably due to a single case reported from Bahrain so far.

TABLE 6: Bivariate analysis of Awareness and Knowledge of MERS –CoV to the Socio-demographics of the study participants (n=498).

Awareness and Knowledge Domains	Gender	Age	Educational Levels	Employment	Chronic Health Conditions	Travel history of KSA
MERS corona is a	0.350	.033*	.003*	0.472	0.319	0.173
Respiratory system-MERS corona affects which system	0.712	0.275	0.554	.016*	0.366	.007*
circulatory system-MERS corona affects which system	0.706	0.189	0.802	0.678	0.939	0.177
urinary system-MERS corona affects which system	0.437	0.827	.039*	0.379	0.97	0.509
Digestive system-MERS corona affects which system	.046*	0.414	0.128	0.297	0.982	0.797
Neurological system-MERS corona affects which system	0.652	0.153	0.262	0.779	0.878	0.244
I don't know-MERS corona affects which system	0.654	0.891	0.233	.035*	0.377	.016*
Do you think that contracting the MERS corona is:	0.321	0.136	.013*	0.058	0.151	0.117
Cough- signs and symptoms of MERS corona	0.745	0.286	0.383	0.275	0.314	0.060
Fever- signs and symptoms of MERS corona	0.711	0.118	0.563	0.071	0.250	.005*
Shortness of breath- signs and symptoms of MERS corona	0.748	0.283	0.823	.028*	0.429	.028*
Nasal and throat congestion- signs and symptoms of MERS corona	0.236	0.641	0.672	0.206	0.677	.016*

Awareness and Knowledge Domains	Gender	Age	Educational Levels	Employment	Chronic Health Conditions	Travel history of KSA
Vomiting and diarrheal signs and symptoms of MERS corona	0.740	0.087	0.468	0.176	0.392	.039*
Joint and muscle pain signs and symptoms of MERS corona	0.769	0.118	0.304	0.216	0.852	0.091
Droplet like coughing and sneezing-It can be transmitted by	0.202	0.585	0.208	0.194	0.509	.009*
Blood transfusion-It can be transmitted by	0.707	0.153	0.148	.001*	0.256	.010*
Shaving equipment-It can be transmitted by	0.192	0.508	0.283	0.296	0.926	0.305
Contacting an infected individual	0.384	0.381	0.414	0.087	0.576	.001*
Eating and drinking	0.903	0.443	0.178	.027*	0.720	0.203
Animals(camel)-It can be transmitted by	0.874	0.091	0.472	0.597	0.932	0.079
Sex	0.648	0.468	0.648	0.199	0.681	0.107
There are no complications (move to Q4 if answered yes)	0.168	0.866	.044*	0.532	0.488	0.392
Sepsis	0.197	0.812	0.331	0.533	0.948	0.376
Organ failure(liver and kidney)	0.987	0.553	0.428	0.178	0.370	0.320
Death	0.669	0.199	0.420	.025*	0.835	.048*
Severe shortness of breath and infection	0.386	0.721	0.151	.016*	0.795	.024*
Wearing a face mask	0.786	0.46	0.628	0.582	0.142	0.139
Washing hands with soap and water	0.895	0.272	0.632	0.051	0.406	.044*
Using sanitizer	0.512	0.75	0.773	.038*	0.249	0.072
Avoiding an infected individual	0.282	0.755	0.631	0.068	0.072	0.058
Using a tissue or a napkin to cover the mouth and nose when sneezing	0.734	0.421	0.481	0.058	0.386	.047*
Avoiding to touch the mouth, nose and eyes as much as possible	0.418	0.307	0.932	0.061	0.883	0.098
Avoid contact with animals and consuming their products (camels)	0.533	0.142	0.772	.044*	0.494	0.600
*. The Chi-square statistic is significant at the .05 level.						

The factors that influence the levels of knowledge on an infectious illness include the severity of the disease, transmission dynamics, and ways of disseminating the

knowledge. We observed an equal proportion of participants (50%) in our study who were able to correctly classify the signs and symptoms except for vomiting, diarrhea, and joint and muscle pain and this was lower when compared to a study among the students community of a University in the Kingdom of Saudi Arabia, where, the majority (78.9%) of the respondents recognized the typical symptoms of MERS-CoV²⁷. Results from documented literatures suggest that many details of camel-to-human transmission are not clear, however, transmission from camels to human constitute the only confirmed zoonotic source for the human infection. Patients may be exposed to MERS-CoV by consumption of unpasteurized camel milk^{28,29}. Over 65% of the study participants significantly identified the mode of transmission of the diseases, and over 60% of them were able to classify the complications of MERS-CoV. We were puzzled to note that more than 50% of them were unable to classify the prevention strategy, as there are no vaccines to protect or antivirals available to treat the MERS-CoV. There was a lack of adequate knowledge in identifying the signs and the symptoms, transmission and prevention of MERS-CoV among the Bahraini community. The bivariate analysis (Table-6) has given us statistically significant associations between the education, occupation and previous travel history to the Kingdom of Saudi Arabia that has a significant value on the awareness and knowledge domains of MERS-CoV.

Our study is the foremost to assess the levels of Knowledge and Awareness in Bahrain on MERS-CoV, however, with a few limitations. First, the representativeness of the sample is unknown, as we adopted the convenient sampling method in the study. Second, considering the face-to-face interview method adopted in the study, interviewer bias could not be eliminated as an individual's style, expression and explanation may have affected the participant's response. Third, self-reported data is subject to recall bias.

Several important questions about MERS-CoV epidemiology, routes of transmission, pathogenesis, and treatment still remain unanswered. During mass gathering, good infectious disease surveillance and control measures are essential. Raising awareness about MERS-CoV among travelers to and from affected countries is good public health practice. In accordance, the Kingdom of Saudi Arabia periodically issues/updates health guidelines for the pilgrims and visitors³⁰. Although, achieving community participation in awareness and knowledge of health issues has remained a challenge, following the guidelines issued by the health authorities would be helpful. The Bahraini community needs to be made aware to avoid direct contact with camels when travel to Kingdom of Saudi Arabia is undertaken. Infection-control practices in the hospitals have to be strengthened in the wake of an MERS-CoV case detected. Further, the health officials

should highlight the seasonal occurrence of MERS-CoV outbreak¹¹ and take better preventive measures to minimize the incidence and burden of MERS-CoV.

6. Conclusion

Our study highlights the need for awareness and health education among the Bahrainis about MERS-CoV infection, transmission potential, avoid direct contact with camels when travel to Kingdom of Saudi Arabia is undertaken, management of infected individuals, especially elderly individuals with comorbidities, and preventive measures. Infection-control practices in the hospitals have to be strengthened in the wake of an MERS-CoV case detected. Adopting guidelines issued by the health authorities would be helpful.

References

- [1] Memish ZA, Mishra N, Olival KJ, Fagbo SF, Kapoor V, Epstein JH, et al. Middle East respiratory syndrome coronavirus in bats, Saudi Arabia. *Emerg Infect Dis.* 2013;19:1819–23.
- [2] Anthony SJ, Gilardi K, Menachery VD, Goldstein T, Ssebide B, Mbabazi R, Navarrete-Macias I, Liang E, Wells H, Hicks A, Petrosov A, Byarugaba DK, Debbink K, Dinnon KH, Scobey T, Randell SH, Yount BL, Cranfield M, Johnson CK, Baric RS, Lipkin WI, Mazet JA. Further Evidence for Bats as the Evolutionary Source of Middle East Respiratory Syndrome Coronavirus. *MBio.* 2017 Apr 4;8(2). pii: e00373-17. doi: 10.1128/mBio.00373-17.
- [3] Azhar EI, El-Kafrawy SA, Farraj SA, Hassan AM, Al-Saeed MS, Hashem AM, et al. Evidence for camel-to-human transmission of MERS coronavirus. *N Engl J Med.* 2014;370:2499–505.
- [4] Ali M.A., Shehata M.M., Gomaa M.R., Kandeil A., El-Shesheny R., Kayed A.S., El-Taweel A.N., Atea M., Hassan N., Bagato O., et al. Systematic, active surveillance for Middle East respiratory syndrome coronavirus in camels in Egypt. *Emerg. Microbes Infect.* 2017;6:e1. doi: 10.1038/emi.2016.130. [PMC free article, PubMed, Cross Ref]
- [5] Miguel E., Chevalier V., Ayelet G., Ben Bencheikh M.N., Boussini H., Chu D.K., El Berbri I., Fassi-Fihri O., Faye B., Fekadu G., et al. Risk factors for MERS coronavirus infection in dromedary camels in Burkina Faso, Ethiopia, and Morocco, 2015. *Euro Surveill.* 2017;22doi: 10.2807/1560-7917.ES.2017.22.13.30498. [PMC free article, PubMed, Cross Ref]

- [6] Saqib M., Sieberg A., Hussain M.H., Mansoor M.K., Zohaib A., Lattwein E., Muller M.A., Drosten C., Corman V.M. Serologic evidence for MERS-CoV infection in Dromedary Camels, Punjab, Pakistan, 2012–2015. *Emerg. Infect. Dis.* 2017;23:550–551. doi: 10.3201/eid2303.161285. [PMC free article, PubMed, Cross Ref]
- [7] World Health Organization. Middle East respiratory syndrome coronavirus (MERS-CoV) situation update. Available online at: <http://www.who.int/emergencies/mers-cov/en/>
- [8] World Health Organization. Fact Sheets. Middle East respiratory syndrome coronavirus (MERS-CoV). Available online at: [http://www.who.int/en/news-room/fact-sheets/detail/middle-east-respiratory-syndrome-coronavirus-\(mers-cov\)](http://www.who.int/en/news-room/fact-sheets/detail/middle-east-respiratory-syndrome-coronavirus-(mers-cov)).
- [9] Wong G, et al. MERS, SARS, and Ebola: the role of super-spreaders in infectious disease. *Cell Host Microbe.* 2015;(18)398–401.
- [10] Lee SS, Wong NS. Probable transmission chains of Middle East respiratory syndrome coronavirus and the multiple generations of secondary infection in South Korea. *Int J Infect Dis.* 2015;38:35–7.
- [11] Nassar MS, Bakhrebah MA, Meo SA, Alsuabeyl MS, Zaher WA. Global seasonal occurrence of middle east respiratory syndrome coronavirus (MERS-CoV) infection. *Eur Rev Med Pharmacol Sci.* 2018 Jun;22(12):3913–3918. doi: 10.26355/eur-rev_201806_15276.
- [12] Kingdom of Bahrain Ministry of Health. Health Statistics 2015. Available online at: https://www.moh.gov.bh/Content/Files/Publications/statistics/HS2015/hs2015_e.htm (last accessed 2 June 2017)
- [13] Harcourt JL, Rudoler N, Tamin A, Leshem E, Rasis M, Giladi M, Haynes LM. The prevalence of Middle East respiratory syndrome coronavirus (MERS-CoV) antibodies in dromedary camels in Israel. *Zoonoses Public Health.* 2018 May 31. doi: 10.1111/zph.12482. [Epub ahead of print]
- [14] Nahed Seddiq, Manaf Al-Qahtani, Jaffar A. Al-Tawfiq, and Nazar Bukamal, “First Confirmed Case of Middle East Respiratory Syndrome Coronavirus Infection in the Kingdom of Bahrain: In a Saudi Gentleman after Cardiac Bypass Surgery,” *Case Reports in Infectious Diseases*, vol. 2017, Article ID 1262838, 4 pages, 2017. <https://doi.org/10.1155/2017/1262838>.
- [15] Hui DS, Perlman S, Zumla A. Spread of MERS to South Korea and China. *Lancet Respir Med.* 2015 Jul;3(7):509–10. doi: 10.1016/S2213-2600(15)00238-6. Epub 2015 Jun 4.
- [16] Bermingham A, Chand MA, Brown CS et al. Severe respiratory illness caused by a novel coronavirus, in a patient transferred to the United Kingdom from the Middle East. *Euro Surveill* 2012; 17: 20290. [PubMed]

