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Stanislowski L, Lefevre M, Bourd K, Soheili-Majd E, Goldberg M, Perianin A (2003). TEGDMA-induced toxicity in human fibroblasts is associated with early and drastic glutathione depletion with subsequent production of oxygen reactive species. *J. Biomed. Res.* 66:476-82.

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*Full Length Research Paper*

# **Fatigue factors among regional pilots in Malaysia**

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**Fatigue among pilots and aircrew has been acknowledged as a human factor safety issue since commercial aviation started. The first objective of this study is to investigate the promoting and interfering factors that are involved in pilots' sleep patterns. Meanwhile, the second objective of this study is to understand pilots' duty hours and delay factors that eventually lead to fatigue. The findings from the study demonstrate that most pilots have no difficulty in getting to sleep and most had never taken any sleeping aid. The study found five sleep-interfering factors, all of which can be categorised as either environmental or physiological factors. Environmental interfering factors include heat, noise and lighting. Physiological factors include biological needs and personal worries. Personal worries top the list of the five interfering factors that were identified in this study. The study also found that flight delays can easily fatigue pilots and aircrews. Fatigue is a serious problem because 93% of pilots have admitted that they had nodded off while in control of their flights. It can be concluded that pilots have no problem with sleeping; however, their duty hours and, especially, flight delays cause them to experience fatigue.**

**Key words:** Fatigue, survey, aircraft fatigue, pilots, aircrew.

## **INTRODUCTION**

Regional airline operations within Malaysia and neighbouring countries are a growing segment of the commercial air-transport industry. The increasing frequency of air travel causes fatigue and a lack of alertness among the aircrew, especially pilots. Significant evidence has shown that aircrew and pilot fatigue has been the primary factor in several air incidents and accidents around the world (Neville et al., 1994; Samel et al., 1995; Caldwell, 2001). Fatigue which includes sleepiness and tiredness is the largest identifiable cause of accidents in transport operations (Akerstedt, 2000). Recently, Petrie et al. (2004) suggested that fatigue is a major problem for many pilots especially for those who are operating regional and international routes.

Caldwell (2001) reported a results from surveys on pilots and aircrew members reveal that fatigue is an important concern throughout today's 24/7 non-stop

flight operations. Scheduling factors sleep deprivation, circadian rhythm disruptions and extended duty periods continue to challenge the alertness and performance levels of pilots. Limiting flight hours and ensuring at least minimal periods of crew rest have mitigated pilots' fatigue problems to some extent; however, these precautions have not completely removed the risk of this air safety threat (Caldwell 2001; Sexton and Klinec, 2001).

A review study by Williamson et al. (2011) revealed that fatigue is mainly affected by a combination of time of day and sleep related factors. Sleep physiology can be categorised into homeostatic factors and circadian factors. Homeostatic factors are related to the level of sleepiness. It is important to understand that sleep loss accumulates, and the only way to restore it is through restorative and adequate sleep. Another physiological factor that can control and regulate body functions is the circadian rhythm, which is otherwise known as the 'internal clock'. The human body is programmed to sleep and wake up in accordance to this 'internal clock'. This 'internal clock' cannot be rescheduled and

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resynchronised immediately; however, it is a well-known fact that pilots always fly to different time zones and are, therefore, subjected to fatigue due to the circadian rhythm factor. Petrilli et al. (2006) found that sleep is very important and it is a countermeasure for fatigue during international flights that involve not only long hours but also irregular sleep schedule and multiple time zone changes.

In summary, pilot fatigue can be a major flight safety concern and, therefore, demands special attention. Civil aviation started in Malaysia, then Malaya, in 1937 (Fyfe, 2002). Before the emergence of the low cost carrier concept, Malaysia Airlines primarily monopolised aviation in Malaysia. In the past, many studies have investigated pilot and aircrew fatigue, but none has been conducted in the context of the Malaysian aviation environment (Caldwell, 2004; Goode, 2003; Gander, 2001; Janic, 2000). Regulatory requirements, scheduling practices, sleep patterns and other factors have been suggested as potential fatigue factors for regional air operators in the world. For example, the work on short-haul operations in UK by Powell et al. (2007, 2008) have shown that pilot fatigue among others are caused by the duty length, time of day and its impact on the timing of sleep. Before objective measurement like studying the sleeping patterns could be done on specific number of pilots, a survey is inevitable. Hence, the objectives of this study are twofold: first, to identify sleep patterns and their promoting and interfering factors that impact pilots, and second, to investigate pilots' duty hours and the delay factors that eventually lead to fatigue. This study is limited to pilots in Malaysia who fly narrow-body aircraft and fly to regional destinations that are within 4 h of flight time.

## MATERIALS AND METHODS

### The questionnaire

A survey was carried out based on the questionnaire that was used in the survey conducted by Co et al. (1999) for National Aeronautics and Space Administration (NASA) technical report. Some modifications were implemented to adapt the questionnaire to the Malaysian aviation environment and to suit to the primary objectives of this study. The survey questionnaire used in this study consisted of 37 questions and was divided into 4 sections: General, Sleeping Pattern, Duty, and Fatigue. The questions are mainly open-ended and also in the form of 5-point Likert items. The phrasings that were used were similar to the original version of the questionnaire by Co et al. (1999). For example, under the sleeping pattern section, the pilots were asked to rate the frequency with which they napped based on a 1 to 5-scale, ranging from "never" to 'very often'.

### Survey distribution

The survey questionnaires were distributed to randomly selected pilots via email and hard copy. A cover letter was attached to the survey that explained the objectives of the survey and what was required from the participants. It was highlighted to the participants that the survey was voluntary, anonymous and confidential. The respondents included pilots from 3 regional air operators in

Malaysia. The respondents were not required to identify themselves, and they were asked in the cover letter to provide truthful answers. The data collection took almost 3 months to compile because many of the participants did not reply to the first email request.

## RESULTS AND DISCUSSION

This section is divided according to the main components of the survey: sleeping pattern, duty-related factors and fatigue. One hundred fifty-nine (159) questionnaires were distributed via email and hard copy. From the 125 returned survey questionnaires, 8 were eliminated because only parts were filled out; therefore, only 73.6% of the total number of distributed questionnaires was used in the analysis.

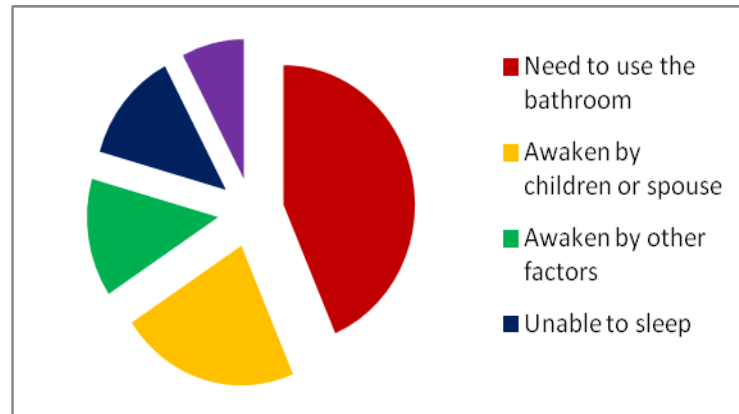
### Respondents' demographic

The mean age of the respondents was 31.8 years, with ages ranging from 19 to 55 years old. All of the respondents were males, 44% of whom were single and 56% were married. The respondents' designations are according to their ranks; 38.5% of the subjects were commanders (captains) and 61.5% were co-pilots. Among the respondents, 80 pilots held an Airline Transport Pilot Licence (ATPL) and 37 held a Commercial Pilot Licence (CPL). The ATPL is the highest level of license whereas CPL is for beginner. The respondents levels of experience ranged from less than 1 year up to 33 years of experience with an average of 10.2 years as an aviator, and the total flight hours recorded ranged from 300 to 20,000 h.

