Asian Journal of Medicine and Health

13(3): 1-8, 2018; Article no.AJMAH.33128
ISSN: 2456-8414

Seroprevalence of HIV, HBV and HCV among Prisoners in Sokoto, Nigeria

Onuigwe Festus Uchechukwu[1*], Yakubu Abdulrahman[1], Aliyu Umar Aliyu[1], Ummu Mustaphar[2], Isaac Zama[1], Adias Teddy Charles[1], Ibrahim Kwaifa[1], Buhari Hauwa Ali[1], Okwesili Augustine[1], Ahmed Marafa[1], Erhabor Osaro[1], Udomah Francis Patrick[1], Imoru Momudu[1], Bagudo Aliyu Ibrahim[1] and Okorie Hope[3]

[1]Department of Haematology, Faculty of Medical Laboratory Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria.
[2]Medical Unit, Sokoto Central Prison, Sokoto, Nigeria.
[3]Department of Medical Laboratory Science, Imo State University, Owerri, Nigeria.

Authors' contributions

This work was carried out in collaboration between all authors. Authors OFU, YA, ATC and EO designed the study. Author UM counseled and prepared the prisoners for their participation in the research. Author AUA undertook all the experimental procedures. Authors AM, BAI and OH were involved in data collection, statistical analysis and literature searches. Authors IZ, IK, BHA and OA managed the analyses of the study. Authors UFP, OFU and IM wrote the first draft of the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJMAH/2018/33128
Editor(s):
(1) Dr. Galya Ivanova Gancheva, Associate Professor, Department of Infectious Diseases, Epidemiology, Parasitology and Tropical Medicine, Medical University-Pleven, Bulgaria.
Reviewers:
(1) David Bukbuk, University of Maiduguri, Nigeria.
(2) Enedina Jiménez Cardoso, Hospital Infantil de México Federico Gómez, Mexico.
(3) Marfoua S. Ali, Omar Al-Mukhtar University, Libya.
Complete Peer review History: http://www.sciencedomain.org/review-history/28014

Original Research Article

Received 05 February 2017
Accepted 28 April 2017
Published 31 December 2018

ABSTRACT

Prisoners are at exceptional risk of viral infection because of the numerous high risk activities associated with incarceration. Prisons are incubators for infectious disease, yet are not readily accessible for screening and intervention. They provide a high-yield opportunity for early prison employees, but also family members and the general population.

**Corresponding author: E-mail: uchemls@yahoo.com;*

Aim: The aim of this study was to determine the prevalence of HIV, HBV and HCV among prisoners in Sokoto State central prison, Sokoto State, Nigeria.
Study Design: This was a cross sectional study involving male prisoners because of certain religious reasons we were not allowed access to female prisoners
Duration: The study lasted for three months between April to June, 2015
Methodology: A total of 99 male prisoners from Sokoto State central prison had their blood samples collected and screened for antibodies against Human Immunodeficiency Virus (HIV), hepatitis B Virus (HBV) and Hepatits C Virus (HCV) using the principle of lateral flow chromatographic immunoassay. HBV screening test carried out using Onsite HBs Ag rapid test Dip-strip (plasma) by Nantong Economy and Technology Development Zone, China. While HCV screening was done using HCV Ab plus rapid test strip (plasma) by Nantong Economy and Technology Development Zone, China. And HIV screening carried out using onsite HIV 1/2 Ab plus Combo Rapid Test by CTK Biotech, Inc. United State of America.
Results: The sero-prevalence of HIV, HBV and HCV was 1.0%, 11.1%, and 4.0% respectively of the 99 prisoners screened. None of the prisoners practice homosexuality. The age 18-35 years were mostly affected. Seroprevalence of HBV among the prisoners (11.1%) was high.
Conclusion: This study indicates a high prevalence of seroprevalence of HIV, HBV, and HCV among prisoners. There is need for prison-focused intervention initiatives in Nigeria including awareness programmes about these infections. Resources for testing and treatment of prisoners should be provided. Care providers for prisoners should be empowered to protect the privacy and confidential health care information about prisoners to prevent stigmatization.

Keywords: Seroprevalence; HIV; HBV; HCV; prisoners; Sokoto; Nigeria.

