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ORIGINAL ARTICLE

DISTRIBUTION OF HEPATITIS B INFECTED POPULATION BY SEX AND AGE GROUPS IN DISTRICT D.I.KHAN, PAKISTAN

Imran Ullah[1], Nisar Khan[2], Farmanullah Shah[3], Ejaz Ahmad[4], Asif Saeed[4]

[1]District Health Office, D.I.Khan, Departments of [2]Medicine & [3]Gastroenterology, MMMT Hospital, D.I.Khan, [4]Department of Medicine, Lady Reading Hospital, Peshawar, Pakistan

ABSTRACT

Background: Significant morbidity and mortality is caused by untreated hepatitis B virus infection through cirrhosis and hepatocellular carcinoma. The objectives of our study were to determine distribution of hepatitis B infected population by sex and age groups in District D.I.Khan, Pakistan.

Materials & Methods: This cross-sectional study was done at District Health Office, D.I.Khan, Pakistan from January 30, 2021 to February 15, 2021. Data was collected for period from March 14, 2013 to January 28, 2021 for 2368 hepatitis B infected cases from population at risk consecutively. Sex and age groups were demographic variables. Data type was nominal for sex and ordinal for age groups. Distribution was analyzed by count, percentage and confidence intervals for proportion for population. Hypotheses for distribution were substantiated by chi-square goodness-of-fit test.

Results: Out of 2368 hepatitis B infected population, 1670 (70.52%) were men & 698(29.48%) women, and 562 (23.73%) were in age group 0-20 years, 1266 (53.46%) in 21-40 years, 462 (19.51%) in 41-60 years &78 (3.30%) in >60 years. Our distribution by sex ($p<.00001$) and age groups ($p<.00001$) were different than expected respectively.

Conclusion: In our study, hepatitis B infection was more common in men than women and most common in age group 21-40 years, followed by 0-20 years, 41-60 years and >60 years. Our observed prevalence of hepatitis B infection in men was higher than expected & in women it was lower than expected. Our observed prevalence in the four age groups was not similar to expected.

KEY WORDS: Distribution; Population; Hepatitis B; Hepatitis B Virus; Sex; Age Groups; Chi-square Goodness of fit Test; Pakistan.

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1. INTRODUCTION

1.1 Background: Globally hepatitis B virus infects about 296 million people accounting for 3.8% prevalence in 2019. In 2019, about 1.5 million new infections and 0.82 million mortality were caused by hepatitis B virus infection globally. About 6 million (0.9%) children under 5 year of age are infected with HBV.[1]

Corresponding Author:

Dr. Imran Ullah
District Health Office
D.I.Khan, Pakistan
E-mail: drimranullah89@gmail.com

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If not treated, hepatitis B and hepatitis C virus infections may cause cirrhosis& hepatocellular carcinoma, causing 96% of the deaths due to viral hepatitis. In 2015, 2.7 million HIV infected patients also had HBV infection. Peoples in the European and Eastern Mediterranean regions are more infected.[2]In 2019, in Eastern Mediterranean Region, the prevalence of hepatitis B infections was 2.5%, estimating about 18.2 million infections.[1]

Badawi, et al.[3] from Khartoum state of Sudan for the period from Oct. 2011 to Jan. 2017 distributed 2109 PCR detected HBV infection as 77.81% (1641*100/2109=77.81) men &22.19% (468*100/2109=22.19) women, and 6.16% (130*100/2109=6.16) in age group<20 years,64.06% (1351*100/2109=64.06) in 20-39 years, 24.56% (518*100/2109=24.56) in 40-59 years, 4.93% (104*100/2109=4.93) in 60-79 years &0.29% (6*100/2109=0.29) in >80 years.

Soliman, et al.[4] from Luxor, Egypt during Jun. 2016-May 2017 distributed 2947 HBsAg positive patients as 67.25% (1982*100/2947=67.25) men and 32.75% (965*100/2947=32.75) women.

Tao, et al.[5] from Shenzhen, China for the period from 26 August 2015 to 11 Sep 2018 distributed 19922PCR detected HBV infections as 58.53% (11661*100/19922=58.53) men &41.47% (8261*100/19922=41.47) women, and 0.27% (54*100/19922=0.27) in age group <1 year, 0.09% (18*100/19922=0.09) in 1-5 years,1.56% (310*100/19922=1.56) in 6-19 years, 77.82% (15503*100/19922=77.82) in 20-49 years &20.26% (4037*100/19922=20.26) in ≥50 years.