### Sleeping pattern

In order to evaluate pilot normal sleeping pattern, the first section of the questionnaire ask on sleeping pattern. It is important to highlight that these respondents were asked to rate the questionnaires based on the average night of sleep for at least two days after returning home after a trip. The results show that on average, the pilots go to bed at 0010 h (12:10 am) in the morning and rise at 0756 h (7:56 am). Most pilots had normal sleep profiles of 7 h and 46 min on average. The pilots reported that they fell asleep after an average of 14.8 min after going to bed. Because this survey was a self-reported survey, this claim was only an estimate. The results also demonstrated that there was an average of 1.04 awakenings per night. Only three of the respondents, who were aged 53, 52 and 39, reported being awakened 3 times a night.

From the answers alternatives given in the questionnaire, the primary causes of the reported awakenings included 43.6% who had a 'need to use the bathroom', 22.2% who reported that they were awakened by their children or spouse, 13.7% who were awakened by 'other factors', 12.9% who were unable to sleep, and 7.7% who



**Figure 1.** Primary causes of awakenings

**Table 1.** The averages of top 5 sleep promoting and interfering factors.

Number	Sleep promoting factor	Mean value	Sleep interfering factor	Mean value
1.	Comfort of clothing	4.16	Heat	1.60
2.	Pillows	3.97	Thoughts running through your head	1.65
3.	Bed sheets	3.64	Trips to bathroom	2.07
4.	Ventilation	3.59	Random noise events	2.24
5.	Quality of sleep surface	3.54	Background lighting	2.33

were awakened due to 'noise'. The results are depicted in Figure 1. For 'other factors', 9 out of 117 respondents stated that they awoke to perform prayers, thereby accounting for 7.7% of all respondents.

Meanwhile, 4 respondents listed dreams and nightmares as their primary cause of waking. After waking, the respondents reported that it took them an average of 10.9 minutes to return to sleep.

In order to investigate the history of napping behaviour and sleeping problems, several questions regarding the frequency of naps taken during off-days and problems faced when getting to sleep were asked. 'Very often' is defined as napping 5 to 7 times a week. The middle rating of 'rarely' is defined as 1 to 10 times a year, 'sometimes' as 1 to 3 times a month, and 'often' as 1 to 4 times a week. The results indicate that 45.3% of the respondents reported 'never', 6% reported 'rarely', 21.4% reported 'sometimes', 12.8% reported 'often' and 14.5% reported 'very often'. The average reported nap length was 1 hour and 17 minutes.

In terms of sleeping problems, 66.5% claimed that they 'never' or 'rarely' had problems falling asleep, whereas 20.5% reported that they 'sometimes' did, and 12.8% reported that they 'often' or 'very often' had problems falling asleep. Exactly 94% of the respondents never used any medications to aid sleep, whereas 5.9% said they rarely or sometimes used medication to aid sleep. Regarding alcohol use to aid in sleep, 88% reported 'never', 4.3% reported 'rarely', 4.3% reported 'sometimes',

and 3.4% said they use it 'often' or 'very often'.

Subjects were asked an open-ended question to identify which types of foods or beverages, aside from alcohol or medication helped them fall asleep. Exactly 74% of the participants responded to this question, with most suggesting hot beverages, such as hot milo, hot milk and fibre-rich dishes similar to oatmeal.

Next, respondents were asked about 16 factors that might have effects on sleeping. Respondents had to rate these using a Likert scale that included '1-interferes' through '3-no effects' to '5-promotes'. The top five promoting and interfering factors based on these averages are shown in Table 1. In another open-ended question where respondents were asked to list 5 factors that promoted or interfered with their sleep, 46% responded with 'thoughts running through your head' as their main interfering factor, whereas 39% of the respondents quoted 'pillows' as a promoting factor. The responses are illustrated in figure 2.

In addition, a Likert scale that ranged from '1= strongly interferes' to '5= no effects' was used to ask respondents how these factors affected them. The results demonstrate that personal worries were the most interfering factors identified by the respondents: 24.8% of the 117 respondents rated these factors as a 1, where the mean score was 2.82. Meanwhile, hunger was rated first by 11.1% of the total respondents (mean of 2.91), followed by thirst (10.3% and a mean of 3.24) and, lastly, respiratory factors (10.3% and a mean of 3.33).

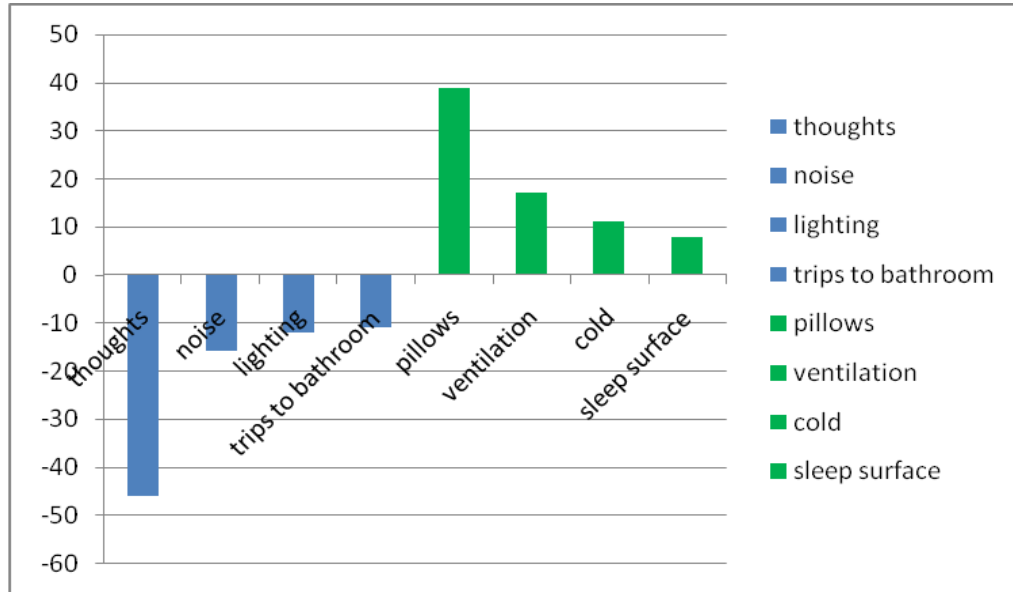


Figure 2. Sleep promoting and interfering factors.

These findings strongly suggest that emotional and psychological factors, such as thoughts and personal worries, genuinely affect pilots' rest days.

### Duty-related factors

In this section, the respondents were asked questions about their duty-related matters over the past 2 months. These data encompassed a large timeframe, from August 2009 through early December 2009; therefore, the data range was very wide. Surprisingly, the data showed an almost even distribution. On average, the pilots worked for 19.04 days in a month, with 10 days being the least, and 23 days are the most. The average number of flying hours among the respondents was 76.8 h (76 h 48 min). Sixty hours of flight time was the lowest clocked in a month, whereas 95 hours was the most.

When asked about how many hours the pilots work in a single duty day, the average typical day was 9.32 h (9 h 19 min), the shortest day was 4.34 h (4 h 20 min), and the longest was 13.10 h (13 h 6 min). All of the respondents reported that delays do somehow affect their daily flights. The average typical delay duration was identified to be 10.1 min, with the shortest and longest being 5.4 and 81.7 (1 h 22 min) minutes, respectively. Out of all of the collected data, 2 respondents reported maximum delays of 4 h, whereas 34% reported a maximum delay of more than 2 h. Most of the time, these types of delays are unavoidable; however, certain mechanisms for handling such delays, such as a standby aircrew or pilots, should be made available beforehand.

