Websites:
http://www.sciencepub.net/nature
http://www.sciencepub.net

Emails:
naturesciencej@gmail.com
editor@sciencepub.net

Nature and Science

MARSLAND PRESS
Multidisciplinary Academic Journal Publisher

Prevalence Of Hepatitis C Positivity In Apparently Healthy Individuals In Akure, Nigeria.

*Akande, E. B., Oladejo B. O., Oladunmoye M. K., Abodunrin T. F., and Ogunlana, D.O.

Department of Microbiology, Federal University of Technology, Akure, Ondo State.
* akandeemmanuelb@gmail.com

Abstract: Hepatitis C (HCV) viral infections have remained recurring decimals in blood transfusion, vertical transmission, liver cirrhosis and hepatocellular carcinoma. Most of the published studies of the prevalence in Southern Nigeria are among HIV/AIDS patients. The need for vital information among apparently healthy population was the basis for this study. This study was conducted over a period of ten months (October, 2016 – July, 2017). During this period, a questionnaire (data collection sheet) was administered which covered social demographic characteristics and some risk factors. About 871 blood samples were collected among apparently healthy individuals attending State General Hospital, Akure, Nigeria. Rapid diagnostic tests were used to screen for anti-HCV antibodies. Of the 871 individuals screened, 121 were positive for the virus giving an overall prevalence of 13.89% in the study area. The prevalence was high in males (17%) than the females (14%) among the age group 18-30 years, generally males had higher prevalence when compared with female gender. Also, higher prevalence of the virus among individuals that are single especially in males with 21% and female with 18% when compared to married (10% and 9% male and female respectively) were noticed. Majority of the participants were unemployed, with the highest prevalence rate of 23% in age group 31-42 years. The higher prevalence of HCV in individuals with multiple sex partners was 23% in males and 22% in females when compared to those without multiple sex partners with prevalence rate of 10% and 9% in male and female respectively and this supports the claim that multiple sexual partners are a risk factor for contacting hepatitis C. The higher prevalence was observed among individuals with drug use with 54% and 40% in age group 31-42 years and18-30 years respectively. Whereas those that said no to drug use had lower prevalence, this supports the claim that the intravenous drug use (IDU) is a major risk factor for hepatitis C in many parts of the world. However it is suggested that a comprehensive survey of HCV prevalence should be conducted in Nigeria in no distant future to determine the national prevalence, regional prevalence differences, high risk groups, and the associated risk factors for contracting the disease. This will go a long way to help in articulating a deliberate national action plan to prevent the disease transmission and to treat those who are already infected.

[Akande, E. B., Oladejo B. O., Oladunmoye M. K., Abodunrin T. F., and Ogunlana, D.O. **Prevalence Of Hepatitis C Positivity In Apparently Healthy Individuals In Akure, Nigeria.** *Nat Sci* 2020;18(6):9-16]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). http://www.sciencepub.net/nature. 3. doi:10.7537/marsnsj180620.03.

Keywords: Hepatitis, Infection, Prevalence, Antibody, Questionnaire

1. Introduction

Hepatitis C virus (HCV) is a worldwide disease agent causing liver disease (Lakoseljac *et al.,* 2007). HCV infection is transmitted with high efficacy via blood to blood contact (CDC, 2016; Maheshwari and Thuluvath, 2010). The prevalence of HCV within different countries, regions and populations is closely related to the incidence of blood borne (mainly intravenous drug use) HIV infection. HCV infection is one of the most important public health problems today. It is estimated that more than 170 million individuals are infected with HCV worldwide, most of them chronically (Lakoseljac *et al.,* 2007). Hepatitis C was first recognized as a cause of transfusion associated acute and chronic hepatitis in 1989 and plays a major role in chronic liver injury with potential for neoplastic degeneration (Houghton, 2009). It is mainly transmitted via parenteral route; however although with lower efficacy, it may also be transmitted by sexual intercourse and mother to child. HCV is responsible for about 350,000 deaths annually; among western countries, southern Europe and particularly Italy is among the most affected areas (Zaltran *et al.,* 2012). Africa has the highest WHO estimated regional prevalence (5.3%) with Egypt having the highest prevalence (22%) and Kenya with high risk groups of 4.7% (Karoney *et al.,* 2013). Available data on HCV in Africa reveal high prevalence in patients with hepatocellular carcinoma or chronic liver disease; (Burundi; 55%, Rwanda 45.7%) and sexually transmitted diseases (Ethiopia; 38.2%) (Karoney *et al.,* 2013).

