Hearing Impairment in Thais Due to Sport Shooting : A Preliminary Report

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Abstract

Ninety one sportshooters from several sportshooting clubs ranging in age from 20-49 and 85 control subjects were carefully examined for hearing ability. The male and female ratio was 10.37:1. It was found that 9.34 per cent of the subjects were suffering from hearing impairment at the level of 3,000-8,000 Hertz. At most frequencies the mean decibel between the groups of shooters (1-5 years, 5-10 years, more than 10 years) was significantly different, with the right ear being significantly more impaired than the left ear (α=0.1). At all frequencies the mean decibel level for the control group was significantly different from that for the sportshooters (α=0.1).

In conclusion, it is the responsibility of the National Environmental Board on Noise Pollution, the Royal College of Otolaryngologists of Thailand and other related organizations should be much more aggressive in educating sportshooters with regard to protecting their ears against acoustic trauma.

The relationship between loud noise and hearing loss has been recognized for thousands of years[1]. The oldest report containing a special discussion of gunfire was written by Niemire[2]. In 1917 Bryant[3] mentioned hearing loss as a result of noise-related injury commonly found in the French Army, and 30 years later Murray[4] reported temporary deafness due to gunfire for which he called the term "Temporary Threshold Shift".

A study of Taylor and William[5] in 1966 with specific interest in sport hunters showed that the specific loss of hearing occurred at 3,000 to 8,000 Hertz. Another study concerning hearing loss due to gunfire was written by Keim[6] in 1969. It consisted of a study of fourteen soldiers and concluded quite specifically that the maximum loss occurred at 6,000 Hertz instead of 3,000 and 4,000 Hertz.

In Thailand, the report dealing with hearing loss due to gun blast was presented by one of the authors i.e., P. Amatyakul at a meeting of the Medical Association of Thailand held in Phuket

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in 1973. Later published in 1976, it reported three cases of hearing impairment resulting from gun blast, with permanent hearing loss in two of the cases cited(7).

It is both fascinating and challenging to study this particular problem of hearing loss in sportshooters, so as to accumulate more information in the field and to stimulate the society act for protection and rehabilitation in hearing deficits.

MATERIAL AND METHOD

Three thousand sportshooters from several sportshooting clubs, age range from 20-49 years were invited to participate by means of sending public information through newspapers, magazines and radio broadcasts. Letters were mailed directly to 15 individual sportshooters whose names appeared on membership lists of the National Sports Shooting Association of Thailand. Some of

Table 1. Degree of hearing loss in 91 sportshooters.

Degree of loss (3000-6000Hz)	Number of cases		% of 182 ears
	Right ear loss	Left ear loss	
26-40 dB	7	8	8.24
41-55 dB	2	1	1.1
Total	9	9	9.34