Mousawea, et al.[6] from Kabul, Afghanistan for the period from Apr. 2014 to Aug. 2017 distributed 2430 HBsAg positive patients as 79.01% (1920*100/2430=79.01) men and 20.99% (510*100/2430=20.99) women, and 8.68% (211*100/2430=8.68) in age group 1-20 years, 49.79% (1210*100/2430=49.79) in 21-40 years, 30.91% (751*100/2430=30.91) in 41-60 years& 10.62% (258*100/2430=10.62) in ≥61 years.

Khan, et al.[7] in Lahore, Punjab, Pakistan during 2008-2010 distributed 3143 PCR detected HBV infections as 68.15% (2142*100/3143=68.15) men and 31.85% (1001*100/3143=31.85) women.

Ullah, et al.[8] in Peshawar, Pakistan during Nov. 2015-Apr. 2016 distributed 65 HBsAg positive patients as 38.46% (25*100/65=38.46) men &61.54% (40*100/65=61.54) women, and 1.61% (1*100/62=1.61) in age group 1-20 years, 24.19% (15*100/62=24.19) in 21-40 years, 50% (31*100/62=50) in 41-60 years& 24.19% (15*100/62=24.19) in 61-80 years.

Khan, et al.[9] from Mardan, Pakistan during Jan. 2014-Jan. 2015 distributed 260 PCR detected HBV infections as 56.92% (148*100/260=56.92) men & 43.08% (112*100/260=43.08%) women, and 11.54% (30*100/260=11.54) in age group 1-20 years, 60.38% (157*100/2109=60.38) in 21-40 years, 19.62% (51*100/260=19.62) in 41-60 years & 8.46% (22*100/260=8.46) in >60 years.

Ullah, et al.[10] from Mardan, Pakistan during 2017-2020 years distributed 276 PCR detected HBV infections as 61.23% (169*100/276=61.23) men & 38.77% (107*100/276=38.77) women and 3.62% (10*100/276=3.62) in age groups 10-20 years, 78.26% (216*100/276=78.26) in 21-40 years,16.67% (46*100/276=16.67) in 41-60 years &1.45% (4*100/276=1.45) in ≥61 years.

2 Research Problems, Knowledge Gaps, Research Questions & Rationale: Lack of information regarding the distribution of hepatitis B infected population by sex and age groups in District D.I.Khan were our two research problems. Pertinent data in regard to these research problems could not be recovered by online search, showing two gaps in our existing knowledge. How will be the hepatitis B infected population of District D.I.Khan distributed by sex and age groups will be our two research questions. To answer these two questions will be the justification for our project.

1.3 Research Objectives (ROs)

RO 1: To find out the distribution of hepatitis B infected population by sex in District D.I.Khan.

RO 2: To find out the distribution of hepatitis B infected population by age groups in District D.I.Khan.

1.4 Research (Null) Hypotheses

H_{01}: The observed and expected distribution of hepatitis B infected population by sex was not different in District D.I.Khan.

H_{02}: The observed and expected distribution of hepatitis B infected population by age groups was not different in District D.I.Khan.

2. MATERIALS AND METHODS

2.1 Study Design, Settings & Duration: This descriptive study was executed at District Health Office, D.I.Khan, Pakistan from 30-1-2021 to15-2-2021.

2.2 Population, Sample Size & Technique and Sample Selection: District D.I.Khan population was 852,995 in 1998 Census. It was assumed to be around 1400,000 in 2013. Sample size was calculated as 2368 assuming expected prevalence rate of HBV as 2.5%[1]in our population with margin of error 0.6283% and 95%CL.[11] Consecutive sampling method was employed. All hepatitis B infected patients were included. Those with incomplete data were not eligible.

2.3 Conduct of Procedure: Detailed information was taken regarding clinical features, risk factors, co-morbidities and indications for treatment. Necessary investigations like HBsAg by ICT and/ or ELISA were done. Polymerase chain reaction (PCR) was done to confirm infection and quantitate viral load. After confirming diagnosis and indications for treatment, patients were started on recommended antiviral treatment.

2.4 Data Collection Plan: Sex and age groups were demographic variables. Sex was nominal while age group was an ordinal variable.

2.5 Data Analysis Plan

2.5.1 Descriptive Statistics and Estimation of Parameters: Distribution for sex and age groups for the sample was described by count and percentage. Estimated distribution for the population were estimated as CI at 95%CL by normal approximation method.[12]

2.5.2 Hypotheses Testing: Two hypotheses were verified using chi-square goodness of fit test at alpha .05, showing observed & expected counts, test statistics, degree of freedom and significance (H_{01} & H_{02}).[13-15]

3. RESULTS

3.1 Descriptive Statistics & Estimation of Parameters

3.1.1 Distribution of hepatitis B infected population by sex and age groups

The distribution of 2368 hepatitis B infected population by sex and age groups is seen in Table 3.1.1. Based on confidence intervals, the prevalence is more common in men 70.52% than women 29.48% and most common in age group 21-40 years (53.46%), followed by 0-20 years (23.73%), 41-60 years (19.51%) &>60 years (3.30%).