1. INTRODUCTION

Prisons are incubators for infectious diseases, yet are readily accessible for screening and intervention [1]. They provide a high-yield opportunity for early disease detection, intervention, and treatment, which would benefit not only prisoners and prison employees, but also family members and the general population due to the high turnover of prisoners [1,2]. About 9.25 million people are held in prisons worldwide, with 30 million inmates moving from prison to the community and/or back again each year [3]. Prisons are typically overcrowded, offer limited access to health care, and harbor high rates of airborne and blood-borne diseases [1,4]. Inmates often come from marginalized populations, such as injecting drug users (IDUs) and persons with high-risk sexual behaviors (including sex workers), who are already at an increased risk for these infections [4].

Available global data suggest a high prevalence and transmission of infectious diseases, such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and Tuberculosis in prisons [5,6,7,8,9,10,11,12].

HIV is a lentivirus (slowly replicating retrovirus) that causes Acquired Immune Deficiency Syndrome (AIDS) [13], a condition in humans in which there is progressive failure of the immune system allowing life threatening opportunistic infection and cancers to thrive. Infection with HIV occurs by the transfer of blood, semen, vaginal fluid, pre-ejaculate, or breast milk. Within these bodily fluids, HIV is present as both free virus particles and virus within infected immune cells. In prison infection with this virus can occur as a result of homosexual practice by some prisoners and sharing of drug injection needle and shaving blade [14]. HIV infected vital cells in the human immune system such as helper T cells (specifically CD4+ T cells), Macrophages and dendritic cells [15], HIV infection leads to low levels of CD4+ T cells through a number of mechanism including; apoptosis of uninfected bystander cells [16], direct viral killing of infected cells and killing of infected CD4+ T cells by CD8 cytotoxic lymphocyte that recognize infected cells. When CD4+ T cell numbers decline below a critical level, cell-mediated immunity is lost, and the body becomes progressively more susceptible to opportunistic infections [17].

Hepatitis B is an inflammatory illness of the liver caused by hepatitis B virus (HBV) that affect hominoid, including humans. Originally known as “serum hepatitis [18]. The disease has caused epidemics in parts of Asia and Africa, and it is endemic status in china [19]. About a third of the world population has been infected at one point in their life [20].

Numerous activities known to occur among prisoners pose a risk for hepatitis B infection. Use of contaminated cutting or piercing instruments has been shown to be a high behavior for transmitting HBV in prisons particularly in the case of sharing needles for IV drug use [21].

The prison population is at high risk of HIV, HBV and HCV infections though they are most often neglected risk group in the area of prevention and management. Since a prisoner can transmit these infections during and after his or her stay in the prison, transmission can contribute to over-wide pool of infections in the population. The economic costs of the failure to control the transmission of these infections include increased requirement for medical care, high level of dependency and loss of productive labor force, placing heavy burdens on already overstretched health and social services and on the natural economy. Factors contributing to a high rate of transmission of these infections in the prison include overcrowding, poor nutrition, poor hygiene, inadequate medical care and long prison sentences [22]. It should therefore be mandatory that a prisoner is screened for these infections before and after prison sentence. The socio-demographic characteristics of prisoners associated with HIV, HBV and HCV in central prison is not known. A research of this nature has never been reported. Data generated from this study may spur or stimulate planning, management, prevention and control strategies in Nigerian prisons. The aim of this study is to investigate the seroprevalence of HIV, HBV and HCV among prisoners in Sokoto, North Western, Nigeria.

2. METHODOLOGY

2.1 Study Setting

The study was conducted in the Faculty of Medical Laboratory Science of Usmanu Danfodiyo University in collaboration with the Medical unit of Sokoto State Central Prison. Sokoto state has a population of 4.2 million as at 2006 census, the metropolis is estimated to have a population of 427,760 [23,24].

2.2 Study Subjects

The test subjects are male prisoners of Sokoto state central prison. The prisoners within the age range of 18-75 years.

2.3 Inclusion Criteria

All the male inmates of Sokoto state central prison within the age range of 18-75 years that are serving their jail term in Sokoto state central prison for the presence of possible prison acquired infections

2.4 Exclusion Criteria

All individual < 18 or > 75 who are not prisoners in Sokoto state central prison and the female prisoners

2.5 Sample Size

The study included ninety nine (99) male prisoners of Sokoto state central prison within age range of 18-75 range years.

2.6 Informed Consent

Written informed consent was obtained from the prisoners who participated in the study.

2.7 Questionnaire

Questionnaire was used to obtain the socio-demographic and risk factors of the participants.