- [17] Ithete NL, Stoffberg S, Corman VM et al. Close relative of human Middle East respiratory syndrome coronavirus in bat, South Africa. *Emerg Infect Dis* 2013; 19: 1697–1699. [PMC free article, PubMed]
- [18] Centers for Disease Control. Middle East Respiratory Syndrome. Available online at: <https://www.cdc.gov/coronavirus/mers/index.html>
- [19] Mayo Clinic: MERS-CoV. Available online at: <https://www.mayoclinic.org/diseases-conditions/sars/expert-answers/what-is-mers-cov/faq-20094747>
- [20] Alqahtani AS, Wiley KE, Mushta SM, Yamazaki K(2), BinDhim NF, Heywood AE, Booy R, Rashid H. Association between Australian Hajj Pilgrims' awareness of MERS-CoV, and their compliance with preventive measures and exposure to camels. *J Travel Med.* 2016 Jul 18;23(5). doi: 10.1093/jtm/taw046.
- [21] Al-Mohrej OA, Al-Shirian SD, Al-Otaibi SK, et al. Is the Saudi public aware of Middle East respiratory syndrome? *Journal of infection and public health* 2016;9(3):259-66.
- [22] Al-abdullah, Nabeela. Assessment Of The Awareness Of Middle East Respiratory Syndrome-Coronavirus Infection In Saudi Arabia: A Cross- Sectional Survey. *The Internet Journal of Infectious Diseases.* 2016; 15: 1-8. 10.5580/IJPH.46719.
- [23] Alotaibi MS, Alsubaie AM, Almohaimede KA, Alotaibi TA, Alharbi OA, Aljadoa AF, Alhamad AH, Barry M. To what extent are Arab pilgrims to Makkah aware of the middle east respiratory syndrome coronavirus and the precautions against it? *J Family Community Med.* 2017 May-Aug;24(2):91-96. doi: 10.4103/2230-8229.205119.
- [24] Random.Org. True Random Number Generator. Available online at: <https://www.random.org/>
- [25] Zumla A, Hui DS, Perlman S. Middle East respiratory syndrome. *Lancet.* 2015 Sep 5;386(9997):995-1007. doi: 10.1016/S0140-6736(15)60454-8. Epub 2015 Jun 3.
- [26] Masters PS, Perlman S. Coronaviridae. In: Knipe DM, Howley PM, editors. *Fields Virology.* Lippincott Williams & Wilkins; Philadelphia, PA: 2013. pp. 825–58.
- [27] Al-Mohaissen M. Awareness among a Saudi Arabian university community of Middle East respiratory syndrome coronavirus following an outbreak. *East Mediterr Health J.* 2017 Jul 16;23(5):351-360.
- [28] Reusken CB, Farag EA, Jonges M, Godeke GJ, El-Sayed AM, Pas SD, et al. Middle East respiratory syndrome coronavirus (MERS-CoV) RNA and neutralizing antibodies in milk collected according to local customs from dromedary camels, Qatar, April 2014. *Euro Surveill.* 2014;19(23):20829.

- [29] Samara EM, Abdoun KA. Concerns about misinterpretation of recent scientific data implicating dromedary camels in epidemiology of Middle East respiratory syndrome (MERS) *mBio*. 2014;5(4):e01430-14.
- [30] Al-Tawfiq JA, Memish ZA. Mass gathering medicine: 2014 Hajj and Umra preparation as a leading example. *Int J Infect Dis*. 2014;27:26-31.

Conference Paper

Rail Noise Levels Around Dammam Railway Track and Reported Impacts on Human Health

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Abstract

Noise pollution has become a major concern due to its effects on human health. Therefore, the author has chosen to study the effects of noise pollution caused by trains in the rural areas near Dammam city of Saudi Arabia in this study. An attempt is made to monitor the railway noise pollution at certain distances from the railway track. *T*-test was applied to investigate statistical significance of the difference in noise levels at these distances at different timings. Moreover, a survey was conducted among people, who were exposed to noise levels at different distances from the track, to have their opinions about the noise level and its effects. It was found that noise levels diminish significantly at 20 m from the railway track. But the noise levels were still above the recommended Saudi standards for rural areas (which was the type of study area) at this distance. The noise levels were found within the recommended limits after 50 m from the railway track in the day time. After which it started to increase again that could be attributed to the presence of highways generating traffic noise. The noise levels were more than recommended for all locations during night time. Moreover, it was found that residential and educational land uses were allowed within 50 m from the track. This could result in continuous exposure and sustained effects on inhabitants' health. The most common problems due to railway noise were reported to be annoyance, sleep disturbance and nervous turbulence. Sleep disturbance and nervous turbulence were reported by the people who live within 50 m from the track, where the noise levels were found to be above the allowable standards. It was recommended by the survey respondents to either construct a barrier around the tracks or relocate them.

Keywords: Dammam, Rural Areas, Rail Noise, Health Effects

1. Introduction

There has been substantial development in all sectors of life including communication and transportation making it faster and convenient. Meanwhile, this has had a very

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bad impact on the society in the form of pollution. Engineers and developers are working to mitigate and reduce this impact in order to maintain life quality and health. Transportation, including road, railways, air and sea, is considered to be one of the highest contributor to pollution along with industries and power production (Smith, 2011).

One of the crucial aspects of pollution that has resulted from development and innovations is noise pollution. Noise pollution takes place when there is either excessive amount of noise or unpleasant sound that causes temporary disruption in the natural balance (MED-EL, 2015). It has become very difficult or even impossible to escape noise pollution in our daily activities. It can be sourced by inside or outside homes. Many of the electrical appliances, such as air-conditioning, inside home emit undesired noise. Health and mood of people can have unnoticeable effects by these home appliances. On the other hand, massive noise coming out of heavy machines and factories might cause chronic health problems, such as hearing and headache problems, to the people around them. The effects of noise pollution are hidden as it is not a sudden disordering but can have severe effects on health with continuous exposure. Researchers have found that exposure to traffic noise can increase the risk of suffering from heart attack. World Health Organisation (WHO) estimates that the region of east Europe has at least one million disability adjusted life years lost due to diseases induced by the noise (Young and Woods, 1970).

Many cities, including those of third world countries, are relying on railway transport for goods and passenger transportation. This mode of transport has been promoted as a solution for congestion on the highways and consequently reduces the emissions due to traffic. However, its widespread use has other impacts on the communities including noise pollution. Railway noise is considered as be a serious issue when tracks/stations are placed near or inside the city centres where its noise combines with other sources. Therefore, community resistance has been observed against railway noise in some countries including China (He et al., 2015).

The major noise pollution in GCC and precisely in Saudi is caused by cars due to the high vehicular demand resulting in congestion. However, there are some places close to the railway tracks and stations where high levels of noise, sourced by the train engines and track friction, are experienced. These locations mainly include some villages, and this could be the reason that we could not find any studies in which noise levels for these locations are studied. Researchers often focus on densely populated urban areas for studying environmental impacts of transportation.

This study had the following objectives. Firstly, reviewing railway noise and its technical measurements and effects. Secondly, measuring noise pollution on certain points surrounding Dammam's railway tracks. Third objective was determining perception, related to effects of noise on health, of the population exposed to this noise. Lastly, analysing the results to recommend practical and technical solution for mitigation of the noise.

There are some limitations that were faced throughout this study. Firstly, there is lack of available information about Dammam's railway and train system. Secondly, the readings and noise measurements were taken by normal phone app, instead of a proper measuring device which would have been more accurate but costly as well.

2. Noise Pollution

While noise is a form of sound level, but there is a difference between the practical meanings of these two terms. Sound can be defined as mechanical wave that results from the back and forth vibration of particles that travel in the medium (Smith, 2014). Noise can be defined as unwanted sound judged to be unpleasant, loud or disruptive to hearing. From a scientific standpoint, noise is indistinguishable from sound, as both are vibrations through a medium, such as air or water. The difference arises when the brain receives and perceives a sound. In experimental sciences, noise can refer to any random fluctuations of data that hinders perception of an expected signal (Bertland, 1970). There are various causes of noise including, vehicles, music instruments, sirens/alarms and industrial tools and equipment (de Bell, 1970).

Generally, the noise can be understood and felt as an annoyance to hearing sourced by different items in the daily activities. It is measured in a unit called the decibel (dBA). Decibel is a unit to measure the intensity or the level of sound and its measured by comparing to a logarithmic scale assigned by scientists to determine the levels (Galloway et al., 1969).

2.1. Noise thresholds

The permitted noise level is 125 decibels as per the Environment Protection Rules 1999. It can be sourced from important uses and non-important uses. Important uses include transportation vehicles, such as; cars, trains and aircraft. Noise from heavy traffic can reach 85 dB which is the level having potential to cause hearing problems with time (Harmsens, 2017). The threshold for hearing is from above Zero to 5 which is barely to

be heard. Range between 20 and 40 is referred to as a quiet place like home at nights. The noise levels can be easily detected when it reaches 65 dB, for e.g., 75dB is the case where there is highway traffic with heavy vehicles (Carlton, 2015).

2.2. Noise types

Noise varies in its levels and types which also varies the risks associated with it. Below are the different types of the noise that affects everyone on daily bases (Thomson, 2017).

2.2.1. Intermittent noise

This type of noise is too frequent and it increases and decreases quickly (Christina, 2011).

2.2.2. Continuous noise

This type of noise is emitted continuously without interruption for a certain while. Usually it comes from a running machinery, ventilation or ACs, etc. It can be measured by sound level meter by exposing it to the noise for few minutes (Stansfeld and Matheson, 2003).

2.2.3. Impulsive noise

This noise is associated mainly with construction fields and explosive processes. It is a result of a sudden substantial increase in sound like a bang; a sudden burst of noise having fast and surprising nature. It can be measured with a meter called personal noise dosimeter or the normal sound level meter (Oyedepo and Saadu, 2009).

2.2.4. Low frequency noise

Low recurrence noise makes up some portion of the texture of our everyday soundscape, such as; low foundation murmuring from power plants. This is additionally the hardest type of noise to decrease from the source, so it can simply spread around longer distances. For low recurrence noise, you ought to utilize a sound level meter with Third Octave Band (Waye et al., 2001).

2.3. Rail noise pollution

According to Europal, Rail noise is a sound emission sourced by the operation of trains, trams and metro (Carlton, 2015). There are a wide variety of sources and causes of this type of noise like locomotive acceleration, braking, rail curving squeal sound and vibration from rail corrugation. Rail noise starts with train engines with different types of engines producing varying the levels of noise, and then with the movement of rail, noise is sourced by wheels turning or rolling. Furthermore, horns, bells and whistles are also major types of the noise during acceleration of trains. Rail noise has been under focus due to the reaction of people against it (Bistrup et al., 2001). Consequently, many rules and regulations were set to evaluate the amount of noise and to avoid their effects on health and comfort (van Haaren and Verheijen, 1999).

Rolling noise is considered to be the major source of railway noise and it can be briefly defined as the noise which is resulted from absolute friction between the wheels and the track. It is caused by the effect of amplitude undulation of the wheel and the rail track. This type of noise can be reduced through reduction in vibration in wheel, sleepers and rail track by adding a damping treatment, reducing the noise by barriers, employing smaller wheels and rails and using proper disk brakes instead of ordinary iron blocks (Ritchard, 2011).

Curve squeal is high sound tone which occurs usually at the curves when wheels of the rail are turning on tight radius (Young and Woods, 1970). Typically, squeal can be distinguished by its higher level of noise in comparison with wheels rolling and it adds 20dBA more in level of noise (Millward, 2011). It can be controlled by reducing the friction between the rail wheels and rail tracks through lubricants (de Bell, 1970). Poor rail profile can also be a big cause of squeal noise by generating more stress on the wheels at curves, thus, selecting better properties as well as ongoing maintenance can assure more durable system with less effect of the stresses and noises.

2.4. Noise barriers

Noise barriers have been considered as a basic solution to reduce exposure to rail noise. They are designed exterior structures made of different sound proof properties in order to protect the inhabitants and sensitive land use areas from the noise (Alen, 2014). There are three different types of noise barriers which may be applied, namely: noise berms, noise walls and the combination of noise berms & walls.

3. Methodology

Saudi Railway Organization (SRO) has a total railway track length of 1775 Km. The major railway line starts in Dammam airport and in eastern part of Saudi Arabia and goes till Riyadh, the capital of Saudi Arabia, situated in middle of the country. The major lines connect some industrial areas, farms and military areas to ports and villages. SRO has 3 major lines:

1. Passenger's line: Railway number 1 which is double line and total of 733 Km linking Riyadh to Dammam passing through Hoffof and Bugaig.
2. Cargo line: Railway number 2 which is for transporting the materials and equipment only. It is 556Km and links Abdulaziz port in Dammam to Riyadh dry port.
3. Minor lines: They are 486 Km that link locations of industrials areas and some military areas.