3.2 Hypotheses Testing

3.2.1 Observed vs. expected distribution of hepatitis B infected population by sex (H_{01}): Our observed counts of 2368 patients for men vs. women were 1670:698 against expected counts of 148:112 for 260 patients as shown by Khan, et al.[9] Due to differences in sizes of samples, comparison could not be logical. Therefore the expected counts were adjusted to our sample size of 2368, giving us adjusted expected counts of 1348:1020, with no change in adjusted expected percentages. (Table 3.2.1.1)

Test of significance gave us p-value <.00001, rejecting H_{01}, which shows that the observed prevalence of hepatitis B infection in men 70.52% was higher than its expected (adjusted) prevalence for men 56.92 % & in women 29.48% it was lower than its expected (adjusted) prevalence for women 43.08% as shown by Khan, et al.[9] (Table 3.2.1.2)

Table 3.1.1: Distribution of hepatitis B infected population by sex and age groups in District D. I. Khan, Pakistan (n=2368)

Variables	Attributes	Sample statistics		95%CI for proportion	
		Count	Percentage	Lower	Upper
Sex	Men	1670	1670*100/2368=70.52%	68.65	72.32
	Women	698	698*100/2368=29.48%	27.68	31.35
Age groups (years)	0-20	562	562*100/2368=23.73%	22.06	25.49
	21-40	1266	1266*100/2368=53.46%	51.45	55.46
	41-60	462	462*100/2368=19.51%	17.96	21.15
	>60	78	78*100/2368=03.30%	2.65	4.10
Total		2368	2368*100/2368=100%	Population parameters	

Table 3.2.1.1: Observed, expected and adjusted expected counts and percentages for distribution of hepatitis B infected population by sex in District D.I.Khan, Pakistan (n=2368)

Sex	Observed counts	Observed %ages	Expected counts	Expected %ages	Adjusted expected counts	Adjusted expected %
Men	1670	1670*100/2368 =70.52%	148	148*100/260 =56.92%	148*2368/260 =1348	1348*100/2368 =56.92%
Women	698	698*100/2368 =29.48%	112	112*100/260 =43.08%	112*2368/260 =1020	1020*100/2368 =43.08%
Total	2368	100%	260	100%	2368	100%

Table 3.2.1.2: Observed vs. expected distribution of hepatitis B infected population by sex in District D.I. Khan, Pakistan (n=2368)

Sex	O	E	O-E	$(O-E)^2$	χ^2	$\sum\chi^2$	d.f.	p-value
Men	1670	1348	322	103684	76.92	178.57	1	<.00001
Women	698	1020	-322	103684	101.65	H_{01} rejected at alpha .05		
Total	2368	2368	00	χ^2 goodness-of-fit test with Yates continuity correction				

O= Observed count, E= Expected count, χ^2= Chi-square statistics, d.f. = degree of freedom

Table 3.2.2.1: Observed, expected and adjusted expected counts and percentages for distribution of hepatitis B infected population by age groups in District D.I.Khan, Pakistan (n=2368)

Age groups (years)	Observed counts	Observed percentages	Expected counts	Expected %ages	Adjusted expected counts	Adjusted expected %
0-20	562	562*100/2368 =23.73%	30	30*100/260 =11.54%	30*2368/260 =273.23	273.23*100/2368 =11.54%
21-40	1266	1266*100/2368 =53.46%	157	157*100/260 =60.38%	157*2368/260 =1429.91	1429.91*100/2368 =60.38%
41-60	462	462*100/2368 =19.51%	51	51*100/260 =19.62%	51*2368/260 =464.49	464.49*100/2368 =19.62%
>60	78	78*100/2368 =3.30%	22	22*100/260 =08.46%	22*2368/260 =200.37	200.37*100/2368 =08.46%
Total	2368	100%	260	100%	2368	100%

Table 3.2.2.2: Observed vs. expected distribution of hepatitis B infected population by age groups in District D.I.Khan, Pakistan (n=2368)

Age groups (years)	O	E	O-E	(O-E)2	$\chi 2$	$\sum\chi 2$	d.f.	p-value
0-20	562	273	289	83521	305.94	399.19	3	<.00001
21-40	1266	1430	-164	26896	18.81			
41-60	462	465	-3.00	9	0.02			
>60	78	200	-122	14884	74.42	H_{02} rejected at alpha .05		
Total	2368	2368	00	χ^2 goodness-of-fit test with Yates continuity correction				

O= Observed count, E= Expected count, χ_2= Chi-square statistics, d.f. = degree of freedom