2.8 Sample Collection

About 3 millimeters of whole blood were collected using syringe and needle into EDTA anti-coagulated tube to be used for HBsAg rapid screening test, for HCV Ab plus rapid test and for HIV 1/2 rapid test.

2.9 Method for Screening

HBV screening test carried out using Onsite HBs Ag rapid test Dip-strip (plasma) by Nantong Economy and Technology Development Zone, China. While HCV screening was done using HCV Ab plus rapid test strip (plasma) by Nantong Economy and Technology Development Zone, China. And HIV screening carried out using onsite HIV 1/2 Ab plus Combo Rapid Test by CTK Biotech, Inc. United State of America.

2.10 Data Analysis

The data collected was recorded on an Excel spreadsheet and later subjected to Statistical analysis using Computer data-based software SPSS version 21 to generate frequency distribution and percentage prevalence of the

various parameters, Comparison was made using chi-square test. A P-value of ≤0.05 was considered statistically significant in all comparison.

3. RESULTS

Out of the 99 study population with age ranges from 18-75, one inmate (1.0) of the study population was HIV positive and it was found among those aged 18-35. 11 (11.0) were hepatitis B positive and the highest prevalence of HBV (7.0) was found among those aged 18-35, while the lowest prevalence was found within the age group 56-75. Four inmates (4.0) of the study population are hepatitis C positive and are found among the age group of 18-35 equally.

Table 1 shows the prevalence of HIV, HBV and HCV as follows; 11 (11.1), 4 (4.0) and 1 (1.0) respectively.

Table 2 shows Seroprevalence of HIV, HBV and HCV Infections by Risk Factors and socio-demogrphic factors among Prison inmates of Sokoto State Central Prison. And illicit drug injection showed association with P=0.033 while all others are not statistically significant.

Table 1. Prevalence of HIV, HBV and HCV among male prisoners in Sokoto State

	HIV	HBV	HCV
Positive (%)	1 (1.0)	11 (11.1)	4 (4.0)
Negative (%)	98 (98.9)	88 (88.9)	95 (95.9)
Total	99 (100)	99 (100)	99 (100)

Key: (%)= Percentage

Table 2. Seroprevalence of HIV, HBV and HCV infections by risk factors and socio-demogrphic factors among Prison inmates of Sokoto state central prison

Risk factor	No tested	HIV Pos.	P value	HBV Pos.	P value	HCV Pos.	P value
Marital status							
Married	32	0	0.487	3	0.704	3	
Single	67	1		8		1	0.062
Illicit drug use							
Yes	18	1	0.033	3	0.407	0	
No	81	0		8		4	0.336
Needle sharing							
Yes	6	0	0.798	2	0.074	0	
No	93	1		9		4	0.604
Age group							
18-35 years	72	1		7		2	
36-55 years	21	0	0.827	3	0.074	2	0.337
55-75 years	6	0		1		0	
Length of stay							
1-5 years	79	1		10		4	
6-10 years	12	0	1.000	0	0.971	0	0.958
11-15 years	2	0		0		0	
16-25 years	6	0		1		0	
Education level							
Formal	20	0		1		1	
Informal	51	1	0.622	8	0.319	2	0.968
Tertiary	28	0		2		1	
Sexual intercourse							
Yes	60	1	0.418	7	0.827	1	0.137
No	39	0		4		3	
Condom use							
Yes	29	0	0.518	2	0.390	0	0.189
No	70	1		9		4	

Key: Pos= Positive

4. DISCUSSION

This study investigated the seroprevalence and risk factors for HIV, HBV and HCV infections among prison inmates in Nigerian Sokoto State. Such studies have been undertaken in a good number of countries, especially in Europe and America, yet reports on these infections among Nigerian prison inmates are scarce [25]. The impact of HIV pandemic is enormous, robbing many countries of the world of both human and natural resources. A previous report of HIV among prison inmates in Nigeria has not yet provoked the expected government policies on care, management and prevention strategies on Nigerian prison inmate [26].