An average of 8.7 delay occurrences per week derives from air traffic control (ATC). ATC delays only

refer to departure delays, as most of the arrival delays follow from previous delays. Departures that are held up by weather, such as rain, wind or poor visibility, account for 5.21 delays per week. Meanwhile, mechanical delays due to technical defects on the airplanes occurs an average of 1.03 times per week. From the data collected, it can be concluded that ATC-related delays are a major concern in extending the crew duty day and eventually lead to fatigue. Respondents were asked to report the number of times they typically operate in high-density terminal control areas (TMAs), which are separate from Kuala Lumpur International Airport (KLIA), and the number of times they operate in a no-radar environment. In high-density TMAs, such as Singapore Changi, Bangkok Suvarnabhumi or Hong Kong Airport, the amount of traffic that is departing and arriving is so high that pilots need to be highly alert and at their best performance; however, these places have radar assistance, which means that the aircraft is positively controlled by the air traffic controllers and that the separation between airplanes and terrain clearances are almost guaranteed by the ATC. In contrast, in a no-radar environment, pilots have to be highly alert to make sure that they maintain separation between other airplanes and the terrain. In both conditions, pilots must always be on high alert and at their best performance. The respondents reported that they flew into high-density airports and no-radar TMAs almost 7.3 times and 6.4 times on average, respectively. Therefore a total of 13.7 instances of high stress and fatigue could be induced in a week. Because the average number of duty days in a month is 19 days, the pilots fly into these types of places almost 3 times a day. It can be said that these pilots are exposed to these issues almost every time they fly.

**Table 2.** Suggestions and strategies to overcome fatigue before and during a flight.

Before and during flight	Suggestion and strategy
Before flight	1. Sufficient sleep
	2. Good duty and day-off rostering and scheduling by the company
	3. Fewer legs in a duty day
	4. Nutritious food and meal before flight
	5. Maintaining a high fitness level
	6. Transport: not having to drive to the airport. Starting one's rest period upon arrival to the hotel (transportation is not counted as part of the rest period)
	7. Smoking before a flight
	8. Avoiding unnecessary domestic confrontations before a flight
In-flight	1. Allowing a control nap/sleep break in the cockpit
	2. The company should provide nutritious food/refreshments
	3. Drinking a lot of water
	4. Practicing good communication/crew resource management (CRM) skills in the cockpit to create a stress free cockpit environment
	5. Reading the newspaper while cruising to avoid boredom and increase alertness
	6. Taking a brisk walk in the cabin and performing a light stretching exercise after a few hours of cruising
	7. Suggesting that smoking be allowed in the cockpit

## Fatigue

Fatigue in aviation was investigated in Section D of the survey. The respondents were required to rate their concern and view regarding the effects of fatigue. From the findings, 86% considered fatigue to be a 'moderate' to 'serious' concern, whereas 14% considered it to be a 'minor' concern or not a concern at all. Another worrying finding is that 91% of the respondents described fatigue as a common occurrence during flight operations. Up to 92% of the respondents indicated that when crew fatigue occurs, it is a 'moderate' to 'serious' safety issue.

The result demonstrates that 51% of the respondents reported fatigue that mostly occurred 'en-route', whereas 27% reported it during 'descent' and 10% during 'landing'. Meanwhile, 'taxi' and 'take-off' flight phases scored 4 and 8%, respectively. From these data, the approach phase, which encompasses the 'descent' and 'landing' phases, accounted for 37% of the reported fatigue. Another alarming response was that 93% of the respondents admitted that they had experienced nodding off during a flight at some time.

Subsequently, a 4-point scale, which included '1-not at all', '2-slightly', '3-moderately' and '4-seriously', was used to rate 16 factors regarding the extent to which each factor affects the fatigue levels depicted in Figure 3. The frequency of when each factor occurs was also presented on a similar 4-point scale, including '1-very rarely', '2-sometimes', '3-often' and '4-very often'. Each scale item was defined as follows: 'very rarely' was defined as 1 to 10 occurrences a year, 'sometimes' was defined as 1 to 3

occurrences a month, 'often' was defined as 1 to 4 occurrences per week, and 'very often' was defined as 5 to 7 occurrences per week. According to Figure 3, the top 10 factors that affect fatigue levels are: flying without an autopilot, aircraft dispatch with major deferred defects, flying multiple sectors of 4 or more, a lack of available nutritious food, dehydration, a high ambient temperature, flying multiple sectors of 1 to 3 sectors, flying following actual instrument flight rules (IFR), severe turbulence and ATC interactions.

According to Figure 1, it can be seen that the most frequent cause of fatigue is flying using actual IFRs, which means flying completely based on instruments. The fatigue effect from this factor is midway between 'slightly' to 'moderately'. It is an important fact that most Malaysian regional pilots fly in an area with high meteorological activity, due to Malaysia's being geographically located near the equator. Thus, flying into clouds and making an IFR approach in poor visibility due to rain and fog is a common contributor to fatigue.

The next question was an open-ended one, wherein the respondents were asked about their strategies for overcoming fatigue before and during a flight. A number of the suggestions and strategies that were mentioned by the respondents in the survey are depicted in Table 2.

## DISCUSSION

Pilots work hard every month. Pilots clocked an average of 76 h and 48 min per month and an average duty day that lasted 9 h and 19 min. Flight hours start when

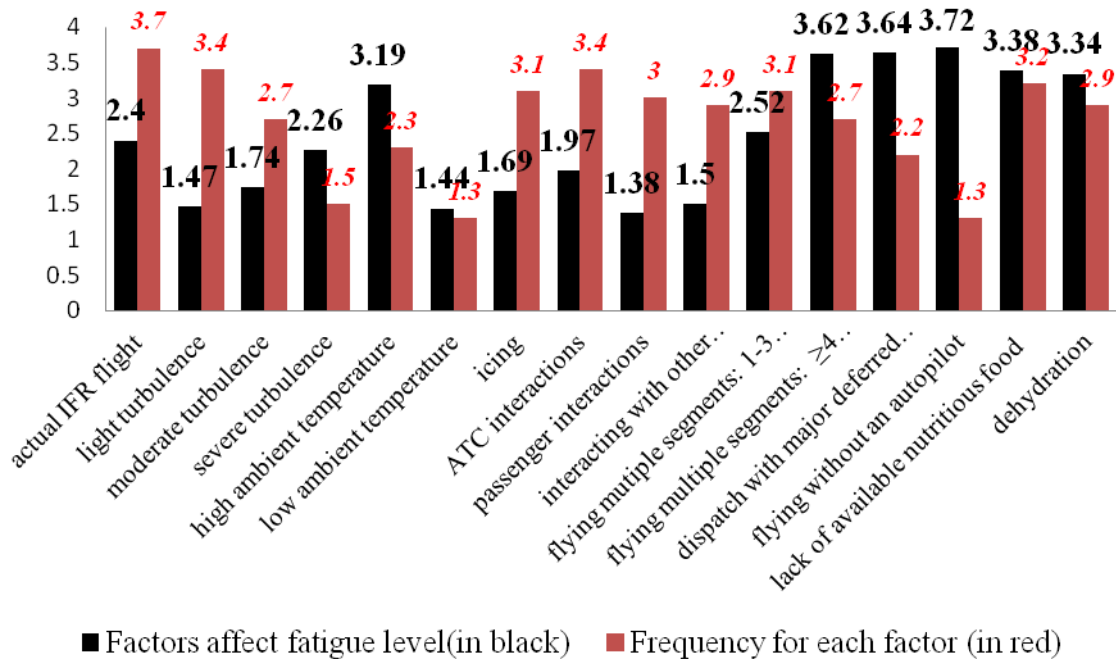


Figure 3. The mean values and frequencies of factors that impact fatigue

an aircraft moves on its own power and end when it comes to a complete stop. Flight hours and duty hours are two different things and both affect pilot performance. Delays also induce fatigue, as they lengthen the duty period. Delays were experienced by 100% of the respondents, the shortest delay being 5.4 min and the longest delay being 1 h 22 min. More than half of the respondents reported experienced delays of between 1 and 2 h. The most critical delay-causing factors were ATCs and the weather. Another matter that could contribute to pilot fatigue is the nature of Association of Southeast Asian Nations (ASEAN) regional aviation in which pilots frequently fly into many high-density airports and also through no-radar assisted environments.