3.1. Noise level observations

We started by measuring the noise level of the train over several distances; first interval was closest to the railway track which is located within 20 meters. The second one was from the nearest village which is 20-50 meters away. Third interval was at 50-100 meters away and last point was at 130 meters away from the tracks. At each interval 12 readings were recorded and at 2 times a day (evening and morning). The measurements of noise were taken by an iPhone application called (Decibel 10) which is created for such sound measurements. The measurements of noise through mobile applications has been proved to give satisfactory results (Kardous and Shaw, 2014). At each selected location, the application was operated for a continuous measuring period of 5-10 min during which twelve readings of noise were automatically recorded and saved.

3.2. Questionnaire survey

Second step was conducting a questionnaire survey to know respondents' opinion about effects of noise on them from health perspectives. The questionnaire was set consisting of 9 questions. A brief explanation of the questions is given below.

First Question was about the distance between the respondent's place of exposure and railway track. Question two was about the type of activity which that person is

involved in when he/she is near the railway track. Question 3 and 4 were about gender and age. Question 5,6 & 7 have been included to know the perspective related to noise level and its effects on them. Question 8 was to ask the respondent about how the noise level affects their daily activities. Last question was to suggest probable solutions for the railway noise by selecting reasonable options from the given list.

3.3. Analysis methods

The noise observations were compared to get an understanding of noise at different distance intervals. Paired t-test was done in the analysis to find whether there is significance difference between the noise levels at different distances from the track, and different timings. Paired t-test is based on the differences between the values of each pair. The paired t-value can be calculated using equations 1 and 2 (Ritchard, 2017).

$$SE(d) = \sqrt{\frac{sd}{n}} \quad (1)$$

$$T = d \setminus SE(d) \quad (2)$$

Where sd represents the standard deviation for the difference, n is the number of pairs in the data and d is the average difference between the pairs. T-value for the difference in noise datasets was compared with a standard t-value at 95% confidence having $n-1$ degrees of freedom. If the t-value was higher than standard t-value then the difference between the datasets is significantly higher and vice versa (Ritchard, 2017).

4. Data Analysis

Average of noise observations, taken at different distances from the railway track at two different timings is compared in Figure 1. All these averages were compared using the paired t-test (as described in sub-section 3.3) for all possible pairs of data. The t-value for all the tests were higher than the standard t-value hence, it can be said that the average noise levels varies from one location to another location as well as between the observation times.

It should be noted at this point that 12-1AM was selected as more trains are scheduled to pass on the tracks at these times. Whereas, lesser number of trains are scheduled between 1-2PM. Therefore, higher noise levels are observed during 12-1AM at all the locations except at 130m away from the track. It can also be observed that the noise

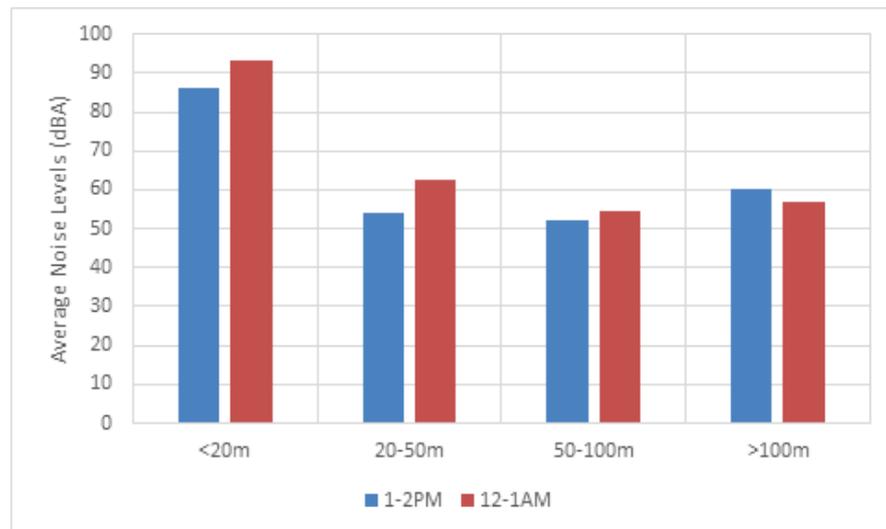


Figure 1: Average Noise Levels at Different Locations and Timings.

levels at this location increased although they were decreasing for observations with increase in distance for other intervals. It was observed during the visit of observation sites that roads are constructed at 100m away from the track. So, the peculiar noise levels at 130m, which are not consistent with the trends shown by rest of the data, can be attributed to road traffic noise.

According to Saudi environmental standards, community noise should be in the range of 55-50 dBA during day times and within 45-50 during night times (Zytoon, 2016). The night-time ranges are violated at all the study locations, mainly because of the movement of trains. The day-time standards are maintained at 20m and 50m away from the track.

4.1. Survey data description

General characteristics about the survey respondents are given in table 1. Majority of the survey respondents belonged to a mature age group of above 20 years. Approximately equal number of responses were taken at different distances intervals from the railway track. Majority of the respondents were male due to cultural values in Saudi Arabia wherein interviewing women, by male data collectors of this study, is comparatively difficult. There was a significant number of respondents who reported living or studying within 100m from the railway track which means continuous exposure.

Interestingly, people did not rate the noise level very high and majority of them reported that noise level did not affect their health or efficiency. The possible reasons for this trend could be that due to long exposure to the rail noise (as majority of them

TABLE 1: General Characteristics of Respondents.

Variable	Data
Total respondents	97
Number of people exposed within 20m	26
Number of people exposed within 20-50m	21
Number of people exposed within 50-100m	23
Number of people exposed after 100m	27
% of people living near track	50
% of people doing business near track	15
% of people passing near the track	30
% of people studying near the track	5
% male respondents	67
% of respondents having age between 15-20 years	25
% of respondents having age between 20-40 years	45
% of respondents having age between 40-60 years	25
% of respondents having age above years	5
% of respondents thinking they are affected by noise	32
Average rail noise ranking by the respondents (1=low, 5=high)	3.2
% of respondents reporting nervous turbulence due to rail noise	30
% of respondents reporting sleep disturbance due to rail noise	25
% of respondents reporting only annoyance due to rail noise	45
% of respondents reporting loss in efficiency for work/study due to rail noise	20

are living/working/studying near the track), respondents are used to it. The respondents which reported having effects of noise on them reported sleep disturbance as the main health issue associated with exposure to rail noise. It has already been established that noise levels exceed the Saudi environmental standards for night time at locations. More than 40% of the respondents suggested to relocate the railway track from the current location and/or construct noise barriers around them.

4.2. Locational comparison

The perceptions of respondents, exposed to rail noise at different distances, were compared and the results are shown in figures 2-4. It can be observed that more than 40% of the respondents were living or working close to the railway track (less than 50m away). Furthermore, there are approximately 20% of respondents who are studying in the same proximity.

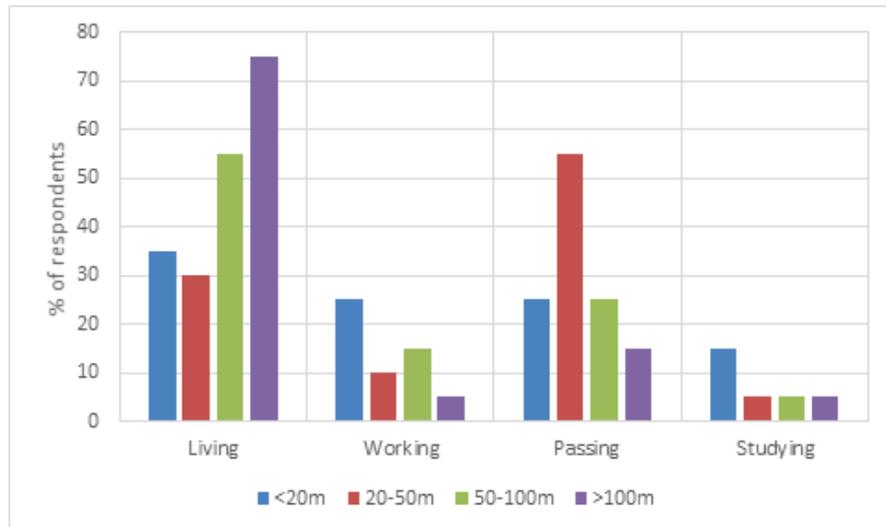


Figure 2: Comparison of Respondents' Activities.

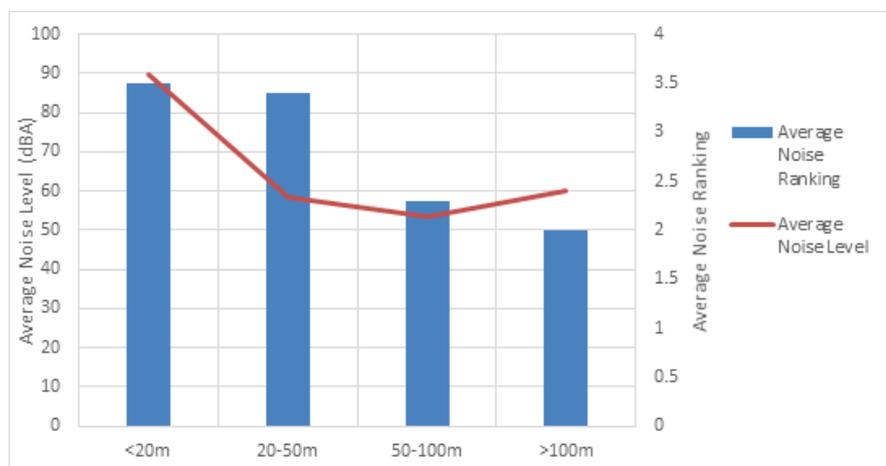


Figure 3: Comparison of Noise Levels and Rankings.

The ranking of the noise level, according to respondent's perception about rail noise, decreases with the increase in distance from track (see Figure 3). However, a considerable decrease is shown in the ranking by respondents who are 50m away, while the noise level reduces considerably after 20m. Moreover, the noise level at more than 100m from the track is slightly higher, than previous interval, due to highway traffic but the noise ranking keeps on getting lower at this interval. From these observations, it could be said that people's perception about environmental hazards (such as noise) can differ slightly from the actual data.

Nervous turbulence was mainly reported by respondents who are exposed at less than 20m from the track (see Figure 4). Sleep disturbance was a common phenomenon which is reported by most of the respondents, irrespective of their distance from the track. It should also be noted that Saudi environmental standards for night times (50

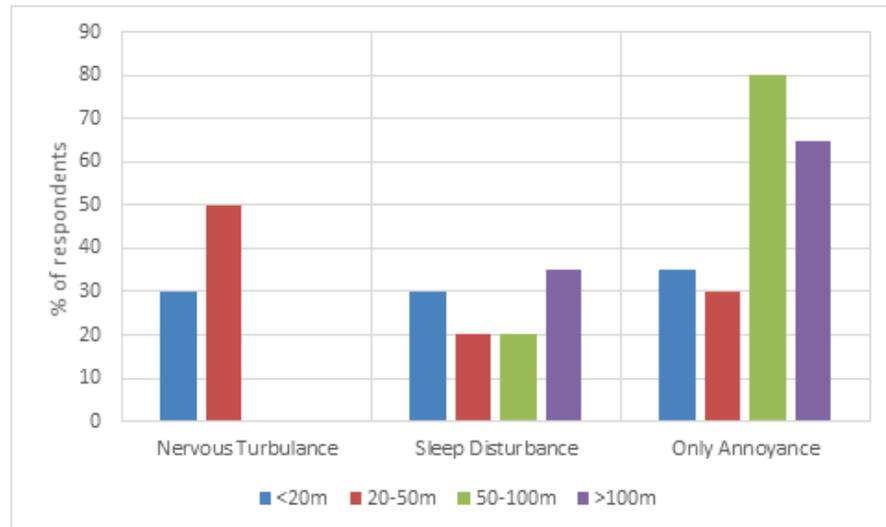


Figure 4: Comparison of Perceived Health Problems.

dB(A) have been violated at all these locations (Zytoon, 2016). This data shows that violating these standards is causing nervous turbulence (within 50m from the track for day time) and sleep disturbance to the exposed population. Annoyance was reported by majority of the respondents who are exposed at more than 50m away from the track, while it is reported by some respondents at other intervals as well.