The initial phase of HCV infection is called acute hepatitis C. The incubation period for acute hepatitis C averages 6 to 10 weeks (Hsu and Greenberg, 1994). Most persons (~80%) who develop acute hepatitis C have no symptoms (Mast *et al.,* 1999). The onset of disease is usually insidious, with anorexia, vague abdominal discomfort, nausea and vomiting, fever and fatigue, progressing to jaundice in about 25% of patients (EASL, 1999; Hsu and Greenberg, 1994). If the virus persists in the body for more than six months, the disease enters the chronic hepatitis C phase. In some cases, it may lead to cirrhosis (a condition in which healthy liver cells are replaced by scar tissue) that affects the liver's ability to function. The hepatitis C virus is an enveloped RNA virus with a diameter of about 50 nm, HCV is a positive stranded RNA virus classified as family Flaviviridae and genus Hepacivirus (Brooks *et al*., 2007; Willey *et al*., 2008). The reservoir of HCV is man, but the virus has been transmitted experimentally to chimpanzees (Houghton, 1996; Lemom and Brown, 1995; Purcil, 1999; Walker, 1999).

Before the development of routine screening, HCV accounted for more than 90% of hepatitis cases developed after blood transfusion. However, nucleic acid test is invaluable for the proper diagnosis of HCV infection and provides critical prognostic information for guiding treatments and measuring the response to antiviral therapy. Thus, sensitive nucleic acid tests are recommended as confirmation of acute and chronic HCV infection (Scott and Gretch, 2007). Over 1 million new cases of hepatitis C virus infection are reported annually worldwide (Willey *et al*., 2008).

HCV is a leading reason for liver transplantation in US and Britain (Willey *et al*., 2008; Talaro and Talaro, 2002; SGM, 2007). The prevalence is said to be highest among intravenous drug users (80%) and least among persons who engage in high sex practices (1%) (Falase and Akinkugbe, 2003; Talaro and Talaro, 2002; Brooks *et al*., 2007).

Hepatitis C virus can be transmitted from mother to child. It has also been found in the saliva from more than a third of patients with HCV and HIV co-infection. As in the case of hepatitis B, HCV also poses a great threat to health care workers. Transmission has been linked to an attempt to treat the parasitic disease, schistosomiasis, by therapy that involved multiple infections, often with improperly sterilized or reused needles (Willey *et al*., 2008; Falase and Akinkugbe, 2003). Meanwhile, effective immunotherapy and vaccine against HCV is still awaited (Irshad *et al*., 2008). This study was conducted to determine the prevalence rate of anti-HCV among apparently healthy individuals who constitutes the reservoir of voluntary blood donors in our society.

2. Materials And Methods

Study area

The study was carried out at State General Hospital, Akure, where participants were recruited from various Departments. The State General Hospital, Akure is a referral hospital and as such receives large numbers of patients from different parts of the country. It also serves as a primary health care facility for a significant proportion of the population in Ondo State and its environs for the middle to lower socio economic classes.

Study population

The enrollment strategy was based on individuals attending State General Hospital, Akure. Study subjects were blood samples of individuals of about 18years of age and above submitted to the laboratory and the basic information of the participants was obtained by questionnaire.

Sample size

WHO estimated regional prevalence for Africa was 5.3% with Egypt having the highest prevalence (22%) of HCV in the world (Karoney *et al.,* 2013). Africa's prevalence rate (5.3%) was therefore used for sample size estimation in this study.