There is a great deal of concern that pilot schedules could lead to fatigue and an increased chance of an aviation accident or incident (Folkard and Monk 1979; Dinges, 1991). According to Goode (2003), the Federal Aviation Administration (FAA) of the US proposed a rule to clarify and simplify flight and duty time limits and rest requirements to ensure that flight crews receive adequate rest. Air operators in the US are subject to different sections of the Federal Aviation Regulations (FARs) based on the number of passenger seats. FAR Part 135 applies to aircraft with 30 or fewer passenger seats, whereas Part 121 applies to those with more than 30 seats (Co et al., 1999). For air operators who fall under Part 121, their pilots are limited to 30 flight hours in any 7 consecutive days. Part 121 also limits flight crewmembers not to exceed 1,000 h in any 12 calendar months. Operators are currently required to provide each crew member with a minimum of 24 consecutive hours

of rest each week.

On the other hand, in Malaysia, the governing body of civil aviation and air operators use the United Kingdom Civil Aviation Authority CAP371, 'The Avoidance of Fatigue in Aircrews', which was first published in 1975 (MAS, 2009). This publication represents the UK version of the FARs. CAP 371 contains duty limitations, flight time limitations and the minimum required rest period in addition to a set work pattern for the flight crew to prevent the onset of fatigue. It was made known from the responses in the pilot study that fatigue and scheduling practices are sensitive issues to the pilot community. Due to this sensitivity, this survey did not question the justification of scheduling practices, although scheduling practices and demands make up the majority of fatigue-related problems in aviation. As Caldwell (2004) suggested, human beings are simply not designed to operate effectively on the pressured 24/7 schedules that are becoming today's flight operations, whether these schedules consist of short-haul or long-haul commercial flights. The multiple flight legs, long duty hours, limited time off, early report times, less-than-optimal sleeping conditions, rotating and non-standard work shifts and jet lag have all become so common throughout modern aviation and pose significant challenges to the basic biological capabilities of pilots and crews. Scheduling and rostering have been the most talked-about concerns related to fatigue, especially length of duty and night time duties (Powell et al., 2008). Even though this survey did not investigate these factors, due to the reason mentioned above, this issue has to be addressed in order to enhance flight safety. An overall review of

scheduling practices must be made without jeopardising air carriers' economic interests.

In the authors' point of view, awareness and education is the most effective tool in managing fatigue. Pilots, air carriers and all parties who are involved in Malaysia's regional flight operations should be well-equipped and aware of the effects of fatigue. Pilots and all concerned parties should be educated and trained regarding sleep requirements, circadian physiology and their safety concerns. Fatigue is a physiological issue that cannot be simply overcome by motivation, training, willpower or remuneration. Human beings cannot reliably judge their own fatigue level, and there is no one solution for all possible situations. Every human slightly differs in terms of fatigue. Awareness and knowledge are the most significant tools for improving regional flight safety fatigue issues. It actually has been confirmed in a survey done in New Zealand by Signal et al. (2008); the authors suggested that there is a need to raise the level of knowledge within the industry regarding the causes and consequences of fatigue and processes of its management.

As evidenced by the responses to the open-ended question, it can be seen that the most efficient strategy for minimising fatigue before flight duty is sufficient and adequate sleep at home. However, it is important to highlight that fatigue cannot be represented by simple summation of the individual factors but rather the complete interaction of the timing of duty related to the circadian rhythm of fatigue, and the duration of duty and its impact on the timing of sleep (Powell et al., 2007). Even though each individual's sleep requirements could be different, 8 hours of sleep will generally guarantee adequate alertness in most people. Sleep loss can degrade cognitive processes, vigilance, physical coordination, judgment and decision-making, communication and countless other parameters (Broughton and Ogilvie, 1992; Dinges and Kribbs, 1991). According to Co et al. (1999), 1 hour of sleep loss can affect waking alertness, and 2 h of sleep loss can significantly affect both alertness and performance. Nodding off is caused by sleep debt, and the length of unintentional sleep episodes, also known as micro-sleep, normally ranges from 3 s to a maximum of 15 s (Blaivas et al., 2006). Naps should also be considered by pilots to promote alertness during flights. In situations in which sleep is frequently disrupted or missed altogether, scheduled naps could be used as a countermeasure against fatigue until normal sleep is possible. According to research papers as quoted by Caldwell (2001), a short nap of 5 to 20 min has been found to enhance productivity and is an effective fatigue countermeasure in aviation. He has suggested that naps be taken at appropriate times, such as between 1 and 6 am or between 2 and 5 pm, such that they do not disturb the circadian rhythm; however the effects of napping are relatively short and may only last for 10 to 30 min. Pilots

must always be physically fit and regularly exercise. Besides keeping one's body healthy, exercise may be an effective method (probably temporarily) to increase alertness and arousal (Caldwell, 2001). Another recommendation would be to have a light stretching exercise while on board to boost alertness. In the survey itself, the pilots suggested reading a newspaper as a strategy to cope with fatigue. Boredom could also be a cause of sleepiness, especially while the aircraft is in cruising mode (sedentary activity). Reading a newspaper or any other material should be done in tandem, with priority being given to monitoring the flight progress. This recommendation should be practiced with caution. Aside from reading, another recommendation would be to engage in conversations and take rest breaks. The most common remedy to sleepiness is to have a cup of coffee for a temporary boost. A cup of coffee has approximately 100 mg of caffeine (Caldwell, 2001). Research has shown that 200 mg doses could reduce sleepiness for 1 to 2 h; however, this effect only occurs 30 min after consumption. It must be highlighted that Caldwell (2001) suggested that caffeine is less effective to those who consume caffeine regularly.

Nevertheless, these techniques would only help increase alertness for short periods of time. If sleepiness is a problem, cockpit naps should be allowed. In Malaysia, aviation regulations have not yet approved cockpit napping. This matter should be seriously investigated. Cockpit napping can only be practiced while in cruising mode when one pilot stays awake and takes control of the flight while another naps on his seat. This activity is often referred to as called 'control sleep' or 'planned sleep' (Rosekind et al., 1995). A study by Rosekind et al. (1995) has shown that naps of up to 40 minutes in length are both safe and effective for long-haul pilots. Roach et al. (2011) indicated that long-haul pilots could obtain substantial sleep during duty periods, however not likely for shorter flights for example, regional flights.

Nonetheless, survey studies are limited by the subjective nature of the data in which the responses depend on respondents' perceptions, memories and understanding of the questions. Sasaki et al. (1986) and many other research papers have indicated that individuals' subjective perceptions of their sleep often differ from physiological parameters. Self-assessed estimates of sleep latency; sleep duration, the number of awakenings, fatigue level, and other measures are mostly inaccurate; therefore, the interpretation of these findings should account for the limitations of these subjective data

Further studies that conduct objective studies on psychological and physiological aspects should be conducted to verify the findings obtained by this survey.

## CONCLUSION

It was found that the majority of the respondents have normal daily sleep profiles of approximately 7 hours and 46 min. Most of the respondents did not have

any problems concerning their ability to fall asleep and had never taken any sleeping aid, such as alcohol or medication; however, 5 interfering factors were identified, as per the suggestions of the respondents. The top 5 interfering factors included heat, noise, lighting, biological processes and personal worries. Personal worries topped the list of factors that interrupted a pilot's sleep at night. A compromised night of sleep can eventually lead people to fatigue.

According to the survey itself, the issue of fatigue in Malaysia's regional aviation industry can be considered to be very significant. Almost all of the respondents agreed that fatigue is a common occurrence in their flight operations and is a serious safety issue when fatigue really occurs. Most fatigue occurs in the cruising phase, and more than one third of instances occur during the approach and landing phases. The latter is the most crucial phase and requires the highest level of crew alertness. Moreover, 93% of respondents reported that they have nodded off while in control. This finding is a serious matter, as fatigue sets in without a pilot realising it. This phenomenon could jeopardise the lives of passengers and crew members and is also a risk to aircraft safety itself. It was identified that 5 factors highly affect fatigue, including two dietary factors (dehydration and a lack of nutritious food), one aircraft factor (dispatch with major deferred defects), one environmental factor (a high ambient temperature), and one scheduling and rostering factor (flying more than 4 sectors). Interestingly, when asked to provide suggestions of improvement, many pilots brought up the issue of scheduling and rostering. Many pilots want scheduling practices to be re-evaluated. The scheduling of flights and also the number of required flights to be operated by the same crew in a single day have been long-standing issues between airline companies and pilots. Many want the regulations to be amended such that control sleep or napping in cockpit seats is allowed to reduce fatigue. Most pilots also acknowledged that physical fitness, good food and a good diet, in addition to sufficient sleep, are generally well-accepted ways to reduce fatigue. This study only touches some surface issues regarding fatigue in aviation. Future studies regarding this issue must be conducted to understand and minimise fatigue further for pilots and aircrews.