5. Conclusions and Recommendations

The aim of the study was to investigate the railway noise pollution and the perception of people about it. It was found that noise levels have significantly reduce when the distance from the track is increased by 20m. The frequency/schedule of trains also has a significant impact on the noise levels.

We found that most of the survey respondents are used to high noise levels due to consistent exposure, therefore, do not believe that noise pollution affects them. Although, rail noise is more than allowable Saudi environmental standards on most of the surveyed locations, but there was a significant population of respondents who live/work/study near the track (within 50m). Nervous turbulence and sleep disturbance have been reported as the main health issues, related to the exposure of rail noise, on locations where it exceeds the environmental standards. Majority of the respondents suggested construction of noise barriers or relocation of railway tracks, away from population, to reduce the impacts of their noise on them. The relocation of residential areas away from the track would also be relevant in this case. Other possible solution for reducing noise could be maintenance and updating of railway

system to comply with modern European standards which are considered a benchmark for modern railway systems.

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References

- [1] Bertland, T. (1970). Noise: The third pollution. Public Affairs Committee, Inc.
- [2] Bistrup, M. L., Hygge, S., Keiding, L., Passchier-Vermeer, W. (2001). Health effects of noise on children and perception of the risk of noise. Copenhagen: National Institute of Public Health.
- [3] Carlon, S. (2015). What are the four different types of noise. Available: <http://www.cirrusresearch.co.uk/blog/2015/01/4-different-types-noise/>. (Accessed on 22th April 2017).
- [4] Christina, S. (2011). Noise research in special supplement. (Online) Available: <https://www.cdc.gov/niosh/updates/upd-02-03-11.htm>. (Accessed 15th June 2017).
- [5] de Bell, G. (1970). A future that makes ecological sense. The environmental handbook. New York: Ballantine Books.
- [6] van Haaren, E., Verheijen, E. (1999). A literature study and a proposal for a measurement protocol for curve squeal noise, Dutch title: Literatuurstudie en een voorstelMeetprotocol Booggeluid. NSTO-report NSTO/99/8110026/038.
- [7] Kardous, C. A., Shaw, P. B. (2014). Evaluation of smartphone sound measurement applications. *The Journal of the Acoustical Society of America*, 135(4), EL186-EL192.
- [8] Harmsens, N. (2017). Horn noise. ABC news, Available: <http://www.abc.net.au/news/2015-02-19/residents-complain-about-train-horns-noise/6152474>. (Accessed on 18th April 2017).
- [9] He, G., Mol, A. P., Zhang, L., & Lu, Y. (2015). Environmental risks of high-speed railway in China: public participation, perception and trust. *Environmental Development*, 14, 37-52.

- [10] MED-EL. (2015). Sound and Noise. Available: <https://blog.medel.com/what-is-sound-what-is-noise/>. (Accessed on 15th February 2017).
- [11] Millward, D. (2011). *Road and rail transport*. The Telegraph, Available: <http://www.telegraph.co.uk/news/uknews/road-and-rail-transport/8340584/Number-of-homes-to-be-hit-by-high-speed-train-noise-cut.html>. (Accessed on 12th January 2017).
- [12] Oyedepo, O. S., & Saadu, A. A. (2009). A comparative study of noise pollution levels in some selected areas in Ilorin Metropolis, Nigeria. *Environmental Monitoring and Assessment*, 158(1-4), 155.
- [13] Ritchard, T. (2017). Paired t test, Available at: <http://math.tutorvista.com/statistics/paired-t-test.html> (Accessed on 15th Nov 2017).
- [14] Ritchard, T. (2011). *Noise*. Available: <http://whatis.techtarget.com/definition/noise>. (Accessed on 18th Feb 2017).
- [15] Smith, A. (2016). Sound wave. Available: <http://www.physicsclassroom.com/Class/sound/u11l1c.html>. (Accessed on 12th March 2017).
- [16] Smith, P. (2014). *The world is too loud*. Available: (4) <https://psibrone.wordpress.com/2014/06/09/the-world-is-too-loud-2/>. (Accessed on 20th Sep 2017).
- [17] Stansfeld, S. A., & Matheson, M. P. (2003). Noise pollution: non-auditory effects on health. *British Medical Bulletin*, 68(1), 243-257.
- [18] Thompson, D. (2008). *Railway noise and vibration: mechanisms, modelling and means of control*. Elsevier, Amsterdam, The Netherlands.
- [19] Waye, K. P., Bengtsson, J., Kjellberg, A., Benton, S. (2001). Low frequency noise "pollution" interferes with performance. *Noise and Health*, 4(13), 33.
- [20] Young, M. F. Woods, D. L. (1970). Threshold noise levels. Texas Transportation Institute, December 1970, Accession Number: 00222602.
- [21] Zytoon, M. A. (2016). Opportunities for environmental noise mapping in Saudi Arabia: A case of traffic noise annoyance in an urban area in Jeddah city. *International Journal of Environmental Research and Public Health*, 13(5), 496.

Conference Paper

Visual Discomfort Health Concerns in the Future Cities of the Arabian Gulf: Case of Bahrain

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Abstract

Like the rest of the world, the landscape of architecture has changed in many of the Arabian Gulf cities with the introduction of new design technologies and parameterisation methods. Some of the contemporary designs of building facades comprise of perforated walls generated by computer software. Such perforations are similar in their shapes and nature to the Lotus Seed Pod. An image with specific spatial properties that have been found to negatively affect its viewers and cause a state of visual discomfort termed tryphobia. The new condition, recently studied by a limited number of researchers triggers physiological and psychological reactions that range from headaches, sickness to even vomiting in some extreme cases. Using on-site surveys as the primary method for investigation, this research measures the baseline of the tryphobic population in Bahrain to be between 26.50% and 39.32%, a number that is much larger than the UK's estimated baseline of 13–17%. The results also showed that reactions to natural stimuli are much more severe than manmade ones. Nevertheless, reactions to manmade stimuli are still significant. The study highlights the need to further investigate the effects of parameterisation methods on building designs in relation to visual discomfort.

Keywords: Tryphobia, visual discomfort, Architecture, Bahrain

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1. Introduction

A closer look into the architecture practices of today highlights the pioneering numerical approaches of the 'digital design' that are celebrated by well-known universities around the world like Harvard, MIT and UCLA (Oxman 2008). Many of these approaches are dependent on the computing skills of the practitioners who enjoy experimenting with new conceptual forms using the various software's that are now made available to the design community. Forms created in such processes are often 'alienated' from

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their surroundings. This rapid change in architecture and design requires an understanding of the implications of the created forms on the public and the building users' preferences, stimulation and the physical and psychological health of its occupants.

Sensible architects have been for long recommending the consideration of all ecological and human health factors involved when developing a new project (Cordero, 2001 and Evans and McCoy, 1998). By adopting sustainable visions, sensible architecture has been not only about energy efficiency but also cater to the best interest of both the occupants of the developed design and the earth in its heart. This research discusses visual discomfort in the contemporary architectural scene by focusing on tryphobia; a discomfort resembled in a set of physiological and psychological reactions induced by viewing images or forms of certain spatial properties, mainly clusters of objects.

2. Literature Review

2.1. Shift in architecture paradigm

The change in architecture typology has been linked to the theories and design concepts that rapidly changed since the 18th century. While architects had always used their drawing skills before building their projects these drawings have been the architect's medium to generate ideas and spaces to inform design decisions. The perspectives were used in Renaissances and projective geometry was the highlight in Modernism that leaped the design forward. Traditional architecture was known to be an 'additive process', in which design development and complexity was achieved by overlapping independent signs traced on many layers of papers, yet it could not manage forces and constrains (Terzidis 2004) (Tedeschi, 2014).

The later use of Computer Aided Drafting (CAD) software made the architecture paradigm progress as it helped in improving the ability to perform repetitive tasks as the diagram of Peter Eisenman's House IV did in the 60's. Architecture typology has changed from form-making to form finding in the late 19th century, when the work of Gaudi (1852-1026), Otto (1925) and Isler (1926-2009) had rejected typology and investigated self-formation processes in nature as a way to design buildings and organise them. The architecture paradigm continued to shift with the development of CAD and introduction of Computer Aided Manufacturing (CAM) systems until the current trend of Algorithm Aided Design (AAD) and 3D printing of buildings.

2.2. Parametric architecture

The use of code and mathematical relationships in Architecture has a long tradition (Starvic and Marina, 2011). From hypersurfaces to the exploration of blobs and folds many architects continues to explore new forms (Tersidis, 2004). The traditional space formation and proportions were gradually informed, transformed and reformed by computational and technological possibilities and digital processes. These processes have developed in the past few years with the intensive use of computation capabilities, where codes in architecture are now instructing certain attributes to a building form generating what is now known as Algorithm Aided Design (AAD).

The use of dedicated software solutions for the creation of three-dimensional building models is becoming vital in current architecture practices. Computer Aided Drafting (CAD) software and recently Building Information Modelling (BIM) makes creating complete logical-functional models of a project possible. The benefits of using this technology ranges from increasing architect's visualisation, abstraction skills and productions, improving visual communication of designed buildings while reducing design cost (Fiamma, 2003 and 2011).

In 1939, the Italian architect Luigi Moretti invented the definition "Parametric Architecture". Moretti in collaboration with the mathematician Bruno De Finetti when they investigated in their research the link between the different parameters and the dimension dependent on it in a project that was showcased in an innovative exhibition in Milan, in 1960. In his design of a soccer stadium, Moretti linked the parameters to viewing angles and economic feasibility, where he attempted to optimize views from every position in the stadium.

In the late 1980 the most profound progress has happened in architecture when designers tried to escape simple editing's and manipulated the software from the inside to find unexplored solutions through programming (Tedeschi, 2014). This resulted in creating more complex forms that are beyond human capabilities when allowing the computer to model through a step-by-step procedure or algorithm. The nature of an algorithm in mathematics is to run a procedure that perform a task or return a solution to a question through a finite list of well-defined basic instructions. Parametric or Algorithmic design allow the architect to be the editor of these algorithms using programs like Rhinoceros and Grasshopper developed By Robert McNeel & Associates in 2007 that will allow them to form complex geometries out of simple algorithms.

The increasing use of 3D printing, the wide-spread movement of fab labs, and the creation of innovation hubs or ecosystems in cities reinforce the idea that parametric architecture and digital fabrication technologies is rapidly becoming ubiquitous (Tedeschi and Andreani, 2014). Parametric urbanism in smart and sustainable cities is expected to become the target of architects today that are adopting procedural thinking not typological (Fusero et al., 2013). However, it is equivalently important that current architects respect occupant comfort and health while designing buildings especially ones that have holes due to the parametrisation process it had gone through.

2.3. Trypophobia and architecture

The repulsion of clusters of small objects or holes that are reminiscent of cluster of holes is what Trypophobia was defined with (Cole and Wilkins, 2013). The birth of this phobia is linked in its discovery to the rapid advancement of technology (Aminuddin, and Lotfi, 2017). The inducing stimuli may be a visual scene or an image that presents clusters of objects close in proximity to each other. It was also suggested that not only clusters of pumps or holes cause discomfort, but also clusters of other objects, like eyes, could stimulate an aversion reaction. Examples of these images are found in nature as seen in the patterns of a barnacles and honeycomb. Few researchers were capable of recording the symptoms of this phobia conditions such as sweating, discomfort, panic and even vomiting (Le 2015). Limited literature exists in relation to this condition and it has not yet been classified as a phobia by DSM-5.

By comparing the natural images to architectural ones, some spatial properties are common making them a possible tryphobia trigger and stress generator which could result in visual discomfort leading to headaches and seizures in susceptible people (Fernandez and Wilkins, 2008). Buildings can stress and stimulate its users by the amount of information it has in a setting or object that has different complexity, variety and intensity (Evans and McCoy, 1998). Parametric building designs for sure has a level of complexity and variety in its stimulation but too much stimulation is argued to cause distraction and overload that may interfere with users' cognitive process that may demand concentration. This research argues that current architecture trends like parametric architecture forms and spatial properties can cause distress to some individuals visual system in Arab cultures similar to that in the United Kingdom or Japan were other studies had taken place.

3. Research Methodology

Trypophobia is a psychological condition that has never been investigated in Bahrain before. Thus, the first logical step in the formation of the research design was to locate studies, which were done elsewhere in the world, and adopt their methodologies if possible to the Bahraini scene.