The formula for sample size calculation used was; $N = Z^2PQ / d^2$

Where: N = Minimum sample size

Z = Constant, standard normal deviation (1.96 for 95% confidence interval)

P = Population proportion with characteristic of interest

Q = 1-P

d = Acceptable margin of error

Z = 1.96

P = 0.053

Q = (1 - 0.053) = 0.947

d = 0.05

$$N = \frac{(1.96)^2 0.053(1-0.053)}{0.05^2}$$

N = 77 individuals (Minimum sample size)

Collection of blood sample

This study was conducted over a period of ten months (October, 2016 – July, 2017). During this period, a questionnaire (data collection sheet) was administered which covered social demographic characteristics and some risk factors. The blood samples were collected after approval by the ethical review committee of the healthcare institution. About 3ml of blood samples were collected into sterile container.

Screening for HCV in the blood

One step ANTI-HCV rapid screen test (Gemc Technology Group Ltd., China) is a lateral flow, immunochromatographic screening test. Two purified recombinant antigens of HCV were used in test band as capture materials and gold conjugates. If the

antibody of Anti-HCV is present in the sample in concentration above the labeled, complex was formed. This complex was then captured by antigen immobilized in the Test zone of the membrane. The colour intensity was dependent of the concentration of the anti-HCV present in the sample. The Serum was separated from the whole blood sample by allowing to clot for about 60 minutes at room temperature. The clot was removed by centrifuging at 1300g for about 20 minutes and the supernatant was carefully removed using sterile pipette. The test strip was removed from the pouch by carefully tearing the sealed pouch along the notch and the test strip was immersed into the serum with the narrow end pointing towards. Care was taken not to immerse below the MAX (maximum) line. The strip was withdrawn after about 8-10 seconds and laid on a flat, clean, dry and nonabsorbent surface. The result was read only within 15 minutes after the appearance of coloured bands.

Interpretation of result

Negative result: Only one band appears on the control region. No apparent band on the test region. This indicates that there is no detectable anti-HCV in the blood.

Positive result: Distinct color bands appear on the control region and test region. Both test line indicate that the specimen contains detectable amount of anti-HCV.

Invalid result: No visible band at all or only one colored band appears on the test region, this is an indication of a possible error in performing the test.

Statistical analysis

The data obtained was subjected to one way analysis of variance (ANOVA) and differences between samples were determined by Duncan's Multiple Range test using SPSS 16.0 version. *P* values < 0.05 was regarded as significant and *P* values < 0.01 as very significant.

3. Results

Prevalence of HCV in the study area

Of the 871 patients tested, 121 were positive, implying an overall prevalence of 13.89%. 49 (15.41%) of the 318 male participants tested positive while 72(13.02%) of the 553 female patients tested positive (Table 1).

Prevalence of HCV among individuals based on their Age and Gender

The age and gender related prevalence of the participants is depicted in Table 2. Age groups18-30 years had the highest prevalence of HCV both in male and female (17% and 14%), followed by age 31-42 years with a prevalence of 16% and 15% in male and female respectively, 43-54 years with16% and 13% in male and female, followed by>67 years group with 11% for both male and female, age group 55- 66 years has the least prevalence of 9% and 10% in male and female respectively.

Prevalence of HCV among Genders and Marital status

Table 3 shows that single individuals had the highest prevalence of 21% and 18% in both males and females respectively, followed by married individuals with prevalence of 10% and 9% in male and female respectively.

Prevalence of HCV in individuals among Employment and Age groups

Majority of the participants were unemployed (Table 4) with the highest prevalence of 23% among age groups 31-42 years, 18% prevalence for students between age group 18-30 years and also for unemployed individuals in age group 43-54, self-employed with 16% and employed individuals with 14% among age group 18-30 years. The least prevalence was 0% among employed individuals in age group 55- 66 years.

Prevalence of HCV among individuals based on Education status with gender

Table 5 shows the prevalence of HCV based on education status with gender, with uneducated individuals having the highest prevalence of 22% and 18% in male and female respectively while educated individuals has the least prevalence of 12% and 9% for male and female respectively.