## REFERENCES

- Akerstedt T (2000). Consensus statement: fatigue and accidents in transport operations. *J. Sleep Res.*, 9: 395.
- Blaivas AJ, Rajeshri P, Hom D, Antigua K, Hormoz A (2006). Quantifying microsleep to help assess subjective sleepiness. *J. Sleep Med.*, 8: 156-159.
- Broughton RJ, Ogilvie RD (1992). *Sleep, Arousal and Performance*. Boston: Birkhauser, pp. 1-8
- Caldwell JA (2001). The impact of fatigue in air medical and other types of operations: a review of fatigue facts and potential countermeasures. *Air Med. J.*, 20(1): 25-32.
- Caldwell JA (2004). Fatigue in aviation. *Travel Med. Infect. Dis.*, 3: 85-96.
- Co EL, Gregory KB, Johnson JM, Rosekind MR (1999). Crew factors in flight operations XI: a survey of fatigue factors in regional airline operations, NASA AMES Research Center Report No.: NASA/TM-1999-208799
- Dinges DF (1991). What management should know about fatigue in corporate aviation safety? The 36<sup>th</sup> Corporate Aviation Safety Seminar. Flight Safety Foundations, pp. 160-166
- Dinges DF, Kribbs NB (1991). Performing while sleepy: effects of experimentally-induced sleepiness. *Sleep, Sleepiness and Performance*. Chichester: Wiley, pp. 97-128
- Folkard S, Monk TH (1979). Shiftwork and performance. *Hum. Factors*, 21: 483-492.
- Fyfe C (2002). *Wheels in Malaya: The Wearne Brothers and their company*. Laremont: Lana Press, pp. 16-26
- Gander P (2001). Fatigue management in air traffic control: the New Zealand approach. *Transportation Research Part F: Traffic Psychol. Behav.*, 4(1): 49-62.
- Goode JH (2003). Are pilots at risk of accidents due to fatigue? *J. Saf. Res.*, 34: 309-313.
- Janic M (2000). An assessment of risk and safety in civil aviation. *J. Air Transport Manage.*, 6(1): 43-50.
- MAS (Malaysia Airlines) (2009). Our History (online: <http://www.malaysiaairlines.com>), [15 September 2010].
- Neville HJ, Bisson RU, French J, Boll PA, Storm WF (1994). Subjective fatigue of C-141 aircrews during operation desert storm. *Hum. Factors*, 36(2): 339-349.
- Petrie KJ, Powell D, Broadbent E (2004). Fatigue self-management strategies and reported fatigue in international pilots. *Ergonomics*, 47(5): 461-468.
- Petrilli RM, Roach GD, Dawson D, Lamond N (2006). The sleep, subjective fatigue and sustained attention of commercial airlines pilots during an International pattern. *Chronobiol. Biol. Int.*, 23(6): 1357-1362.
- Powell D, Spencer MB, Holland D, Broadbent E, Petrie KJ (2007). Pilot fatigue in short-haul operations: effects of number of sectors, duty length, and time of day. *Aviat. Space Environ. Med.*, 78: 698-701.
- Powell D, Spencer MB, Holland D, Petrie KJ (2008). Fatigue in two-pilot operations: implications for flight and duty time limitations. *Aviat. Space Environ. Med.*, 79: 1047-1050.
- Roach GD, Darwent D, Sletten TL, Dawson D (2011). Long-haul pilots use in-flight napping as countermeasure to fatigue. *Appl. Ergon.*, 42(2): 214-218.
- Rosekind MR, Miller DR, Gregory KB, Dinges DF (1995). Flight crew sleep in long-haul aircraft bunk facilities: survey results. *Sleep Res.*, 24: 112.
- Samel A, Wegmann HM, Vejvoda M (1995). Jet lag and sleepiness in aircrew. *J. Sleep Res.*, 4(2): 30-36.
- Sasaki M, Kurosaki Y, Mori A, Endo S (1986). Patterns of Sleep-Wakefulness Before and After Transmeridian Flight in Commercial Airline Pilots. *Aviation. Space. Environ. Med.*, 57(12): 29-42.
- Sexton JB, Klinec JR (2001). The link between safety attitudes and observed performance in flight operations. In *Proceedings of the Eleventh International Symposium on Aviation Psychology*. The Ohio State University. pp. 1-6.
- Signal L, Ratieta D, Gander P (2008). Flight crew fatigue management in a more flexible regulatory environment: an overview of the New Zealand aviation industry. *Chronobiol. Biol. Int.*, 25(2-3): 373-388.
- Williamson A, Lombardi DA, Folkard S, Stutts J, Courtney TK, Conroy JL (2011). The link between fatigue and safety. *Acid. Anal. Prev.*, 43(2): 498-515.



*Full Length Research Paper*

# Molecular prevalence of Hepatitis B virus infection in Khyber Pakhtunkhwa, Pakistan

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Hepatitis B virus (HBV) infection is a major health problem in the developing countries including Pakistan. This study aimed to investigate various risk factors and prevalence of HBV in different areas of Khyber Pakhtunkhwa province, Pakistan. A total of 1439 individuals (1021 males and 418 females) suspected for hepatitis B infection were screened for HBsAg. All the samples were blindly analyzed for HBV DNA by nested polymerase chain reaction (PCR). Of the total, 49.5% were found positive for HBsAg. Of these HBsAg positive patients, 83.03% were confirmed for HBV DNA. Of the 726 HBsAg negative individuals, 37 (24 males and 13 females) were found positive for HBV DNA. 629 HBV DNA positive individuals include 70.43% male and 29.57% female. Higher prevalence rate (16.53%) was observed in Malakand and lowest (13.35%) in Mardan. Mostly young people with age 16 to 30 years were infected as compared to other age group. Risk factors observed in HBV positive individuals were unhygienic barber practice, blood transfusion, general and dental surgery, unsafe injection and sharing personal items. Trend of sharing personal items was common (20.19%). Extensive vaccination and other preventive measures should be taken to stop the spread of this dreadful disease in the study area.

**Key words:** Hepatitis B Virus, prevalence, polymerase chain reaction (PCR), risk factor.

## INTRODUCTION

Hepatitis B infection is the main health problem throughout the world (Ali et al., 2011; Rauf et al., 2010). Approximately 2 billion people are infected with Hepatitis B Virus (HBV) globally (Zhu et al., 2009; Li et al., 2010; Paraskevis et al., 2002), of which 350 million are chronic HBV carrier (Jose et al., 2012; Ali et al., 2011). Each year approximately 1 to 2 million people die from HBV related complications such as chronic hepatitis, cirrhosis and hepatocellular carcinoma (Khan et al., 2011a).

HBV transmission has been observed by percutaneous or mucosal exposure to infected blood and body fluids (Colin et al., 2006). HBV can transmit through blood, serum, body fluids, semen, saliva and HBV can live for

several days in dried blood on table surfaces, needles, syringes and razors (Workowski and Berman, 2002; Workowski and Berman, 2006). The use of unsterilized dental and surgical instruments, shaving from barber, reuse of needle for nose and ear piercing, reuse of disposable syringes and sharing needles with drugs addicts, sharing personal things such as razors, toothbrushes, and nail cutters, sexual and prolonged close personal contact with infected personnel are also the common ways of HBV transmission (Bukhari et al., 1999).

Pakistan is highly endemic (9 million people infections across the country) (Hakim et al., 2008), with 3% chronic HBV carriers (Noorali et al., 2008; Khan et al., 2011b) and the infection rate is rising day by day (Ali et al., 2011). Generally, the epidemiological studies concerning the prevalence of HBV are restricted to the hospitalized patients (Attaullah et al., 2011), whereas there is very few

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population studies to estimate the exact infected population in different areas.