This research adopted the Trypophobia Questionnaire (TQ), a method for measuring proneness to trypophobia that was used in a number of studies in the UK and Japan before, see (Cole & Wilkins 2013; Le 2015; Chaya et al. 2016). Some researchers questioned the viability of the TQ, nevertheless, no alternative measuring tool for the condition yet exist. (Imaizumi & Tanno 2018) assessed the Rasch-based psychometric properties of the TQ measuring proneness to trypophobia. Their study concluded that although they were able to prove slightly improved psychometric properties by using the Rasch model, nevertheless, their findings were not conclusive enough to determine whether another version of the TQ should be used.

The Trypophobia Questionnaire (TQ) requires the participants to view pictures of stimuli's, in most cases, the Lotus Pod Seed and a honeycomb. Then to rate on a scale from "1. Not at all" to "5. Extremely" the degree to which they experienced the following emotions upon viewing the pictures:

1. Feel freaked out
2. Feel aversion, disgust or repulsion
3. Feel uncomfortable or uneasy
4. Feel like panicking or screaming
5. Feel anxious, full of dread or fearful
6. Feel sick or nauseous
7. Feel nervous (e.g., heart pounding, butterflies in stomach, sweating, stomach ache, etc.)
8. Feel like going crazy
9. Have an urge to destroy the holes Feel itchiness
10. Feel skin crawl
11. Have Goosebumps

12. Feel like crying
13. Vomit
14. Get chills
15. Have trouble breathing
16. Shiver

In addition to stimuli's from nature and for the purpose of this study, participants were also asked to view two pictures of buildings that have spatial properties closest to the natural stimuli's and rate again on a similar scale the degree to which they felt the emotions mentioned above.

The ethical committee at the University of Bahrain reviewed the questionnaire in December 2017, and the following month, a total of 117 responses from the public were collected by students in various places around the country using iPad of a similar size. On average, it took the participants about 7 minutes to complete the questionnaire. 64 female and 53 male participants took part in the study, the youngest of which was 18 years old and the eldest was 83. 44 of the participants completed the questionnaire in Arabic and 73 used the English version.

Survey Monkey was used to design the questionnaire and collect the data from iPad. Each of the questions in the survey was designed to answer one of the research inquiries. After asking for some demographic information, the first questions aimed to measure the baseline of the tryphobic population in Bahrain and the most experienced emotions upon viewing the images. The last question aimed at investigating the difference between reactions to natural and humanmade stimuli's.

All of the gathered data were stored in Survey Monkey in a secured account online. The data set was then organized using Microsoft Excel and processed using SPSS to find the relationship links between the responses.

4. Research Findings

The responses gathered by the contributing students and analysed by the research team demonstrated that 39.32% of the participants have indicated that tryphobic images affected them at least once a year, thus, can be categorised as tryphobic to at least a slight degree. 10.26% of the participants indicated that tryphobic images

affected them once every month or more, those can be considered moderately tryphobic and 8.55% of the participants' noted that tryphobic photos affected them once every week or more, thus, are severely tryphobic.

Participants' reaction to natural and manmade stimuli's needed to be compared. Results indicated that 73.5% of the participants did not feel any reaction towards natural stimuli's. Therefore, are not tryphobic". 26.50% of the participants had some degree of reaction to the natural stimuli's. Accordingly, the research findings indicate that the baseline for the tryphobic population in Bahrain is between 26.5% and 39.32%. It was also noted that in average 5.98% of the participants indicated that they experienced the reactions to natural stimuli's moderately and only 1.71% of the participants experienced considerable and extreme reactions.

The most experienced emotions to natural stimuli's were feeling uncomfortable or uneasy, feeling aversion, disgust or repulsion and having goose bumps. On the other hand, the least experienced emotions were feeling like crying, vomiting, having trouble breathing, feeling like panicking or screaming, feeling like going crazy and shivering.

The findings showed a difference in the respondents' reaction towards natural and manmade stimuli's. It was found that 85.47% of the participants did not feel any reaction to man-made stimuli's. In the other hand, 14.53% of the participants had some degree of reaction to man-made stimuli's, 5.13% had at least moderate reactions to the humanmade stimuli's and similar to natural stimuli's 1.71% of the participants experienced considerable and extreme reactions to man-made stimuli's.

As for the degree of reactions, the most severe emotions to humanmade stimuli's were feeling uncomfortable or uneasy and having goose bumps and the least severe were feeling like crying and having trouble breathing.

In conclusion, the findings indicated that reactions towards natural stimuli's are more severe than humanmade stimuli's, almost double. Nevertheless, responses toward humanmade stimuli's are still significant and are worthy of further exploration. 14.53% of the sample reacted in some degree to the humanmade stimuli's, and 1.71% reported severe reactions. This raises serious questions about the effects of humanmade stimuli's in our urban environment on the health of this percentage of the public if more buildings were designed in ways to induce tryphobia.

5. Discussion

The results of this study add to the accumulating body of literature that discusses visual discomfort in general and tryphobia in particular and are some of the very

few that linked the condition to architecture. Ruggiero et al. (2009) discussed the relationship between visual discomfort and the features of traditional architecture like symmetry and repetitive simplicity. In contrary, this study draws insight on the relationship between visual discomfort and contemporary parametric design.

The responses gathered in this study presented similar findings to the UK research of Cole and Wilkins (2013) and Le et al. (2015) and the Japanese study of Chaya et al. (2016). The results confirmed the sensitivity of some of Bahrain's participants to tryphobia inducing stimuli's. The Bahraini sample, similar to the Japanese represented a higher discomfort level than the British (Chaya et al., 2016, 2016; Cole & Wilkins, 2013;). This suggests the possibility that the substantial incidence may not be particular to Bahrain but generalize to Asia. Thus, the findings are of great importance to Bahrain and the region because such high levels of discomfort to both natural and humanmade stimuli's could easily cause headaches and seizures to vulnerable subjects (Fernandez and Wilkins, 2008).

The findings confirm that some of the contemporary architectural solutions deviate from the consistent spatial properties that are comfortable for the visual system to process. Such findings are in line with Ostwald (2004) claim that digital architecture is now becoming a nihilistic playground for architects who are interested in the generation of new forms. The paradigm shift in architecture has changed the basic principles of design, and the known architect's values, expectations, theories and knowledge in designing buildings and cities as concluded by Terzidis (2004). The results of this study could be used to suggest visual comfort guidelines to contemporary architects who are practicing in the digital paradigm; for instance, a stop function could be added to design software's when the created shape is no longer visually comfortable in a particular scale. Moreover, the findings here stresses the need to use visual comfort as a parameter that governs algorithms in parametric architecture, particularly when designing buildings that requires such special attention to the visual comfort of occupants like health care facilities.

The research findings showed that the reaction of the participants was stronger to natural versus man-made stimuli, which seems to be in accordance with the possibility recently raised by researchers that the phobia might be associated with an evolutionary residue of a reaction to toxin or skin disease.

There is a possibility to generalise the findings of this study to other neighbouring Arabian Gulf countries since similar cultural and behavioural patterns are dominating.

Nevertheless, country specific surveys are encouraged, particularly in the Gulf Cooperation Council as a next step towards the advancement of knowledge on visual comfort in the region.

Additionally, the understanding of visual discomfort generated by the contemporary designs of building should be the focus of design education in college. Students should learn at an earlier stage that although the computer software's of today allow the design of numerous highly complex shapes, they are not necessarily comfortable to the eye or healthy to their occupants and that the basic design principles of symmetry, harmony, contrast, hierarchy, and rhythm should always be the guiding principles to any design. This study recommends a more guided and informed digital design process for both architecture practitioners and students and that radical intervention to the basic design principles are tested for issues of visual discomfort.

6. Conclusion and Recommendations

This study investigated the baseline of the tryphobic population in Bahrain and the severity of the condition in comparison to other parts of the world. The Bahraini sample, similar to the Japanese in the literature, represented a higher discomfort level to stimuli's than the British, suggesting the possibility that the substantial incidence is not particular to Bahrain but generalize to Asia and that culture is a determining factor in perceiving discomfort.

The study also compared between the respondent's reactions to natural versus architecture humanmade stimuli's. The results indicated a significantly larger reaction to natural stimuli's, almost double, nevertheless; reactions to architecture stimuli's were also notable suggesting the need to carefully assess the level of visual comfort of new digital designs. The study recommends setting guidelines of visual comfort into design software's to alert designers when they deviate from the comfortable spatial properties that are comfortably processed by the human brain.

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References

- [1] Aminuddin, I. and Lotfi, H.A., 2017. Understanding tryphobia: the fear of holes. *Malaysian Journal of Psychiatry*, 25(2).
- [2] Chaya, K. et al., 2016. Fear of eyes: Triadic relation among social anxiety, tryphobia, and discomfort for eye cluster. *PeerJ*, 4(9).
- [3] Cole, G. and Wilkins, A., 2013. Fear of Holes. *Psychological Science*, 24(10), pp.1980-1985.
- [4] Cordero, E., 2001. *Sustainability in Architecture* (Doctoral dissertation, Massachusetts Institute of Technology)
- [5] Evans, G.W. and McCoy, J.M., 1998. When buildings don't work: The role of architecture in human health. *Journal of Environmental psychology*, 18(1), pp.85-94.
- [6] Fiamma, P., 2003. Architectural design and digital paradigm: From Renaissance models to digital architecture. In *Connecting crossroads of digital discourse* (Proceedings of the 22nd Annual Conference of the Association for Computer-Aided Design in Architecture). India-napolis: ACADIA (pp. 247-253).
- [7] Fiamma, P., 2011. Architecture: from Generative Design. DISEGNARE CON, pp.152-161.
- [8] Fusero, P., Massimiano, L., Tedeschi, A. and Lepidi, S. (2013). Parametric Urbanism: A new frontier for smart Cities, *Planum, The Journal of Urbanism*, 27(2), pp. 1-13.
- [9] Imaizumi, S. & Tanno, Y., 2018. Rasch analysis of the Tryphobia Questionnaire. *BMC Res Notes*, 11(128).
- [10] Kupfer, T.R., Le, A.T.D., 2018. Disgusting clusters: tryphobia as an overgeneralised disease avoidance response. *Cognition and Emotion* 32, 729-741.
- [11] Le, A.T., 2015. *An exploration of tryphobia* (Doctoral dissertation, University of Essex).
- [12] Oxman, R., 2008. Digital architecture as a challenge for design pedagogy: theory, knowledge, models and medium. *Design Studies*, 29(2), pp.99-120.
- [13] Ruggiero, F., Florensa, R. S., & Dimundo, A. 2009. Re-interpretation of traditional architecture for visual comfort. *Building and Environment*, 44(9), .1886-1891
- [14] Stavric, M. and Marina, O., 2011. Parametric modelling for advanced architecture. *International journal of applied mathematics and informatics*, 5(1), pp.9-16.
- [15] Tedeschi, A. and Andreani, S., 2014. *AAD, Algorithms-aided Design: Parametric Strategies Using Grasshopper*. Le Penseur Publisher.

- [16] Terzidis, K., 2004. Algorithmic Design: A Paradigm Shift in Architecture? *Architecture in the Network Society [22nd eCAADe Conference Proceedings/ISBN 0-9541183-2-4] Copenhagen (Denmark) 15-18 September 2004, pp. 201-207, pp.201-207.*

Conference Paper

Optimization of Polymerase Chain Reaction to Overcome Contamination of Deionized Water and Plumbing Premises By *Pseudomonas* spp. in Molecular Biology Laboratory

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Abstract

The purpose of the current study is to introduce specific optimization steps to overcome non-specific binding of primers to contaminating DNA. The applied modifications provide applicable solutions especially if large number of primer aliquots were contaminated and the cost to replace them is high. Several steps were taken to achieve complete mitigation of non-specific binding: reducing the concentration of both forward and reverse primers, reduction in the total number of PCR cycles from 35 to 25, increasing the annealing temperatures, doing filter sterilizations (0.2 µm Thermo Scientific polyethersulfone membrane) for the deionized water (DI) used in PCR and in certain cases reducing the extension time. The optimization steps carried in this work were successful in eliminating non-specific binding of primers to contaminating DNA found in primer aliquots.

Keywords: Plumbing Premises, Water Contamination, PCR, *Pseudomonas*, Deionized Water

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Selection and Peer-review under the responsibility of the Sustainability and Resilience Conference Committee.