Prevalence of HCV among individuals with multiple sex partners among Genders

In Table 6, it was revealed that individuals with multiple sex partners had the highest prevalence of 23% and 22% in male and female genders respectively while those without multiple sex partners had a prevalence of 10% and 9% in male and female respectively.

Prevalence of HCV in individuals among Drug use group and Age

Table 7 shows those that responded positively to drug use among age group 31-42 years and 18-30 years had the highest prevalence of 54% and 40% respectively. In non-drug usage groups, age group 43-54 years had the prevalence of 16% and the least prevalence of 11% was found in both age group (55-66 and ≥67 years)

Table 1: Prevalence of HCV in the study area

Blood sample screened	Positive	Negative	Prevalence (%)
871	121	750	13.89

Table 2: Prevalence of HCV among individuals based on their Age and Genders

Sex	Age	HCV Positive (%)	Negative (%)	Total
Male	18-30	19 (17)	96 (83)	115
	31- 42	15 (16)	77 (84)	92
	43-54	11 (16)	58 (84)	69
	55- 66	3 (9)	30 (91)	33
	≥67	1 (11)	8 (89)	9
	Total	**49**	**269**	**318**
Female	18-30	29 (14)	182 (86)	211
	31- 42	20 (13)	129 (87)	149
	43-54	17 (13)	118 (87)	135
	55- 66	4 (10)	35 (90)	39
	≥67	2 (11)	19 (89)	19
	Total	**72**	**481**	**553**

There was statistical significance in consideration of the subjects age group between Male $X^2 = 5.784$, P= 0.059 while for Female $X^2 = 5.275$, P= 0.042.

Table 3: The Prevalence of HCV among Genders and Marital status

Sex	Marital status	HCV Positive (%)	Negative (%)	Total
Male	Single	32 (21)	124 (79)	156
	Married	17 (10)	145 (90)	162
	Total	**49**	**269**	**318**
Female	Single	43 (18)	193 (82)	236
	Married	29 (9)	288 (91)	317
	Total	**72**	**481**	**553**

There was significant association between subjects gender and their marital status with Male: $X^2 = 23.045$, P= 0.000 while for Female: $X^2 = 31.369$, P=0.000.

Table 4: The Prevalence of HCV in individuals among Employment and Age

Employment status	Age (Yrs)	HCV Positive (%)	Negative (%)	Total
Student	18-30	18 (18)	84 (82)	102
	31- 42	12 (13)	79 (87)	91
	43-54	1 (6)	22 (94)	23
	Total	**31**	**185**	**216**
Employed	18-30	5 (14)	31 (86)	36
	31- 42	3 (6)	43 (94)	46
	43-54	1 (8)	12 (92)	13
	55- 66	0 (0)	1 (100)	1
	Total	**9**	**87**	**96**
Self employed	18-30	3 (16)	16 (84)	19
	31- 42	9 (15)	51 (85)	60
	43-54	8 (12)	59 (88)	67
	55- 66	2 (9)	21 (91)	23
	≥67	2 (11)	17 (89)	19
	Total	**24**	**164**	**188**
Unemployed	18-30	22 (13)	147 (87)	169
	31- 42	10 (23)	33 (77)	43
	43-54	18 (18)	83 (82)	101
	55- 66	46 (12)	43 (88)	49

	≥67	1 (11)	8 (89)	9
	Total	**57**	**314**	**371**

There was significant association between employment and HCV status among the student group (X^2 = 1.317, P= 0.138) while for Employed group it was statistically not significant (X^2 = 15.747, P=0.000), but for Self-employed group it was insignificant statistically (X^2 = 0.942, P=0.095) while it was significance for Unemployed group (X^2 = 3.816, P=0.048)

Table 5: Prevalence of HCV among individuals with education and Genders

Sex	Education	HCV Positive (%)	Negative (%)	Total
Male	Yes	16 (12)	121 (88)	137
	No	33 (22)	148 (78)	181
	Total	**49**	**269**	**318**
Female	Yes	27 (9)	130 (78)	296
	No	45 (18)	351 (91)	257
	Total	**72**	**481**	**553**

There was significant association between subjects status and their education in Male X^2 = 21.084, P= 0.000 while for Female X^2 = 32.627, P=0.000.