High prevalence of HBV was observed in geographical areas of low economic status, which underscores the importance in controlling this disease because approximately, 67.5% of the Pakistani population belongs to rural areas of low economic status (Akbar et al., 1997; Alam et al., 2007a). This study was planned with the main aim to determine the molecular prevalence of HBV infection and the risk factors associated with HBV infection in Khyber Pakhtunkhwa Pakistan, as limited data is available about the HBV infection in this region of the country.

## MATERIALS AND METHODS

### Study area

This study was conducted in the Khyber Pakhtunkhwa province, Pakistan, which includes seven main regions/Divisions; Dera Ismail Khan (D.I.Khan), Bannu, Kohat, Peshawar, Mardan, Hazara and Malakand.

### Study samples

A total of 1439 blood samples were collected from both gender, directed by clinicians for diagnosis of HBV in District Head Quarter Hospitals of the respective districts. All the individuals were aged between 01 to 70 years. Informed consent was collected from all the individuals included in this study. Out of 1439 patients, 200 each were from Bannu, D.I.Khan, Kohat, Mardan and Peshawar, 226 from Hazara and 213 were from Malakand Division.

A 3 ml blood sample was collected in a vacutainer from each patient; serum was separated and stored at -20°C in the Molecular Parasitology and Virology Laboratory, Department of Zoology, Kohat University of Science and Technology Kohat, Pakistan for further processing.

### HBV screening

HBV screening was carried out with Immunochromatographic (Accurate Diagnostics Canada) for the detection of anti HBsAg.

### Biochemical analysis

Alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were observed (two readings for each patient) for six months with Microlab 300 (Merck USA) using ALT and AST kit (Diasys Diagnostic System Germany) according to the manufacturer's manual.

### HBV DNA detection

HBV DNA was isolated from all 1439 HBsAg positive samples with GF-1 nucleic acid extraction kit (Vivantas USA) according to manufacturer's instructions with minimal alterations.

PCR reactions were carried out in a thermal cycler (Nyxtechnique USA) with 5U *Taq* DNA polymerase (Fermentas USA). The first round of amplification was performed with 5 µl of extracted DNA by

using an outer sense primer and an outer antisense primer specific to the surface gene of HBV. Another round of PCR was carried out with inner sense primer and inner antisense primer.

Amplified product was subjected to electrophoresis in 2% agarose gel stained with ethidium bromide and visualized under UV illuminator.

## RESULTS

Blood samples from 1439 HBV suspected patients (1021 males and 418 female) were collected from the various District Head Quarter Hospitals of Khyber Pakhtunkhwa, Pakistan. Of the total, 49.55% (489 males and 224 females) were found positive for HBsAg and 50.45% were found negative for HBsAg. All the samples including HBsAg negative were further analyzed for the detection of HBV DNA by PCR. Among the 713 HBsAg positive patients, HBV DNA was confirmed in 592 (83.03%) patients and in 121 (16.97%) patients, (70 male and 51 female), HBV DNA was not detected. Among the 726 HBsAg negative patients, 37 patients (24 males and 13 females) were confirmed for HBV DNA and the rest of all were found negative for HBV DNA.

### Division based prevalence of HBV infection

629 (43.71%) samples were positive by PCR for HBV infection. High prevalence of HBV infection was reported from Malakand division (16.53%) and D.I.Khan division (14.63%) as compared to Hazara division (14.15%), Peshawar division (14.15%), Kohat division (13.67%), Bannu division (13.5%) and Mardan division (13.35%) (Table 1). Gender-wise prevalence among the HBV DNA positive samples showed that males were more affected than females. In this study the PCR positive HBV samples included 443 (70.43%) males and 186 (29.57%) females (Table 1). Male to female ratio was found to be 2.38:1.

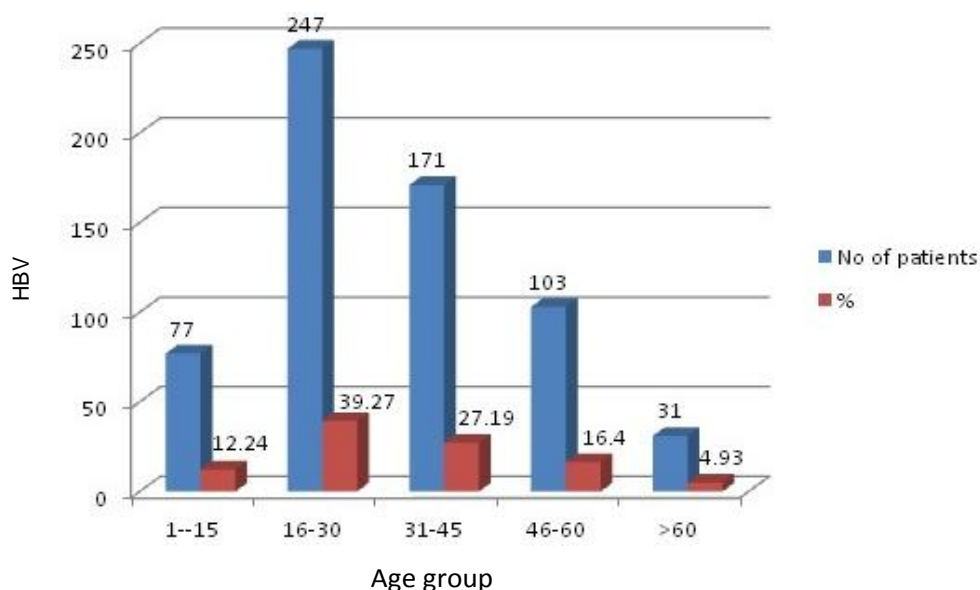
Age-wise prevalence was observed in all the PCR positive samples which were categorized into five age groups. The highest infection rate of 39.27% was observed in the age group of 16 to 30 years while a lower infection rate of 4.93% was observed in the age group of more than 60 years (Figure 1).

### Risk factors associated with HBV

Patients were interviewed for the various risk factors to find out the possible modes of transmission. Over all HBV DNA positive cases showed high trend of sharing personal items (20.19%). Other risk factors identified were shaving from community barber (10.65%), blood transfusion (9.54%), dental procedures (16.06%), general surgery (9.38%), history of injection (16.69%), sexual contact with hepatitis B positive partner (9.7%) and skin tattooing (4.45%) (Table 2).

**Table 1.** HBV Prevalence in the different Divisions of Khyber Pakhtunkhwa (n = 1439).

Division	HBsAg positive		HBV DNA positive		Total HBV positive n (%)
	Male	Female	Male	Female	
Bannu	65	35	68	17	85 (13.5)
D.I.Khan	71	29	61	31	92 (14.63)
Hazara	58	42	59	30	89 (14.15)
Kohat	82	18	70	16	86 (13.67)
Malakand	91	22	74	30	104 (16.53)
Mardan	55	45	56	28	84 (13.35)
Peshawar	67	33	55	34	89 (14.15)

**Figure 1.** Prevalence of HBV among various age groups.**Table 2.** Risk factors associated with HBV transmission.

Risk factor	HBV positive (n = 629)		Total observed, n (%)
	Male	Female	
Barber risk	67	-	67 (10.65)
Blood transfer	43	17	60 (9.54)
Dental risk	74	27	101 (16.06)
G. surgery	38	21	59 (9.38)
History of injections	68	37	105 (16.69)
Sexual contact	40	21	61 (9.7)
Skin tattooing	08	20	28 (4.45)
Sharing personal items	105	22	127 (20.19)

## DISCUSSION

Hepatitis B infection is an international health concerned problem with its continuously increasing burden in

developing countries like Pakistan (Alam et al., 2007a). Representing all the geographical regions of Khyber Pakhtunkhwa, no study on HBV prevalence is available. The current study was conducted with the main aim to

find out the molecular prevalence and the risk factors in all the seven divisions of Khyber Pakhtunkhwa. We found that 43.71% of the subjects were infected with HBV. Almost all the individuals were referred to the D.H.Q. hospitals of the related division/district for HBV diagnosis and medications.