1. Introduction

Contamination of piping and plumbing premises with gram negative bacteria is well documented [1–3]. Among other gram negative bacteria, *Pseudomonas* species inhabit most of the water systems in both industrial and research laboratories [4]. Reports on enumeration of such species became basic routine in certain countries [4]. In University of Bahrain there is continues monitoring for changes in numbers of *Pseudomonas* in water systems. Premises at university use “deionization units” to provide required deionized water (DI) for laboratory procedures. Tested water samples showed high titers of isolated *Pseudomonas* spp. In both tap and deionized waters.

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Deionized water used in PCR is usually sterilized by autoclaving for 15 minutes at 121°C and 15 psi [5]. After autoclaving, heat-stable DNA from dead cells would contaminate subsequent processes such as PCR mixtures and primer aliquots. As a consequence of this step, nonspecific binding of primers due to contaminating DNA would result in false amplifications. The purpose of the current study is to introduce specific optimization steps to overcome nonspecific binding of primers to contaminating DNA coming from contaminated primer aliquots. The applied modifications provide applicable solutions especially if large number of primer aliquots were contaminated and the cost to replace them is high. An estimated cost for single primer would range between \$10-35. Thus for research projects that use a large number of primers, it would cost a lot to replace all primer aliquots contaminated with DNA.

2. Protocol

2.1. Culture media for isolation of *Pseudomonas* spp.

Conventional isolation techniques (standard most probable number techniques) for isolation and enumeration of *Pseudomonas* bacteria were used [6]. *Pseudomonas* were cultivated on asparagine agar media for isolation and enumeration [6]. Other Conventional methods applied to test for presence of coliforms and other possible pathogenic species were carried out too [7].

2.2. PCR conditions

The amplifications were carried using the KAPA2G Fast PCR kit under the following conditions (total reaction volume 25 µl): 0.5 units of KAPA2G Fast DNA polymerase, 0.2mM of dNTPs, 0.5µM forward and reverse primers. The PCR conditions were as following (TECHINE GENIUS thermocycler): initial denaturation at 95°C for 2 minutes, 35 cycles of 10 seconds at 95°C, 10 seconds at 62°C, and 1 second at 72°C. Final extension was for 10 minutes at 72°C.

2.3. Gel electrophoresis

1% agarose was prepared for most amplification runs in this study. The gels were stained with ethidium bromide (0.5µg/ml) for 30 minutes and de-stained before visualization. DNA ladder used is GeneRuler from Thermo Fisher Scientific.

3. Representative Results

The optimization process started with the reduction in the concentrations of both forward and reverse primers (Figure 1-panel B). In the original protocol, the final concentration of both primers was 0.5 μM [8] and was reduced to 0.1 μM . The intensity of the false bands was reduced but not eliminated (Figure 1-panel B). Then the following steps were performed, reduction in total number of PCR cycles from 35 to 25, increasing the annealing temperatures (upon the T_m of primers), doing filter sterilizations (0.2 μm Thermo Scientific polyethersulfone membrane) for the deionized water (DI) used in PCR and in certain cases reducing the extension time (depends on product size). After applying these optimization steps, no non-specific binding was noticed (Figure 1-panel D).

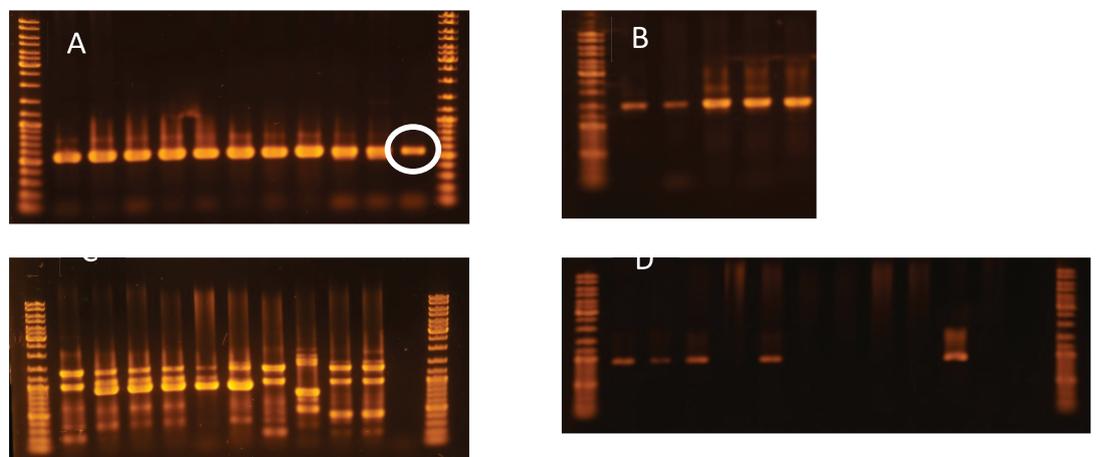


Figure 1: Panel A. Amplification of PCR products using autoclaved deionized water. The white circle shows the non-specific PCR product in the negative control. Panel B. A non-specific PCR amplicon produced in a negative control sample. In this part, different concentrations of primers were used (from left to right the concentrations of primers were: 0.1, 0.2, 0.3, 0.4 and 0.5 μM). Panel C. After the use of filter sterilized deionized waters (0.2 μm Thermo Scientific polyethersulfone membrane) no false amplifications were noticed in the negative control (last column). Panel D. The same amplification in panel C but after applying the optimization steps (e.g., reduction in total number of PCR cycles from 35 to 25, increasing the annealing temperatures). DNA ladder used is GeneRuler from Thermo Fisher Scientific.

4. Discussion

Molecular diagnosis laboratories in hospitals and universities use deionization units to provide water for identification and detection of pathogens and reporting of human diseases [9]. However, as reported before these piping systems are considered the source of contamination for molecular diagnostics protocols as different bacterial populations inhabit these premises [9]. The current study shows the importance of using (0.2 μm) filters to sterilize (DI) water. The study used 0.2 μm filters instead of 0.45

μm to avoid possible contamination of certain species of bacteria such as *Mycoplasma*, known to pass through the $0.45 \mu\text{m}$ filters [10].

The study investigated the presence of *Pseudomonas* spp in water premises of University of Bahrain. However, other bacterial species were noted too (data not shown). No pathogenic or coliforms were detected with conventional procedures in samples studied.

The optimization process started with the reduction in the concentrations of both forward and reverse primers $0.1 \mu\text{M}$. According to previous studies primer concentrations in PCR reactions are the most likely cause of non-reproducible amplifications and that most of these are dependent on primers' sequences [11]. However, further optimization steps were required to mitigate the effects of contamination. According to [8] the primers are not completely used up during the amplification. However, due to the accumulated products at the end of the amplification process the primers would struggle to find their target sequences. Therefore, to avoid high primer concentrations which might increase unspecific priming I reduced the number of PCR cycles to 25 instead of 35 (Figure 1-panels D). Reducing the number of PCR cycles has been found to enhance the amplification process and reduces the smear effects as can be seen in Figure 1-panels C and D [12]. The elimination of the non-specific binding was achievable after applying all optimization steps mentioned above and in certain cases reducing the extension time.

The optimization steps observed exclude the need for other methods previously applied to reduce reagents' contamination: UV and gamma radiations, DNase, restriction digests, plus other chemical treatments [13–20]. All of these methods come with drawbacks such as reduction in enzyme activity due to radiation or DNase treatments, or an increase in the amount of contaminating DNA if restriction enzymes were used [13–20].

The current investigation pinpoint to the importance for more controls and tests when working with culture independent methods as contaminants from different sources might intervene with the obtained results and subsequent analysis.

5. Conclusion

In the current study several steps were applied to reduce/eliminate the effects of contaminating DNA coming from deionized water. The optimization steps were successful to eradicate the effects of the contaminants; however, the optimization steps might not suite different amplification protocols such as multiplex PCR. Moreover, the

optimization steps will not optimize for contaminants of the same species tested if the primer aliquots were the source of contamination.

Disclosures

I have nothing to disclose.

References

- [1] Favero, M. S., N. J. Petersen, L. A. Carson, W. W. Bond, and S. H. Hindman. Gram-negative water bacteria in hemodialysis systems. *Health Lab. Sci.* 12 321-334., (1975).
- [2] White, D. C., and M. W. Mittleman. in *In Proceedings of the Ninth Annual Semiconductor Pure Water Conference*, 17 and 18 January 1990, Santa Clara, Calif. 150-171.
- [3] Matsuda, N., W. Agui, T. Tougou, H. Sakai, K. Ogino, and M. Abe. Gram-negative bacteria viable in ultrapure water isolated from ultrapure water and effect of temperature on their behavior. *Colloids Surf. B Biointerfaces.* 5 279-289, (1996).
- [4] Kulakov LA, M. M., Ogden KL, Larkin MJ, O'Hanlon JF. Analysis of bacteria contaminating ultrapure water in industrial systems. *Appl Environ Microbiol.* 68 1548-1555, (2002).
- [5] Raja, C. E. A., Kolandaswamy; Selvam, Govindan Sadasivam. Isolation and Characterization of A Metal-resistant *Pseudomonas Aeruginosa* Strain. *World Journal of Microbiology and Biotechnology.* 22 (6), 577-585, (2006).
- [6] Hihgsmith, A. K. A., R.L. Evaluation of most-probable-number technique for the enumeration of *Pseudomonas aeruginosa*. *Appl. Microbiol.* 30 596-601., (1975).
- [7] Grabow WOK, H. C. a. C. P. Evaluation of standard and modified M-FC, MacConkey, and Teepol media for membrane filtration counting of faecal coliforms in water. *Appl Environ Microbiol.* 42 192-199, (1981).
- [8] T, C. High primer concentration improves PCR amplification from random pools. *Nucleic Acids Res.* 24 985-986, (1996).
- [9] Salter S, C. M., Turek EM, Calus S, Moffatt M, Turner P, Parkhill J, Loman NJ and Walker AW. Reagent contamination can critically impact sequence-based microbiome analyses. *BMC Biol.* 12 87, (2014).
- [10] Drexler., C. C. U. a. H. G. in *Methods in Molecular Biology* Vol. 946 1-13 (2013).

- [11] Hennessy L. K., T. J. a. K. C. &. PCR conditions and DNA denaturants affect reproducibility of single-strand conformation polymorphism patterns for BRCA1 mutations. *Clin. Chem.* 44 879–882, (1998).
- [12] Bell, D. A., & DeMarini, D. Excessive cycling converts PCR products to random-length higher molecular weight fragments. *Nucleic Acids Reseach.* 19 5079, (1991).
- [13] Rand KH, H. H. Taq polymerase contains bacterial DNA of unknown origin. *Mol Cell Probes.* 4 445–450, (1990).
- [14] Deragon JM, S. D., Mitchell G, Potier M, Labuda D. Use of gamma irradiation to eliminate DNA contamination for PCR. *Nucleic Acids Res.* 18 6149., (1990).
- [15] Sarkar G, S. S. Shedding light on PCR contamination. *Nature.* 343 27, (1990).
- [16] Hughes MS, B. L., Skuce RA. Identification and elimination of DNA sequences in Taq DNA polymerase. *J Clin Microbiol.* 32 2007–2008, (1994).
- [17] Corless CE, G. M., Borrow R, Edwards-Jones V, Kaczmarek EB, Fox AJ. Contamination and sensitivity issues with a real-time universal 16S rRNA PCR. *J Clin Microbiol.* 38 1747–1752., (2000).
- [18] Klaschik S, L. L., Raadts A, Hoeft A, Stuber F. Comparison of different decontamination methods for reagents to detect low concentrations of bacterial 16S DNA by real-time-PCR. *Mol Biotechnol.* 22 231–242, (2002).
- [19] Tamariz J, V. K., Prinz M, Caragine T. The application of ultraviolet irradiation to exogenous sources of DNA in plasticware and water for the amplification of low copy number DNA. *J Forensic Sci.* 51 790–794, (2006).
- [20] Vaishampayan P, P. A., La Duc MT, Bargoma E, Benardini JN, Andersen & GL, V. K. New perspectives on viable microbial communities in low-biomass cleanroom environments. *ISME J.* 7 312–324., (2013).