Table 6: Prevalence of HCV among individuals with multiple sex partners among Genders

Sex	Multiple sex	HCV Positive (%)	Negative (%)	Total
Male	Yes	29 (23)	97 (77)	126
	No	20 (10)	172 (90)	192
	Total	**49**	**269**	**318**
Female	Yes	37 (22)	130 (78)	167
	No	35 (9)	351 (91)	386
	Total	**72**	**481**	**553**

There was statistical relationship between number of sex partner (s) and status among subjects in Male X^2 = 63.028, P< 0.05 while for Female X^2 = 31.725, P< 0.05.

Table 7: Prevalence of HCV in individuals among Drug use group and Age

Drug use	Age	HCV Positive (%)	Negative (%)	Total
Yes	18-30	19 (40)	28 (60)	47
	31- 42	7 (54)	77 (46)	13
	Total	**26**	**34**	**60**
No	18-30	29 (13)	199 (87)	228
	31- 42	28 (15)	165 (87)	193
	43-54	28 (16)	148 (84)	176
	55- 66	7 (11)	58 (89)	65
	≥67	3 (11)	25 (89)	28
	Total	**72**	**481**	**553**

There was significant association between age and injection drug use among subjects with YES: X^2 = 0.164, P= 0.798 while it was significant statistically for subjects with NO: X^2 = 5.672, P=0.025.

4. Discussion

Hepatitis C Virus (HCV) infection remains a major public health challenge especially in the less developed nations where therapy is either unavailable or expensive. Most acute cases become chronic and often results to complications such as Cirrhoses and Cancer (Daniel, 2008). In Britain, HCV is said to be the simple highest cause of request for liver transplants (SGM, 2007). Screening of asymptomatic individuals is an important instrument in disease detection, prompt diagnosis and intervention

especially like in the case of HCV infection. This study was therefore set out to determine the prevalence of HCV antibodies in an apparently healthy population. The prevalence rate of 13.89% out of 871 participants is relatively high in view of the fact that it was found in apparently healthy individuals. The prevalence of HCV infection reported in this study is similar to reports from other parts of Nigeria; where 14.9% was reported in Enugu (Ebie and Pela, 2006), 14% among accident and emergency patients (Halim *et al*., 2001), 14.1% among *Diabetes mellitus* patients (Nwokediuko and Oli, 2008) and 13.3% in Keffi (Grace *et al.,* 2010); although much higher than 5.2% and 11.09% reported in Jos and Kaduna respectively (Strickland, 2002). A pilot study done in Nigerian adults and children gave an average seroprevalence of 8% (Oni and Harrison, 1996), while another study on adult blood donors in Nigeria reported a prevalence rate of 12.3% (Halim and Ajayi, 2000). Also, another study in Ibadan, (Olubuyide *et al.,* 1997) conducted among doctors and dentists recorded a seroprevalence of 11% and 4.3% in a presumed low risk group in Jos (Egah *et al*., 2007). The prevalence of HCV infection in this area was also found to be high when compared with the reports from some countries in Africa (5.3%), Eastern Mediterranean (4.6%), Western Pacific (3.9%), South East Asia (2.15%), America (1.17%) and Europe (1.03%) (WHO, 2007). This observed prevalence is also high when compared with reports from various researches; 2.2% among healthy individuals admitted in a University hospital for routine health check (Demirturk *et al*., 2006); 3.8% among dental patients with impacted teeth or jaw deformities (Takata *et al*., 2003) but lower than reports from Egypt which was 20% (Frank *et al*., 2002), 26% among patients with gingivitis and adult periodontitis patients (Farghaly *et al*., 1998); 30.5% among incarcerated male substance abusers in Taiwan (Chu *et al*., 2009). Also, a study of adolescent and adult patients with sickle cell Anaemia (SCA) in Benin by Mutimer *et al.,* (1994), showed 20% prevalence rate. Findings shows that the general increase in HCV infection may be due to transmission by asymptomatic carriers which make it unknowingly and easily assessable.