The 1.0% prevalence rate of HIV observed in this study does not supports previously reported cases [27]. In that report a prevalence rate of 12% was obtained in Kaduna prison. The HIV antibody seroprevalence in this study was however less than the 9% seroprevalence found among prisoners in Lagos by Idigbe and colleagues [14], it is less than the prevalence of 7% found in male prison inmates in Jos prison [28], it is also less than the National prevalence of 5% estimated by the sentinel Survey of the Federal Ministry of Health in 2003 and an estimated HIV prevalence by UNAIDS In 2006 which was 3.9% [29]. In this study we observed that there may be relationship between HIV infection and illicit drug injection (p=0.033). The seroprevalence of (1.0) observed in this study were found in the 18-35 age group who made up majority of the prisoners. This finding compared well with the National Sentinel Survey results showed these groups to be the most affected probably because of their high sexual activity. However for this age brackets in the National Survey, the prevalence was 5.6% [30]. Compared to 1.0% in this study. The less prevalence observed in this study may be as a result of decreased or absence of some high risk behaviors in Sokoto State central prison such as homosexuality in those with longer sentences where the older party provides the younger with resources such as protection and food in exchange for sex [31]. None of the respondent admitted to homosexual. This is in contrast to the western world where homosexuality is an important risk factor as well as a common occurrence, which is not voluntarily admitted by those who practice it in Nigeria [31].

According to Hodges and colleaques the classification of high endemicity for HBV infection has been defined as HBsAg greater than 7% in adult population [32]. But from this study the prevalence of hepatitis B virus infection among prisoners of Sokoto State central prison is 11 (11.1%). This therefore confirms that prisoners of Sokoto state central prison are chronic carriers of HBV. The result of this study is in conformity with 9 (18%) among 50 inmates of Bali prison in Taraba state reported previously by Monday and colleagues [33] the infection seen in Sokoto state central prison may be attributed to the large population of prisoners which result to overcrowding, the non-availability of clean/ sterilized shaving instruments, probably sexual activity among male within the prison, reuse of contaminated razor blades, and possibly sharing of cups, spoons and toothbrush [34]. The 11.1% sero-positivity reported in this study is higher than 5.2% reported by Babalola and colleagues among selected tertiary institution student in Ogun state, Nigeria [35]. But in conformity with the 12.0% reported among pregnant women attending ant-natal clinic at central hospital, Warri, Delta State [36]. This is also in consistent with previous report by Niematullah and colleagues in Quetta Pakistan [37].

The age of inmates may have also contributed especially young men between the ages of 18-35 years with factors such as high sexual behavior before and during incarceration, intravenous drug use with sharing of syringes and tattooing among inmates. Also poor condition prevailing in the prison could contribute to the higher prevalence of hepatitis B virus among the prisoners. The presence of hepatitis B virus among inmates is a cause for continuing public health concern because the incarcerated represent an extremely important segment of the community, especially with regard to the communicable disease. We also observed that inadequate medical facilities, staff and access to good health care delivery within and outside the prison could also contribute to the prevalence of hepatitis B virus among prisoners of Sokoto State central prison. This corroborates the findings of Muhammad and colleagues where he observed that inadequate medical facilities and staff in the Lahore Jail and access to appropriate health care outside the prison system was very difficult for inmates [38].

In this study, we observed HCV prevalence of 4.0% among prisoners of Sokoto state central prison, North Western Nigeria. The seroprevalence of HCV observed in this study is in agreement with a prevalence of 6.7% among male prisoners in Lagos reported by Dada and colleagues, this prevalence rate is startling

because it is not higher than that of the general population of Lagos, even though the prisoners population is known to be a high risk one; however, it is possible that the Lagos inmates have low or absence of high risk behavior similar to our subject [39]. The HCV prevalence observed in this study is less than 12.3% previously reported by Moses et al. 2009 in Nasarawa State of Nigeria it is also inconsistent with 19.2% previously reported among prison inmates in Ghana [5]. However, the HCV sero-prevalence rates from both studies are higher than what our study reveals, and this may be attributed to a possible practice of high rate of injected drug use by those inmates and a high risk behavior absent among our subject. It should be noted, however, that although majority of our subjects did not confirm the practice of injected drug use, it is possible this probability happens among Nigerian prisoners but at a very minimal level, not enough to influence the outcome.

5. CONCLUSION

In this study we observed a high sero-prevalence of blood borne infections among our subjects in Sokoto State central prison, Nigeria and reaffirm the need to routinely screen all prisoners before and after incarceration for HBV, HIV and HCV. As a safety measure because active and untreated HBV, HCV, and HIV infections among prison inmates can lead to transmission in both civilian and incarcerated populations. The insecure manner of acting such as illicit drug injection, tattooing, piercing, use of unsterilized blades and extramarital sex with very low condom use were the most important factors related to the infections.