Conference Paper

Thermodynamics of Dissociation and Micellization of Sodium Surfactant Solutions in Formamide

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Abstract

Electrical conductivity and surface tension measurement of sodium surfactants, such as sodium caprylate, sodium laurate, sodium palmitate and sodium stearate, in formamide has been determined at different temperatures. The methods show that micelles are formed in formamide solution. Critical micelle concentration (CMC) has been determined for each of the sodium surfactants. The result show that these surfactants behave as a weak electrolyte in dilute solution of formamide below the critical micellar concentration, and the conductance result can be explained on the basis of Ostwald's formula and Debye-Huckel's theory of weak electrolytes. The dissociation constant and thermodynamic parameters for dissociation and micellization processes of these surfactants are also evaluated. The micellization process has been found to be predominant over the dissociation process.

Keywords: Critical Micelle Concentration (CMC), Micellization, Conductivity, Dissociation, Thermodynamics, Surface Tension

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1. Introduction

The study of metallic soaps is becoming increasingly important in technological and academic fields. It has been a subject of intense investigations in the recent past on account of its role in such diversified fields as detergents, softeners, stabilizers, plasticizer, lubricants, cosmetics, medicines, emulsifier, insecticides and water-proofing agents [1–9].

Several researchers [10–19] have prepared transition metallic soaps by treating the fatty acid with the requisite amount of metal oxide or hydroxide in the presence of aqueous to non-aqueous solutions. The critical micelle concentration (CMC) of these soap solutions, both in aqueous and in non-aqueous or in mixture of these solvents at different temperatures were determined using conductometrically and by ultrasonic

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velocity measurements. Few researchers [19, 20] studied the thermodynamics of dissociation and micellization of metallic soaps in mixed organic solvents to determine physicochemical properties and structures.

The present work deals with the evaluation of CMC values, degree of dissociation (α), dissociation constants (K_d), of sodium surfactants (caprylate, laurate, palmitate and stearate) in formamide by conductivity and surface tension measurements at different temperatures. These two methods are used to check the reliability and reproducibility of CMC values. The various aspects of the interaction of these surfactants in formamide during micelle formations are also discussed. Molar conductance at infinite dilution and the determination of thermodynamic parameters for sodium surfactants in formamide by conductivity measurements at different temperatures were also determined. Formamide, a non-aqueous solvent was chosen, because of its relative permittivity of 109.5 and surface tension of 58.5 mNm^{-1} at 25°C , has sufficient cohesive force to favor adsorption and micellar aggregation, while its dielectric properties ensure that solutions of ionic surfactants have electrolyte properties closely resembling those of aqueous solutions [9]. Some of the physical properties of water and formamide which influence micelle formation are given in table I [21, 22].

TABLE 1: A comparison of some of the physical properties of formamide and water.

Property	Formamide ²⁰	Water ²¹
Dipole moment, D	3.37	1.87
Dielectric constant	109.5 (20°C)	78.45 (25°C)
Surface tension, Nm^{-1}	58.35 (20°C)	62.60 (80°C)
Viscosity, cp	3.764 (20°C)	0.3547 (80°C)
Specific conductance, Scm^{-1}	2×10^{-7} (20°C)	10^{-6} (25°C)

2. Experimental

Formamide was obtained from FLUKA (purity >99%), specific conductance of the formamide at 22°C was found to be $2 \times 10^{-7} \text{ S cm}^{-1}$. For quality assurance purposes, the surface tensions of surfactant solutions are determined using a stalagmometer (TRAUB'S STALAGMOMETER Model 4855). The instrument consists of a straight tube which widens out in the upper part to form a bulb and narrows to a capillary tube in lower part, the open of which is ground smooth. The instrument is calibrated using water and formamide.

All the surfactants used in the present work obtained from FLUKA (purity > 99%), and were used without further purification. Specific conductivities of the solutions

were measured at a different temperature using a CRISON Model 225 CONDUCTMETER and a dipping cell with platinum electrodes (cell constant = 0.12 cm^{-1}). The reproducibility of the instruments was better than 0.1%, and accuracy was better than 0.2%.

3. Results and Discussion

Molar conductance, Λ , of sodium surfactant solutions in formamide decreased with increasing concentration and chain length of the surfactants are reported in table II. For each of the surfactant a drop in the molar conductivity is observed at a concentration, to determine the CMC as described elsewhere [23–27]. The decrease in molar conductivity is attributed to the combined effects of ionic atmosphere, solvation of ions, and decrease of mobility and ionization with the formation of micelles. Similar behavior was observed in using surface tension method (table II). For calculating CMC, tangents are drawn on the two portions (pre-micellar and post micellar regions) of the plots. Points of intersection of these tangents give the CMC [23–27]. The CMC values by these methods are reported in Table III which shows that micelle formations take places at a define soap concentration. It may be noted from Table III that the CMC values, obtained from surface tension measurements, are, in general, appreciably lower than those obtained from the conductance being presumably due to the difference in precision obtained in two methods.

TABLE 2: Molar conductance and surface tension of sodium (caprylate, laurate, palmitate and stearate) in formamide at $25^\circ\text{C} \pm 0.2^\circ\text{C}$.

$c \times 10^4 / \text{mol L}^{-1}$	Caprylate		Laurate		Palmitate		Stearate	
	$\Lambda / S \text{ cm}^2 \text{ mol}^{-1}$	γ / Nm^{-1}	$\Lambda / S \text{ cm}^2 \text{ mol}^{-1}$	γ / Nm^{-1}	$\Lambda / S \text{ cm}^2 \text{ mol}^{-1}$	γ / Nm^{-1}	$\Lambda / S \text{ cm}^2 \text{ mol}^{-1}$	γ / Nm^{-1}
0	2.300	0.032	2.240	0.030	2.200	0.028	2.140	0.026
3.0	2.140	0.029	2.100	0.027	2.060	0.026	2.020	0.025
4.0	2.080	0.027	2.000	0.026	1.960	0.025	1.920	0.024
5.0	1.920	0.025	1.900	0.024	1.840	0.023	1.800	0.022
6.0	1.780	0.024	1.720	0.023	1.700	0.022	1.760	0.021
7.0	1.700	0.022	1.680	0.021	1.640	0.020	1.620	0.019
8.0	1.600	0.020	1.580	0.019	1.560	0.018	1.520	0.016
9.0	1.540	0.019	1.540	0.018	1.520	0.017	1.500	0.015
10.0	1.500	0.018	1.480	0.017	1.460	0.016	1.420	0.014

This behavior suggests that the surfactants form micelle in formamide. It was also observed that the higher the chain length of the surfactant, the lower the solubility of

TABLE 3: Critical micelle concentration (CMC) of sodium surfactants in formamide at 25°C ± 0.2 °C.

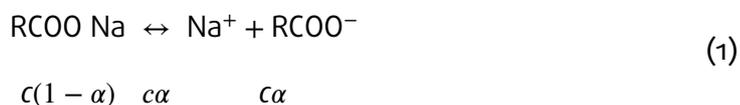
surfactant	C _n	CMC x 10 ⁴ .molL ⁻¹	
		A ^a	B ^b
Sodium caprylate	C ₈	8.6	8.0
Sodium laurate	C ₁₂	7.6	7.4
Sodium palmitate	C ₁₆	6.8	6.5
Sodium stearate	C ₁₈	6.2	6.1

^aConductivity method; ^bSurface tension method

the surfactant in formamide. Similar behavior has been reported for these surfactants in aqueous solution^{28–32}.

CMC for these surfactants in formamide is lower than in water at 22°C^{28–32}. As mentioned earlier, the dielectric constant of water is lower than the dielectric constant of formamide, and the dipole moment of formamide is twice that of water. It seems that dielectric constant plays a more dominant role in CMC formation than dipole moment. The ionization of the surfactants in formamide is higher than in water because formamide has a higher dielectric constant. Therefore, there is tendency of forming micelle at a lower concentration. The CMC for these surfactants in formamide shows that sodium surfactants behave as weak electrolytes in dilute solutions, and the extended Debye–Huckel–Onsager equation is not applicable to these surfactant solutions.

The probable mode of dissociation of surfactants in formamide can be represented as follows:



Where α is a degree of dissociation of surfactants. The dissociation constant K_d can be written as:

$$K_d = \frac{[\text{Na}^+][\text{RCOO}^-]}{[\text{RCOONa}]} = \frac{c\alpha^2}{(1 - \alpha)} \quad (2)$$

Since ionic concentrations are low and interionic effects are almost negligible in dilute solutions, the solutions of surfactants do not deviate appreciably from ideal behavior, and the activities of ions can be taken as almost equal to concentrations. The degree of dissociation, α , may be replaced conductance ratio Λ/Λ_∞ , where Λ is the molar conductance at finite concentration and Λ_∞ is the limiting molar conductance at infinite dilution.

By substituting the value of α and rearranging equation (1) can be written as follows

$$c\Lambda = \frac{K_d\Lambda_0}{\Lambda} - K_d\Lambda_0 \tag{3}$$

The values of K_d from table V were calculated from the slope ($K_d\Lambda_0^2$) and intercept ($-K_d\Lambda_0$) of the linear portion of the plots of $c\Lambda$ vs. $1/\Lambda$ below the CMC (table IV and figure I. It is seen that the values of K_d decreased with an increase in the numbers of carbon atoms in the surfactant molecules, i.e. with increasing chain length of the surfactant.

TABLE 4: The values of Λc and $1/\Lambda$ for sodium surfactants in formamide at $25^\circ\text{C} \pm 0.2^\circ\text{C}$.

Caprylate		Laureate		Palmitate		Stearate	
$\Lambda c \times 10^7 / \text{Scm}^2\text{L}^{-1}$	$1/\Lambda / \text{S}^{-1}\text{cm}^{-2}\text{mol}$	$\Lambda c \times 10^7 / \text{Scm}^2\text{L}^{-1}$	$1/\Lambda / \text{S}^{-1}\text{cm}^{-2}\text{mol}$	$\Lambda c \times 10^7 / \text{Scm}^2\text{L}^{-1}$	$1/\Lambda / \text{S}^{-1}\text{cm}^{-2}\text{mol}$	$\Lambda c \times 10^7 / \text{Scm}^2\text{L}^{-1}$	$1/\Lambda / \text{S}^{-1}\text{cm}^{-2}\text{mol}$
5.70	0.435	5.48	0.446	5.40	0.455	4.28	0.467
6.88	0.467	6.46	0.476	6.18	0.485	5.56	0.495
7.82	0.481	8.00	0.500	6.76	0.510	6.92	0.521
9.50	0.521	8.60	0.526	8.20	0.543	8.10	0.556
10.70	0.562	10.60	0.581	10.20	0.588	9.11	0.568
11.90	0.588	11.80	0.595	11.50	0.610	10.30	0.617
13.10	0.625	12.85	0.633	12.50	0.641	12.20	0.658
14.00	0.641	13.90	0.649	13.70	0.658	13.00	0.667
15.00	0.667	14.80	0.676	14.60	0.684	14.20	0.704

TABLE 5: Values of Λ_0 and K_d as obtained from the plot of Λc vs. $1/\Lambda$ for sodium surfactants in formamide at various temperatures.

Surfactants	298 K		303 K		308 K		313 K	
	$\Lambda_0 / \text{Scm}^2\text{mol}^{-1}$	$K_d \times 10^4$						
Sodium caprylate	8.540	0.953	8.685	0.944	8.830	0.929	8.922	0.914
Sodium laurate	8.143	1.372	8.286	1.356	8.424	1.333	8.510	1.310
Sodium palmitate	8.019	1.424	8.156	1.406	8.294	1.380	8.378	1.356
Sodium stearate	7.987	1.576	8.124	1.552	8.262	1.526	8.342	1.498

However, the decrease in the values of dissociation constant with increasing temperature indicates the exothermic nature of the dissociation of sodium surfactants in formamide.

The heat of dissociation, ΔH_d , for sodium surfactants is determined with the following equation

$$\frac{\partial(\log K_d)}{\partial T} = \frac{\Delta H_d}{RT^2} \tag{4}$$

TABLE 6: Values of Thermodynamic Parameters G_m^o , H_m^o and S_m^o for sodium surfactants in formamide at $25^\circ\text{C} \pm 0.2^\circ\text{C}$.