Findings from this study revealed higher prevalence (17%) in males than in females (14%) among the age group 18-30 years, males also had higher prevalence in nearly all age groups when compared with females. This finding is similar to the higher prevalence of HCV observed in male subjects in studies conducted in Ibadan, Nigeria, among blood donors and in Maiduguri, Nigeria, among AIDS' patients (Udeze *et al*., 2009). However, it is in contrast with previous studies conducted in Ilorin, Jos and the Niger delta of Nigeria where females had higher prevalence of HCV (Udeze *et al*., 2011). The higher prevalence of HCV infection among the male individuals could probably be as a result of higher frequency of exposure to risk factors associated with the viruses such as injection of drug use, unprotected sex and having more than one sex partners as well as occupation and behaviour (Halim *et al*., 2001).

The observation of age-groups 18-30 years having the highest prevalence of anti-HCV, followed by 31-42 years with16% and 13% in male and female respectively correlates with the reports of Koate *et al*. (2002), which claimed that the prevalence was higher in ≥40 years. The age with higher prevalence also correlates with age of greatest sexual activity thus lending credence to the role of sexual transmission (Koate *et al*., 2002) although said to be rare (Sy and Jamal, 2006). A higher prevalence of the virus among individuals that are single especially in males with 21% and female with 18% compared to married (10% and 9% male and female respectively could probably be due to high tendency of promiscuous behaviour among those 'who are single (Mohsen *et al*.,2014). The observed high prevalence in uneducated individuals could be due to their lack of knowledge about the HCV, as they might have not been informed of the preventive measures especially in remote areas. The higher prevalence of HCV in individuals with multiple sex partners 23% in males and 22% in females when compared to those without multiple sex partners with prevalence rate of 10% and 9% in male and female respectively supports the claim that multiple sexual partners are a risk factor for contacting hepatitis C (Wilkins *et al.*, 2010). Intravenous drug use (IDU) is a major risk factor for HCV in many parts of the world (Xia *et al*., 2008) and this might account for the high prevalence observed among individuals with drug use.

5. Conclusion

Prevalence of HCV is high among apparently healthy adult population in the study area. This study provides additional data on the burden of disease in Nigeria. Since majority (>80%) of those who contract HCV will progress to chronic stage. It is therefore, recommended that a comprehensive survey of HCV prevalence should be conducted in Nigeria in no distant future to determine the national prevalence, regional prevalence differences, high risk groups, and the associated risk factors for contracting the disease. This will go a long way to help in articulating a deliberate national action plan to prevent the disease transmission and to treat those who are already infected. Such measures may include: public awareness campaign on how to reduce the risks of infection; formulation and strict implementation of safe national blood transfusion service policy;

provision of voluntary counseling and test services, especially, for those at risk individuals like injection drug users, commercial sex workers and healthcare workers; provision of drugs and other related services at subsidized cost for management of those who test positive as the antiviral agents and the laboratory tests for patients' evaluation are often expensive.

Acknowledgements:

Authors are grateful to the Department of Microbiology, Federal University of Technology, Akure, Ondo State, Nigeria for their support to carry out this work.

Corresponding Author:
Akande Emmanuel B.
Department of Microbiology,
Federal University of Technology, Akure, Nigeria.
Telephone: +234 8039413648
E-mail: akandeemmanuelb@gmail.com