6. RECOMMENDATION

In view of the observed presence of the viruses among prison inmates, we therefore recommend the regular testing for hepatitis B, hepatitis C and HIV antibodies in prisons is necessary to identify those already infected and those in need of specific health care to help limit further transmission of the disease within and outside the prison. Furthermore, introduction of effective preventive measures is recommended and uninfected inmates should be vaccinated with the available vaccines as this will reduce the spread of the diseases.

7. LIMITATION OF THE STUDY

Rapid test kit was used for testing of the subjects. It may be necessary to carry out a larger study and include the use of more advanced and sensitive methods like ELISA and PCR.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

Ethical approval was obtained from Prison authorities of Sokoto central Prison, Sokoto Nigeria. And written informed consent was obtained from prisoners before participating in the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Bick JA. Infection control in jails and prisons. Clinical Infectious Disease. 2007; 45:1047–1055.
2. McIntyre AFA, Studzinski HA, Beidinger C, Rabins. STD, HIV/AIDS, and hepatitis services in Illinois County. Jails Sex Transmissible Diseases. 2009;36(2):S37–40.
3. Walmsley R. World prison population list. London: King's College London; 2007. Available:http://www.kcl.ac.uk/depsta/law/research/icps/downloads/world-prison-pop-seventh.pdf (Accessed January 2010)
4. Niveau G. Prevention of infectious disease transmission in correctional settings. A Review on Public Health. 2006;120:33–41.
5. Adjei AA, Armah HB, Gbagbo J, Ampofo WK, Boamah I, Adu-Gyamfi C, Mensah G, Quaye IKE. Correlates of HIV, HBV, HCV and syphilis infections among prison inmates and officers in Ghana. A national multicenter study. BMC Infectious Diseases. 2008;8:33.
6. Fialho M, Messias M, Shafer K, Farre L, Schmalb M, Pedral-Sampaio D. Prevalence and risk of blood-borne and sexually transmitted viral infections in incarcerated youth in Salvador, Brazil. Opportunity and Obligation for Intervention, AIDS Behav. 2008;12(4):S17–24.
7. MacNeil JR, Lobato MN, Moore M. An unanswered health disparity: Tuberculosis