High prevalence (16.53%) of HBV was observed in Malakand division as compared to other divisions of the province and lowest (13.35%) rate of infection was observed in Mardan division. The high prevalence of HBV in Malakand division may be due to low literacy rate, low economic status, far off from basic health facilities, frequent exposure to risk factors and affect of this area by tiresome and natural disasters (for example, earthquake, floods). Male (70.43%) were found to be more infected with HBV than female (29.57%) and male to female ratio of HBV positive individuals was 2.38:1. In these areas, barber shaving, involvement in blood transfusion practices, drug use and homosexuality are very common which strengthens the arguments for such high prevalence of HBV in males. This study is in line with other studies (Naz et al., 2002; Khan et al., 2011a), who reported that more male were infected with HBV than female. Similarly in another study of hepatitis B virus infection among different sex and age groups in Pakistani Punjab, Khan et al. (2011b) reported high prevalence in male (68.15%) than female (31.85%). Nwokediuko (2010) also reported a significantly higher (79.2%) infection rate in male as compared to the female (20.8%). Zubair et al. (2010) determining the frequency of hepatitis B virus among children with chronic liver disease also find out a high 54% prevalence in male than females 46%. Moosa et al. (2009) and Awan et al. (2010) reported a high (59.1, 58.3%) prevalence in males than females (40.9, 41.7%) respectively. In earlier studies in Pakistan, high prevalence results of HBV in males compared to females have been observed by Alam et al. (2007b) and Usman et al. (2003). In Bangladesh, similar results of high prevalence rate in males (67.86%) as compared to females (32.14%) have been observed by Mahtab et al. 2008. This high prevalence of HBV in male reflects the increased frequency of high risk behavior as compared to females.

This study showed that almost all the age groups were affected by HBV. The prevalence rose from 5.35% in children of age 1 to 15 to a peak of 17.16% in people aged 16 to 30 years. After this, it declined to 12.16 and 7.16% in people aged 31 to 45 and 46 to 60 years respectively. While very old >60 age group were very less frequently 2.15% infected by HBV infection. This means that there was an age effect on the prevalence of hepatitis B infection. This high prevalence among the young age groups may be attributed to the more frequent exposure to risk factors and prolonged HBV infection and may be due to their greater exposures and interaction in society as compared to children and aged peoples. Our study also identified many risk factors for HBV infection.

The barber risk was markedly higher (10.65%) in male individuals. Khan et al. (2011a) also reported 32% barber risk in males as they routinely shaved with community barbers. The previous studies showed that barber risk was the most frequent risk factors contributing to the transmission of HBV infection because of the reuse blades. But during the last few years the trend has changed substantially and barbers now use disposable blades and razors (Janjua and Nizamy, 2004). Because of the presence of HBsAg in the saliva of HBV patients, the contaminated dental instruments also play an important role in HBV infection (Fox, 1996).

Our study identified 16.06% dental risk factors in the individuals. This may be due to low economic status of the patients which were attended by local practitioners which using equipments without any sterilization or autoclaving techniques. These results showed low percentage of dental risk as compared to previous studies of Khan et al. (2011b) (41%) and Usman et al. (2003) (60%). This decrease in the rate of dental risk may be due to awareness and education of the peoples. Sexual contact with hepatitis positive partner (9.7%) and skin tattooing (4.45%) contribute in the spread of HBV infection. Risk factors with history of injection and previous history of surgery contribute 16.69 and 9.38% respectively. This may be due to the lack of awareness about the possible risk factors among the healthcare providers and the population. Blood play significant role in the transmission of HBV infection (Alavian et al., 2007). During this study 9.54% of the respondents had the history of blood transfusion which is supported by the results of 4.04% by Khan et al. (2011a). Similar results of potential source of HBV transmission in Pakistan were reported by Castolo et al. (2001), Ali et al. (2009) and Qureshi et al. (2009).

Sharing personal items (20.19%) have also been identified as major risk factor for Hepatitis B virus infection. Tanveer et al. (2008) also reported the high habit (37.5%) of sharing personal belongings in the infected persons that could account for the high risk of infection.

## Conclusions

It is concluded that HBV infection is still prevalent in the Khyber Pakhtunkhwa Province. Massive awareness programs, extensive vaccination and other preventive measures should be taken to stop the spread of this alarming disease in the Khyber Pakhtunkhwa, Pakistan.

## REFERENCES

- Akbar N, Basuki B, Mulyanto M, Garabrant DH, Sulaiman A, Noer HM (1997). Ethnicity, Socioeconomic status, Transfusions and risk of Hepatitis B and Hepatitis C infection. *J. Gastroenterol. Hepatol.*, 12: 752-757.
- Alam MM, Zaidi SZ, Malik SA, Naeem A, Shaukat S, Sharif S, Angez M,