References

1. Brooks, G.F., K.C. Carroll, J.S. Butel and S.A. Morse. Jawetz, Melnick and Adelbergs Medical Microbiology. 24th Edn., McGraw Hill Co. Inc., New York, 2007. pp: 832.
2. CDC "U.S. 2014 Surveillance Data for Viral Hepatitis, Statistics & Surveillance, Division of Viral Hepatitis". CDC. Retrieved 2016-08-04.
3. Chu, F.Y., Chiang, S.C., Su, F.H., Chang, Y.Y. and Cheng, S.H. Prevalence of HIV and its association with hepatitis B, C and D virus infections among Incarcerated male substance abusers in Taiwan. *J. Med. Virol*., 2009;81: 973-978.
4. Daniel, C. Why is there no vaccine for hepatitis C? Medical Review Board, Retrieved; September 3, 2009, *http://hepatitis.about.com/od/prevention/a/HCVvaccine.htm.*
5. Demirturk, N., T. Demirdal, D. Toprak, M. Altindis and O.C. Aktepe. Hepatitis B and C virus in West-Central Turkey: Seroprevalence in healthy individuals admitted to a university hospital for routine health checks. *Turk. J. Gastroenterol,* 2006;17: 267-272.
6. EASL International Consensus Conference on Hepatitis C. Consensus Statement. *Journal of Hepatology*, 2009;31:3-8.
7. Ebie, J.C. and Pela, O.A. Some sociocultural aspects of the problem of drug abuse in Nigeria. *Drug and Alc. Dep.* 2006; 8: 301-306.
8. Egah, D.Z., Banwat, E.B., Audu, E.S., Iya, D., Mandong, B.M., Awele, A.A. and Gomwalk, N.E. Hepatitis B surface antigen, Hepatitis C and HIV antibodies in a low risk blood donor group, Nigeria. *East Med. Health J.* 2007;13: 211-215.
9. Falase, A.O. and Akinkugbe, O.O. A Compendium of Clinical Medicine. Spectrum Books Ltd., Ibadan, 2003; ISBN: 978-029-208-X.
10. Farghaly, A.G., Mansour, G. A., Mahdy, N.H and Yousri, A. Hepatitis B and C virus Infection among patients with gingivitis and adult periodontitis: Seroprevalence and public health importance. *J. Egypt Public Health Assoc.*, 1998;73: 707-735.
11. Frank, C., Mohammed, M. and Strickland, G. The role of parenteral antischistosomal therapy in the spread of Hepatitis C virus in Egypt. *Lancet*. 2000; 355: 887-891.
12. Grace, R., P., Aliyu Y., Odula, O. and Joseph, F. Prevalence of hepatitis B and C virus infection amongpeople of a local community in Keffi, Nigeria. *African Journal of Microbiology Research* 2010; 4 (4): 274-278.
13. Halim, N.K. and Ajayi, O. I. Risk Factors and sero-prevalence of Hepatitis C Antibody in Blood donors in Nigeria. *East Afr Med J.*; 2000; 77:410-2.
14. Halim, N.K., U., Madukwe, B.D. Saheeb and Airauhi, L.U. Hepatitis B surface antigen and antibody to hepatitis C virus among accident and emergency patients. *East. Afr. Med. J.,* 2001; 78:480-483.
15. Houghton, M. *Hepatitis C viruses*. In: Fields BN, Knipe DM, Howley PM, eds. *Fields Virology, 3rd ed.* Philadelphia, Lippincott - Raven, 1996; pp. 1035-1058.
16. Hsu, H.H. and Greenberg, H.B. Hepatitis C. In: Hoeprich PD, Jordan MC, Ronald AR, eds. *Infectious Diseases. A treatise of infectious processes.,*5th ed. JB Lippincott Co, Philadelphia, 1994; pp. 820-825.
17. Irshad, M., Khushboo, I. and Singh, S. Hepatitis C virus (HCV): *A review of Int. Rev. Immunol.,* 2008; 27: 497-513.
18. Karoney M.J, Abraham Mogisi Siika. Hepatitis C virus (HCV) infection in Africa: A review. *Pan African medical journal,* 2013; 2 (3) 56-53.
19. Koate, B.B., Buseri, F.I. and Jeremiah, Z. Seroprevalence of Hepatitis C virus among blood donors in Rivers State, Nigeria. *Trans. Med.* 2005; 15: 449-451.
20. Lakoseljac D., and Tomislav, R. Epidemiology of Hepatitis C Viral Infection. *Medicana, 2007; 43:112-117.*
21. Lemon, S.M., and Brown, E.A. *Hepatitis C virus*. In: Mandell GL, Bennett JE, Dolin R, eds. *Principle and Practice of Infectious Disease,*