among correctional inmates. American Journal of Public Health. 2005;95:1800–1805.
8. Noeske J, Kuaban C, Amougou J, Piubello M, Pouillot R. Pulmonary tuberculosis in the central prison of Douala, Cameroon. East Africa Medical Journal. 2006;83:25–30.
9. Singh S, Prasad R, Mohanty A. High prevalence of sexually transmitted and blood-borne infections amongst the inmates of a district jail in Northern India. International Journal of STD AIDS. 1999; 10:475–478.
10. Solomon L, Flynn C, Muck K, Vertefeuille J. Prevalence of HIV, syphilis, hepatitis B, and hepatitis C among entrants to Maryland correctional facilities. Journal of Urban Health. 2004;81:25–37.
11. Stuckler D, Basu S, McKee M, King L. Mass incarceration can explain population increases in TB and multidrug-resistant TB in European and central Asian countries. Proceeding of National Academy of Science USA. 2008;105:13280–13285.
12. Wong MY, Leung CC, Tam CM, Kam KM, Ma CH, Au KF. TB surveillance in correctional institutions in Hong Kong. International Journal of Tuberculosis Lung Disease. 2008;12:93–98.
13. Weiss RA. How does HIV cause AIDS? Science. 1993;260(5112):1273-1279.
14. Idigbe ED, Nasidi A, Sofola T, Oyewole F, Odiah F, Ajayi A, Okoye R. Pulmonary tuberculosis and HIV infection among prison inmates in Lagos, Nigeria. The Nigerian Journal of Medical Research. 1997;1(2):17-21.
15. Cunningham AL, Donaghy H, Harman AN, Kim M, Turville SG. Manipulation of dendritic cell functions by viruses. Current Opinion in Microbiology. 2010;13(4):524-529.
16. Garg H, Mohl J, Joshi A. HIV-1 induced bystander apoptosis. Viruses. 2012;4(11): 3020-3043.
17. Kumar V. Robin basic pathology. (9th edition). 2012;147.
(ISBN 9781455737871)
18. Baker FJ, Silverton RE, Pallister CJ. Hepatitis, introduction to medical laboratory science. 7th edition, Butterworth-Heinemann Pubishers. 1998;409.
19. Williams R. Global challenges in liver disease. Hepatology. 2006;44(3):521-526.
20. World Health Organisation (WHO). Weekly epidemiological record. 2009;84:405–420. Harold S, Margolis MD, James M, Hughes MD. Prevention and control of infections with hepatitis viruses in correctional setting. National Centre for Infectious Diseases. 2003;52(01):1-33.
21. Harold S, Margolis MD, James M, Hughes MD. Prevention and control of infections with hepatitis viruses in correctional setting. National Centre for Infectious Diseases. 2003;52(01):1-33.
22. Muhammad T, Auwal U, Baba M, Thilza IB. HIV infection among male prison inmates in Abuja Nigeria. The Nigerian Journal of Medical Research. 2010;2(3): 28.
23. Udo RK, Mamman AB. Nigeria: Giant in the sun. State Survey. 1993;2.
24. National population commission; 2007.
25. Moses P, Adoga Edmund B, Banwat JC, Forbi LN, Christopher R, Pam SD, Gyar YA, Agabi SMA. Human immunodeficiency virus, hepatitis B virus and Hepatitis C virus: Sero-prevalence, co-infection and risk factors among prison inmates in Nasarawa State, Nigeria. Journal of Infection in Developing Countries. 2009; 3(7):539-547.
26. Olayide A. HIV/AIDS in Nigeria: The policy and policies. West African Journal of Medical Research. 2001;20(3):191-8.
27. Joshua IA, Ogboi JS. Seroprevalence of immunodeficiency virus.SWJ. 2008;17-19.
28. Abba OJ, Ibrahim IS, Idoko JA. Prevalence and risk factors for HIV/AIDS among male inmates in Jos prison, Plateau State, Nigeria. Nigerian Journal of Parasitology. 2011;32(2):181-186.
29. Federal Ministry of Health Department of Public Health, National AIDS/STDs Control Program, Technical Report. National HIV Seroprevalence Sentinel Survey; 2003.
30. Ploenjai T. Efforts to prevent tattooing among prison inmates to curb spread of HIV. Report. The Family Foundation Kaisernetwork. Org; 2007.
31. Jonathan EK, Henry M, King K. Giudeline for preventing oppotunistic infections among HIV-infected persons. National Center for HIV, STD, and TB Prevention. 2002;51:1-46.
32. Hodges M, Sanders E, Ait K. Sero-prevalence of hepatitis makers: HIV, HBV, HCV and HEV among primary school children in free town Sierra Leon. West

African Journal of Medicine. 1998;17(1): 36-37.

33. Monday IE, Francis JI. A survey for hepatitis B infection among prison inmates in Bali prison, Taraba State, Nigeria. Journal of Pharmacy and Biological Science. 2014;9(1):134-137.
34. Monica C. District laboratory practice in Tropical countries. (2nd edition). Part 2, United Kingdom, Cambridge University Press. 2005;250-253.
35. Babalola ET, Ainabe OB, Okonkwo OI. Confirmation of hepatitis surface (HBsAg) among selected Tertiary institution student in Ogun State Nigeria. Natural Science. 2013;11(3):107-113. Available:http://www.sciencepub.net/nature (Accessed August 2015)
36. Orphori EA, Wagbasoma A, Atunumu O. Sero-prevalence of hepatitis B among pregnant women attending anti-natal clinic at central hospital ward. Nigerian Journal of Microbiology. 2004;18:1-2.
37. Niamatullah K, Habibur R, Ferhat A, Abbas, Asmatullah K, Ihsanullah K, Muhamma AK. Seroprevalence and risk factors of hepatitis B, C and sexually transmitted treponemapallidum infections in jail inmates of Quetta, Balochistan. Global Advanced Research Journal of Medicine and Medical Science. 2014; 3(11):367-373.
38. Muhammad N, Ghazali J, Ishtiaq A. Jail population: A survey for hepatitis B, hepatitis C and Human immunodeficiency virus infections. Professional Medical Journal. 2011;18(4):697-702.
39. Dada MO, Akanmu AS, Esan OA. Seroprevalence of HIV among male prisoners in Lagos State, Nigeria. Nigeria Postgraduate Medical Journal. 2006; 13(1):6-9.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history/28014