Surfactants	C_n	$\Delta G_m^o / \text{kJmol}^{-1}$	$H_m^o / \text{kJmol}^{-1}$	$S_m^o / \text{Jmol}^{-1}\text{K}^{-1}$
Sodium Caprylate	C_8	-25.31	-4.89	68.5
Sodium Laurate	C_{12}	-25.56	-6.64	63.5
Sodium palmitate	C_{16}	-25.86	-7.02	63.2
Sodium Stearate	C_{18}	-26.18	-7.43	62.6

$$\log K_d = -\frac{\Delta H_d}{2.303RT} + C \tag{5}$$

The values of heat of dissociation, ΔH_d , were obtained from the slopes of the linear plots of $\log K_d$ vs. $1/T$ (Figure 2), and are shown in table VI. The negative values of heat of dissociation, ΔH_d , indicate that the dissociation process for sodium surfactants is exothermic in nature.

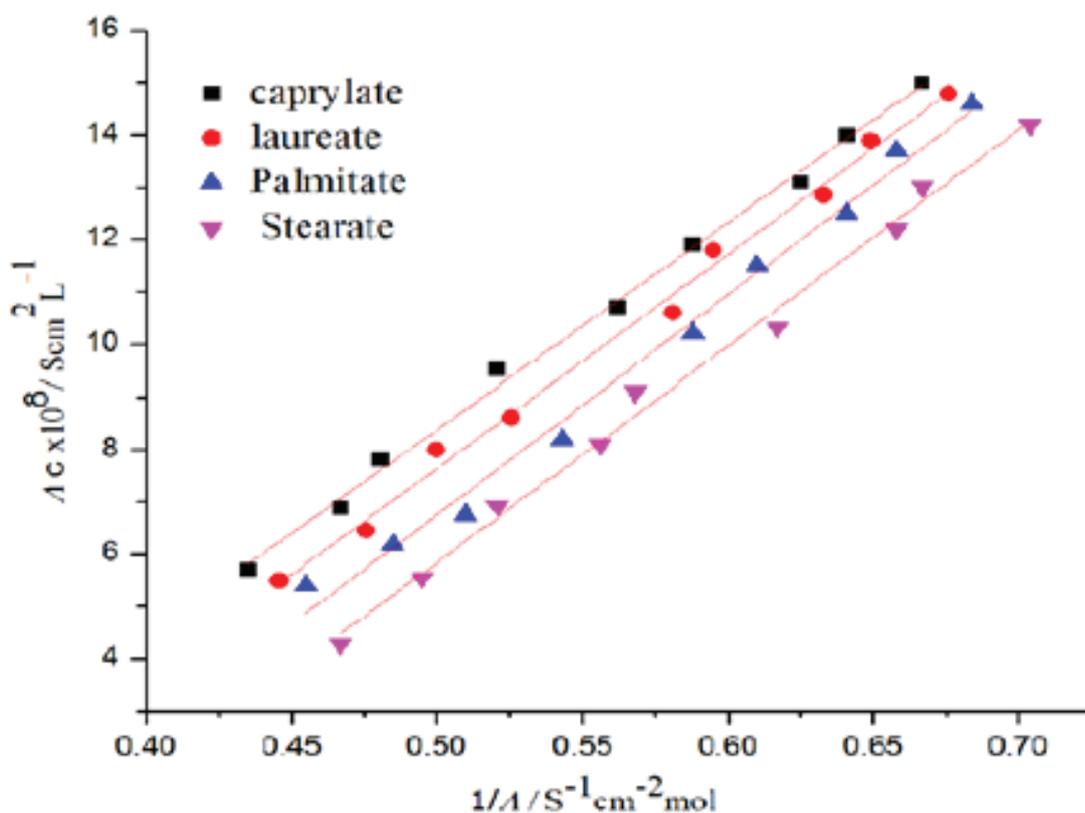


Figure 1: The plot of ΔG vs. $1/\Delta$ for sodium surfactants in formamide at $25^\circ\text{C} \pm 0.2^\circ\text{C}$.

The values of change in free energy, ΔG_d and entropy, ΔS_d per mole for the dissociation process are calculated by using the relationships:

$$\Delta G_d = -RT \ln K_d \tag{6}$$

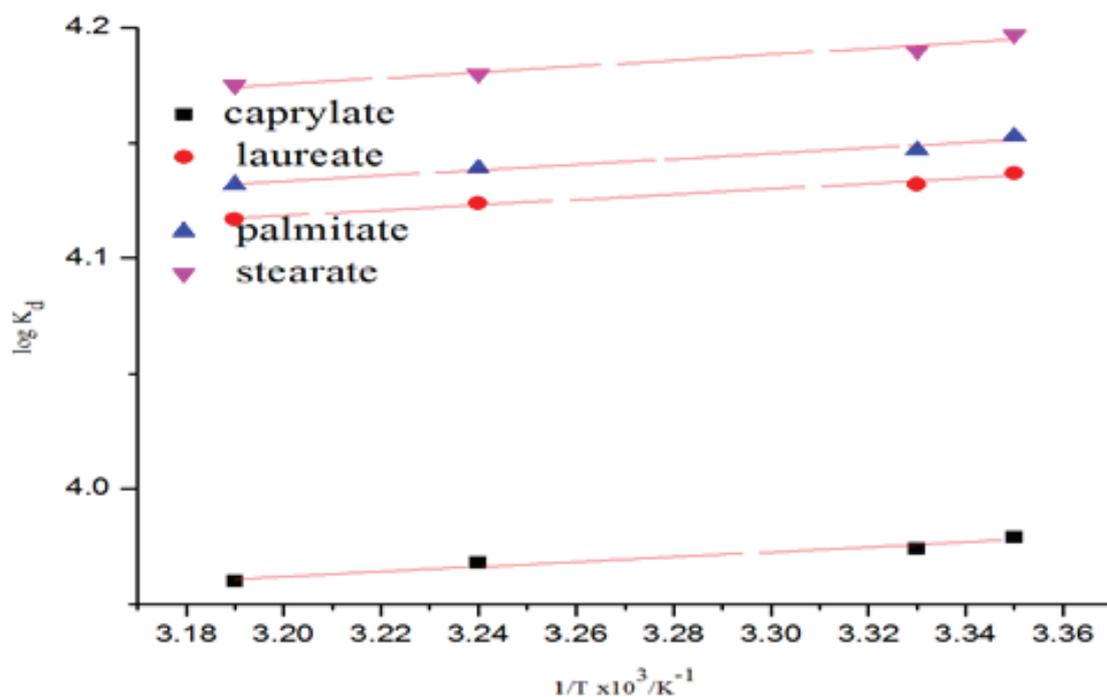


Figure 2: The plot of $\log K_d$ vs. $1/T$ for sodium surfactants in formamide at $25^\circ\text{C} \pm 0.2^\circ\text{C}$.

$$S_d = \frac{\Delta H_d - \Delta G_d}{T} \quad (7)$$

The calculated values of ΔG_d and ΔS_d are shown in Table VI. The thermodynamic parameters indicates that the negative values of ΔG_d , and positive values of ΔS_d for the dissociation process (Table VI) show that the dissociation process is a non-spontaneous occurrence physicochemically for sodium surfactants (caprylate, laurate, palmitate and stearate) in formamide.

However, as can be seen in table VI, the values of change in free energy, ΔG_d increased with increasing temperature whereas the values of entropy, ΔS_d decreased. Since the solute ions are aggregated to form the colloidal particles as micelles near the CMC value and after the CMC the micellization process is replaced the dissociation process, the negative changes of entropy may be obtained below the CMC value.

According to our previous work [23–27], the parameters for the thermodynamics of dissociation and micellization of sodium surfactants in formamide indicates that the negative values of ΔG_m and positive values of ΔS_m for the micellization process and positive values of ΔG_d and negative values of ΔS_d for the dissociation process show that the micellization process is favored over the dissociation process and the micellization is spontaneous occurrence but the dissociation is non spontaneous.

4. Conclusion

The results of conductivity and surface tension show that sodium surfactants in formamide behave as weak electrolytes in dilute solutions below CMC. The results also confirm that there is a significant interaction between surfactant and solvent molecules. The conductivity results show that the thermodynamics of dissociation and association can satisfactorily be explained in the light of phase separation model. The results showed that the micellization process is predominant over the dissociation process and sodium surfactants behaved as weak electrolyte in organic solvent.

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References

- [1] J. M. Corkill, F Goodman, *Adv. Colloid Interface Sci.*, **2**(1969) 297.
- [2] T. Walker, *J. Colloid Interface Sci.*, **45** (1973) 372.
- [3] J. M. Corkill, J. F. Goodman, R. Ha Ottewill, *Trans, Faraday Soc.* **57** (1961) 1627.
- [4] A. E. Ellison, W. A. Zisman, *J.Phys. Chem.*, **63** (1959) 1121.
- [5] N. L. Jarvis, W. A. Zisman, *J. Phys. Chem.*, **64** (1960) 150.
- [6] J. W. Belton, M. G. Evans, *Trans, Faraday Soc.*, **41** (1945) 1.
- [7] I. Rico, A. Lattes, *J. Phys. Chem.*, **90** (1986) 5870.
- [8] M. Almgren, S. Swarup, J. E. Loforth, *J. Phys. Chem.*, **89** (1985) 4621.
- [9] A. Couper, G. P. Gladden, B. Ingram *Faraday Discuss. Chem. Soc.*, **59** (1975) 63.
- [10] S. Prasad, R. C. Srivastava, *J. Ind. Chem.*, **39** (1962) 9.
- [11] W. U. Malik, S. L. Ahmad, *Kolloid Z. Z. Polym.*, **234** (1969) 1045.
- [12] K. N. Mehrotra, S. Singh, A. Kumar, *Ind. J. Chem.*, **31** (1992) 756.
- [13] R. P. Varma, R. Dayal, *J. Am. Oil Chem. Soc.*, **53** (1976) 39.
- [14] R.P. Varma, K. Singh, H. Singh, *Bull. Chem. Soc., Japan* **51** (1978)1530.
- [15] K. N. Mehrotra, K. Tandon, *J. Electrochem. Soc., India* **39** (1990) 143.
- [16] K. N. Mehrotra, K. Tandon, M. K. Rawat, *Bull, Electrochem.* **7** (1991) 237.
- [17] K. N. Mehrotra, V. P. Mehta, T. N. Nagar, *Cellul. Chem. Tachnol.* **7** (1973) 287.

- [18] K. N. Mehrotra, S. K. Upadhyaya, *J. A Oil Chem. Soc.*, **67** (1990) 464.
- [19] K. N. Mehrotra, S. K. Upadhyaya, *Colloids Polym. Sci.*, **267** (1989) 741.
- [20] H. Topallar, Baograk, M. Iscan, *J. Am. Chem. Soc.*, **74** (1997) 793, *Turk. J. Chem.*, **21** (1997) 195, *Turk. J. Chem.*, **22** (1998) 167; *Turk. J. Chem.*, **23** (1999) 31.
- [21] J. A. Riddick, W. B. Unger, *Techniques of Chemistry, Vol. II Wiley Interscience, New York*, 1970, p. 444.
- [22] *Handbook of Chemistry and Physics*, **63** Edn. CRC Press, Boca Raton, FL 1982/1983.
- [23] M. S. Akhter, S. M. Alawi, *Colloids and surfaces*, **196** (2002) 163.
- [24] M. S. Akhter, S. M. Alawi, *Colloids and surfaces*, **219** (2003) 281.
- [25] S. M. Alawi, M. S. Akhter, *Colloids and surfaces*, **72** (2010) 295.
- [26] S. M. Alawi, M. S. Akhter, *J. Mol. Liq.*, **160** (2011) 63.
- [27] S. M. Alawi, M. S. Akhter, *J. Korean chem. Soc.*, **55** (2011) 163.
- [28] P. Mukerjee, K. J. Mysels, *Critical micelle concentration of aqueous surfactant systems*. NSRDS - NBS 36. Washington, D.C. U.S. Government Printing Office, 1971.
- [29] H. Garibi, R. Palepu, G. J. T. Tiddy, D.G. Hall, E. Wyne-Jones, *J. Chem. Soc. Chem., Commun.* **2** (1990) 115.
- [30] P. Bacher, M. J. Schick. (Ed.) *In Non ionic Surfactants*, p. 478, Dekker, New York (1967)
- [31] R. Deer, E. H. Eylar, E. W. Anacker, *J. Chem.* **75** (197) 369.
- [32] P. Molyneux, C. T. Rhodes, J. Swarbrick, *Trans. Faraday Soc.*, **61** (1965) 1043.