Fourth. New York, Churchill Livingstone. 1995; pp. 1474-1486.
22. Mast, E.E., Alter, M.J. and Margolis, H.S. Strategies to prevent and control hepatitis B and C virus infections: a global perspective. *Vaccine*, 1995; 17:1730-1733.
23. Maheshwari, A. and Thuluvath, P.J. Management of acute hepatitis C. *Clinics in liver disease*. 2010; 14 (1): 169–76.
24. Mohsen, A., Benier, A., Lefoulev, L. and Fonttanet, A. Hepatitis C acquisition among Eqyptians: Analysis of a 10-years Survalliance of acute Hepatitis C. *Tropical medicine & International Health,* 2014; 20 (1): 1111- 1241.
25. Mutimer, D.J., Olomu, A. and Skidmore, N. Viral Hepatitis in Nigeria-Sickle cell Diseases and Commercial Blood Donors. *Quart J Med.* 1994; 87: 407- 418.
26. Nwokediuko, S.C. and Oli, J.M. Hepatitis C virus infection in Nigerians with diabetes mellitus. *Nig. J. Clin. Pract.,* 2008; 11:94-99.
27. Oni, A. O. and Harrison, T. J. Genotypes of Hepatitis C virus in Nigeria. *J Med. Viral Hepat*; 1996; 49:178-86.
28. Scott, J.D. and Gretch, D.R. Molecular diagnostics of hepatitis C virus infection: a systematic review. *JAMA: The Journal of the American Medical Association*. 2007; 297 (7): 724–32.
29. Society for General Microbiology, SGM. Possible hepatitis C vaccine. Science Daily. http://www.sciencedaily.com/releases/2007/09/070903204959.htm.
30. Strickland, G.T. HCV in developing Countries. *Postgrad. Doc. (Africa)* 2002; 24: 18-20.
31. Sy, T. and Jamal, M.M. Epidemiology of Hepatitis C virus (HCV) infection. *Int. J. Med. Sci*. 2006; 3: 41 -46.
32. Talaro, K.P. and Talaro, A. Foundation in Microbiology. 4th Edn., McGraw Hill Co. Inc., Boston, 2002; ISBN: 0-07-112275-3.
33. Udeze, A.O., Okonko, I.O., Donbraye, E., Sule, W.F., Fadeyi, A. and Uche, L.N. Seroprevalence of Hepatitis C Virus Antibodies Amongst Blood Donors in Ibadan, Southwestern, Nigeria. *World Appl Sci J*. 2009; 7:1023–1028.
34. Walker, C.M. *Hepatitis C virus*. In: Ahmed R, Chen I, eds. *Persistent Viral Infections*. Chichester, Wiley, 1999; pp. 93-115.
35. Wilkins, T., Malcolm,. J.K., Raina, D. and Schade, R.R. Hepatitis C: diagnosis and treatment. *American family physician*. 2010; 81 (11): 1351–7.
36. Willey, J.M., L.M. Sherwood and C.J. Woolverton,. Prescott, Harley and Kleins Microbiology. 7th Edn., McGraw Hill Co. Inc., Boston, 2008; ISBN: 978-007-126727-4.
37. World Health Organisation. Hepatitis C, estimated prevalence and number infected by world region. Available at http://www.who.int/csr/disease/hepatitis. 2007.
38. Xia, X., Luo, J., Bai, J. and Yu, R. Epidemiology of HCV infection among injection drug users in China: systematic review and meta-analysis. *Public health*. 2008; 122 (10): 990–1003.
39. Zaltron, S., Spinetti, A., Biasi, L., Baiguera, C. and Castelli, F. Chronic HCV infection: epidemiological and clinical relevance. *BMC infectious diseases*. 2012; 12 (2): 2-10.

6/13/2020