3.2.2 Observed vs. expected distribution of hepatitis B infected population by age groups (H_{02}): Our observed counts for 2368 patients for four age groups (0-20:21-40:41-60:>60years) were 562:1266:462:78 against expected counts for 260 patients as 30:157:51:22 as shown by Khan, et al.[9] Due to differences in sizes of samples, comparison could not be logical. Therefore the expected counts were adjusted to our sample size of 2368, giving us adjusted expected counts of 273.23:1429.91:464.49:200.37, with no change in adjusted expected percentages. (Table 3.2.2.1)

Test of significance gave us p-value <.00001, rejecting H_{01}, which shows that observed prevalence of hepatitis B infection in four age groups is not similar to its expected prevalence for four age groups from a study by Khan, et al.[9] (Table 3.2.2.2)

4. DISCUSSION

4.1 Distribution of hepatitis B infected population by sex (H_{01}): The prevalence of hepatitis B infected population was higher in men 70.52% (95% CI 68.65-72.32) than women 29.48% (95% CI 27.68-31.35) in our population. (Table 3.1.1)

Similar to our findings, higher prevalence in men than women were reported by Ullah , et al.[10] (61.23% vs. 38.77%), Khan, et al.[9]from Mardan, Pakistan (56.92% vs. 43.08%), Khan, et al.[7] from Lahore, Pakistan (68.15% vs. 31.85%), Mousawea , et al.[6] (79.01% vs. 20.99%), Tao, et al.[5] (58.53% vs. 41.47%), Soliman, et al.[4] (67.25% vs. 32.75 %) & Badawi, et al.[3] (77.81% vs. 22.19%). Dissimilar to our findings, lower prevalence in men than women were delineated by Ullah, et al.[8] from Peshawar, Pakistan (38.46% vs. 61.54%). No study describing similar prevalence in men and women could be sorted out from literature.

Our observed prevalence of hepatitis B infection in men 70.52% was higher than its expected (adjusted) prevalence for men 56.92 % & in women 29.48% it was lower than its expected (adjusted) prevalence for women 43.08% as shown by Khan, et al.[9] (Table 3.2.1.2)

4.2 Distribution of hepatitis B infected population by age groups (H_{02}): In our study hepatitis B infection was most common in age group 21-40 years 53.46% (95% CI 51.45-55.46), followed by 0-20 years 23.73% (95% CI 22.06-25.29), 41- -60 years 19.51% (95% CI 17.96-21.15) &>60 years 3.30% (95% CI

2.65-4.10). (Table 3.1.1)

In a study by Badawi, et al.[3] PCR detected HBV infection was most common in age group 20-39 years 64.06%,followed by 40-59 years 24.56%, <20 years 6.16%, 60-79 years 4.93% &>80 years 0.29%.

In a study by Tao, et al.[5] PCR detected HBV infection was most common in age group 20-49 years 77.82%, followed by ≥50 years 20.26%, 6-19 years 1.56%, <1 years 0.27% & 1-5 years 0.09%.

In a study by Mousawea, et al.[6] HBsAg positive patients were most common in age group 21-40 years 49.79%, followed by 41-60 years 30.91%, ≥61 years 10.62% & 1-20 years 8.68%.

In a study by Ullah, et al.[8] from Peshawar, Pakistan, HBsAg positive patients were most common in age group 41-60 years 50%, followed by 21-40 years 24.19%, 61-80 years 24.19% & 1-20 years 1.61%.

As reported by Khan, et al.[9] from Mardan, Pakistan, PCR detected HBV infection was most common in age group 21-40 years 60.38%, followed by 41-60 years 19.62%, 1-20 years 11.54% & >60 years 8.46%.

In a study by Ullah, et al.[10] from Mardan, Pakistan, PCR detected HBV infection was most common in age groups 21-40 years 78.26%, followed by 41-60 years 16.67%, 10-20 years 3.62% & ≥61 years 1.45%.

Our observed prevalence of hepatitis B infected population in the four age groups was different from what we expected for the four age groups from a study by Khan, et al.[9] from Mardan, Pakistan. (Table 3.2.2.2)

4.3 Marwat Logical Trajectory of Research Process: We have incorporated the innovated model of "Marwat Logical Trajectory of Research Process" in our project.[16-19]

5. CONCLUSION

In our study, hepatitis B infection was more common in men than women and most common in age group 21-40 years, followed by 0-20 years, 41-60 years and >60 years. Our observed prevalence of hepatitis B infection in men was higher than expected & in women it was lower than expected. Our observed prevalence in the four age groups was not similar to expected.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	IU, NK
Acquisition, Analysis or Interpretation of Data:	IU, NK, FS, EA, AS
Manuscript Writing & Approval:	IU, NK, FS, EA, AS

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.