- Khan A, Butt JA (2007a). Serology based disease status of Pakistani population infected with Hepatitis B virus. *BMC Infect. Dis.*, 7: 64.
- Alam MM, Zaidi SZ, Malik SA, Shaukat S, Naeem A, Sharif S, Angez M, Butt JA (2007b). Molecular epidemiology of Hepatitis B virus genotypes in Pakistan. *BMC Infect. Dis.*, 7: 115.
- Alavian MS, Fallahian F, Lankarani BK (2007). Comparison of Seroepidemiology and Transmission Modes of Viral Hepatitis B in Iran and Pakistan. *Hepatit. Mon.*, 7: 233-238.
- Ali M, Idrees M, Ali L, Hussain A, Rehman A, Saleem S, Afzal S, Butt S (2011). Hepatitis prevalence in Pakistan. A systematic review of prevalence, risk factors, awareness status and genotypes. *Virol. J.*, 8: 102.
- Ali SA, Donahue RMJ, Qureshi H, Vermund SH (2009). Hepatitis B and hepatitis C in Pakistan: prevalence and risk factors. *Int. J. Infect. Dis.*, 13: 9-19.
- Attullah S, Khan S, Naseemullah, Ayaz S, Khan SN, Ali I, Hoti N, Siraj S (2011). Prevalence of HBV and HBV vaccination coverage in health care workers of tertiary hospitals of Peshawar, Pakistan. *Virol. J.*, 8: 275.
- Awan Z, Idrees M, Amin I, Butt S, Afzal S, Akbar H, Rehman I, Younas S, Shahid M, Lal A, Saleem S, Rauff B (2010). Pattern and molecular epidemiology of Hepatitis B virus genotypes circulating in Pakistan. *Infect. Genet. Evol.*, 10: 1242-1246.
- Bukhari SM, Khatoon N, Iqbal A, Naeem S, Shafqat S, Lone A, Naveed IA (1999). Prevalence of Hepatitis B Antigenaemia in Mayo Hospital Lahore. *Biomedica*, 15: 88-91.
- Castolo MC, ndez-ruiz LH, Ibarra-robles IE, Rate IHFN, Pena JEL (2001). Prevalence of Hepatitis B Virus Infection and Related Risk Factors in a rural community of Mexico. *Am. J. Trop. Med. Hyg.*, 65: 759-763.
- Colin WS, Simard EP, Finelli L, Fiore AE, Bell BP (2006). Hepatitis B Virus Infection. *Epidemiology and Vaccination. Oxford J. Epidemiol. Rev.*, 28: 112-125.
- Fox JA (1996). Hepatitis B and the theatre nurse. *Brit. J. Theatre Nurs.*, 6: 26-31.
- Hakim ST, Kazmi SU, Bagasra O (2008). Seroprevalence of Hepatitis B and C Genotypes among Young Apparently Healthy Females of Karachi Pakistan. *Libyan J. Med.*, 3: 66-70.
- Janjua NZ, Nizamy MA (2004). Knowledge and practices of barbers about hepatitis B and C transmission in Rawalpindi and Islamabad. *J. Pak. Med. Assoc.*, 54: 116-119.
- Jose AMM, Carla LAA, Gloria MC, Sergio CR, Jose LFA, Rafael AF, Jesus GM (2012). Prevalence and resistance pattern of genotype G and H in chronic hepatitis B and HIV co-infected patients in Mexico. *Annal. Hepatol.*, 11: 47-51.
- Khan F, Akbar H, Idrees M, Khan H, Shahzad K, Kayani MA (2011a). The prevalence of HBV infection in the cohort of IDPs of war against terrorism in Malakand Division of Northern Pakistan. *BMC Infect. Dis.*, 11: 176.
- Khan F, Suleman S, Qureshi ID, Israr M, Khan H, Sarwar MT, Ilyas M (2011b). Hepatitis B virus infection among different sex and age groups in Pakistani Punjab. *Virol. J.*, 8: 225.
- Li G, Li W, Guo F, Xuc S, Zhaod N, Chena S, Liu L (2010). A novel real-time PCR assay for determination of viral loads in person infected with hepatitis B virus. *J. Virol. Meth.*, 165: 9-14.
- Mahtab M, Rahman S, Karim , Khan M, Foster G, Solaiman S, Afroz S (2008). Epidemiology of hepatitis B virus in Bangladeshi general population. *Hepatobiliary Pancreat. Dis., Int.*, 7: 595-600.
- Moosa FA, Sheikh BA, Choudhry MS, Khan FW, Sultan N (2009). Frequency of Hepatitis B and C in Pre-operative Elective Surgery. *JLUMHS*, 8(02).
- Naz S, Ahmad M, Asghar H (2002). Prevalence of Hepatitis 'B' Among Combined Military Hospital (CMH) Muzaffarabad. *Int. J. Agric. Biol.*, 4: 227-230.
- Noorali S, Hakim ST, McLean D, Kazmi SU, Bagasra O (2008). Prevalence of Hepatitis B virus genotype D in females in Karachi, Pakistan. *J. Infect. Dev. Countries*, 2: 373-378.
- Nwokediuko CS (2010). Risk Factors for Hepatitis B Virus Transmission in Nigerians. *The Int. J. Gastroenterol.*, 10(1).
- Paraskevis D, Haida C, Tassopoulos N, Raptopoulou M, Tsantoulas D, Papachristou H, Sypsa V, Hatzakis A (2002). Development and assessment of a novel real-time PCR assay for quantitation of HBV DNA. *J. Virol. Meth.*, 103: 201-212.
- Qureshi H, Arif A, Riaz K, Alam ES, Ahmed W, Mujeeb AS (2009). Determination of risk factors for hepatitis B and C in male patients suffering from chronic hepatitis. *BMC Res. Not.*, 2: 212.
- Rauf A, Nadeem MS, Ali A, Iqbal M, Mustafa M, Latif MM, Latif MZ, Ahmed A, Shakoori AR (2010). Prevalence of hepatitis B and C in internally disposed persons of war against terrorism in Swat, Pakistan. *Eur. J. Public. Health*, pp. 1-5.
- Tanveer A, Batool K, Qureshi AW (2008). Prevalence of Hepatitis B and C in University of the Punjab, Quaid-E-Azam Campus, Lahore. *ARPJ. Agric. Biol. Sci.*, 3: 30-32.
- Usman HR, Akhtar S, Rahbaqr MH, Hamid S, Moattar T, Luby SP (2003). Injection in health care settings: A risk factor for acute hepatitis B virus infection in Karachi, Pakistan. *J. Epidemiol. Infect.*, 130: 293-300.
- Workowski KA, Berman SM (2002). CDC sexually transmitted diseases treatment guidelines. *Clin. Infect. Dis.*, 3: 135-137.
- Workowski KA, Berman SM (2006). Sexually transmitted diseases treatment guidelines. *Centers for Disease Control and Prevention. MMWR Recomm. Rep.*, 55: 1-94.
- Zhu CT, Dong CL (2009). Characteristics of general distribution of hepatitis B virus genotypes in China. *Hepatobiliary Pancreat. Dis. Inf.*, 8: 397-401.
- Zubair M, Anjum ZM, Zafar S, Shamaoon M, Balouch GR (2010). Frequency of Hepatitis B virus infection among children with chronic liver disease. *A.P.M.C.*, 4(1).

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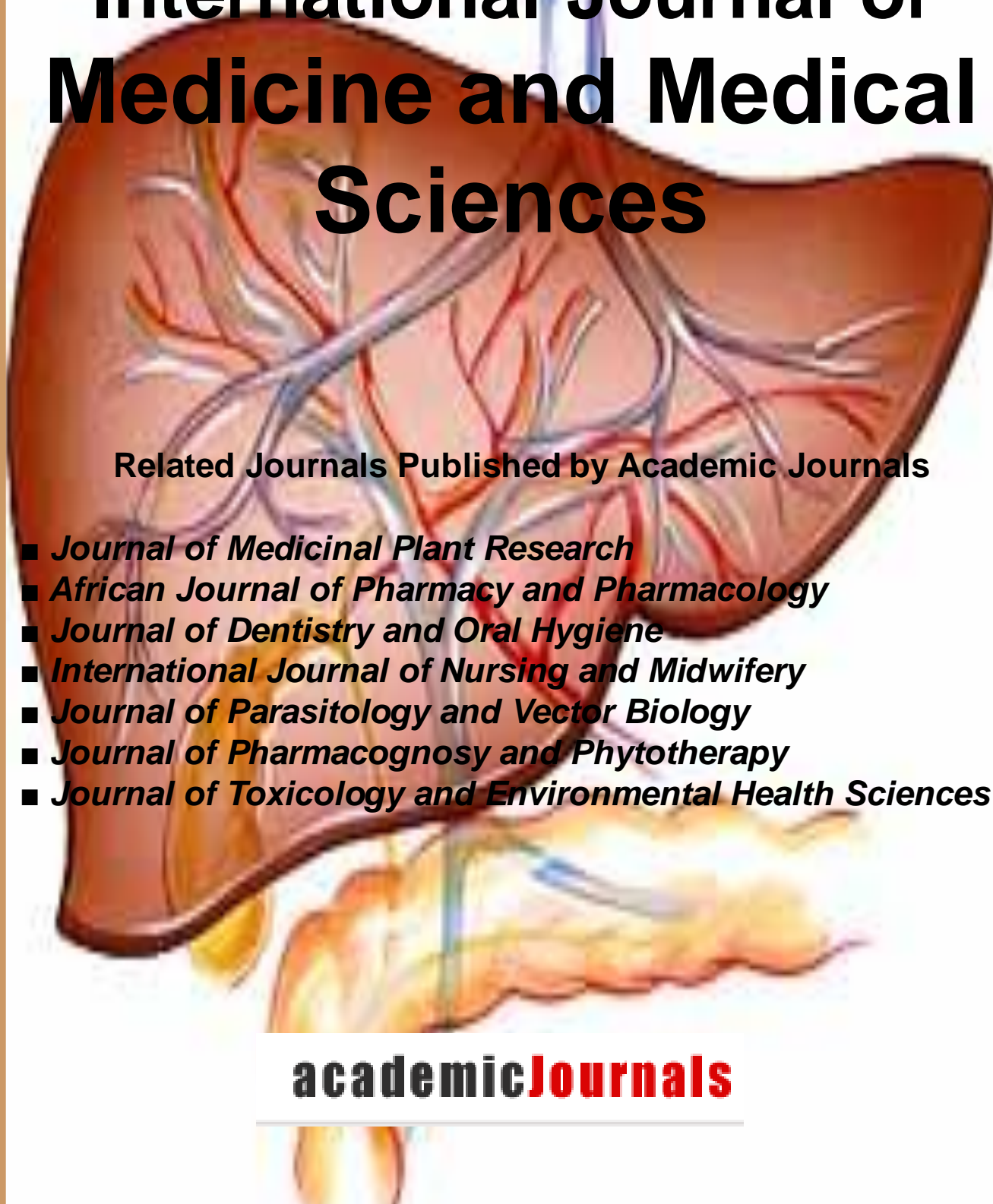
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