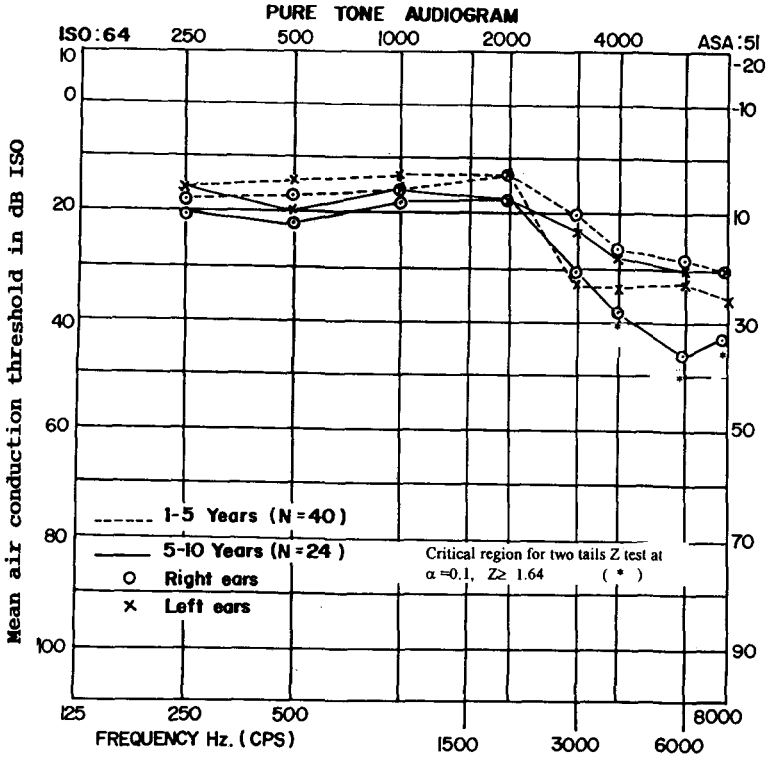
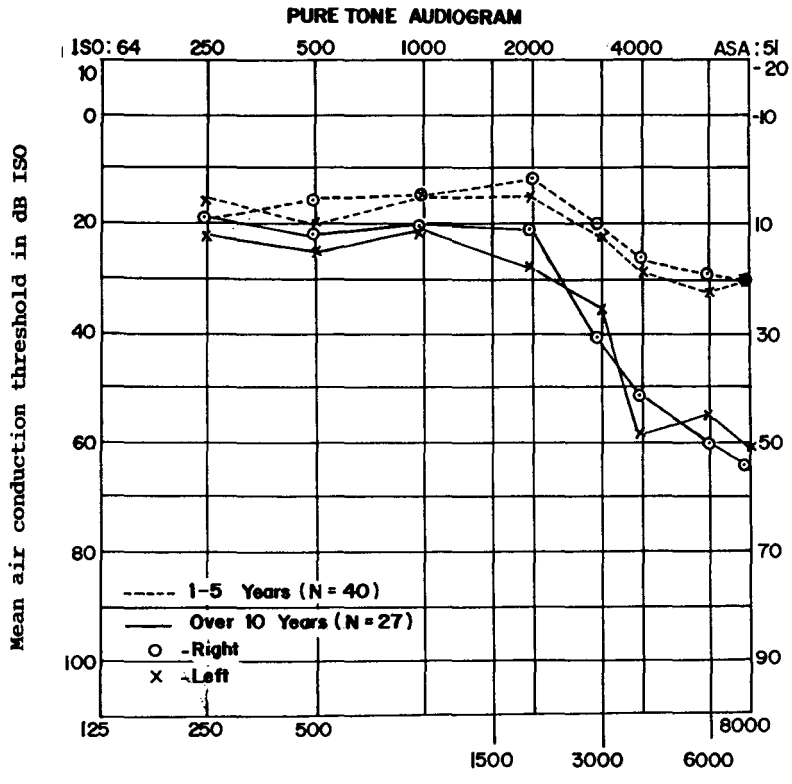


Fig. 1. Comparison between air conduction threshold among sportshooters with 1-5 years' experience of shooting to that with 5-10 years' experience.



Air conduction threshold

	250	500	1000	2000	3000	4000	6000	8000
Z test left ear	**	*	*	***	**	***	***	***
right ear	NS	*	**	***	**	***	***	***

Critical region for two tails Z test at

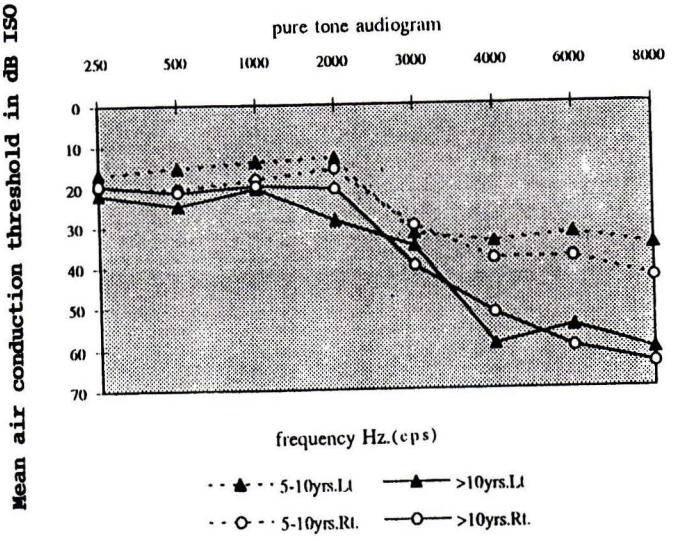
$\alpha = 0.1$, $Z \geq 1.64$ (*)
$\alpha = 0.05$, $Z \geq 1.96$ (**)
$\alpha = 0.01$, $Z \geq 2.57$ (***)
NS= not significant

Fig. 2. Comparison between air conduction threshold among sportshooters with 1-5 years' experience shooting to that among sportshooters with more than 10 years experience.

them were approached personally through the chairpersons of their associations. By these means, 91 subjects were collected.

Eighty five persons were selected at random, the main prerequisite for all these subjects was a lack of shooting experience.

The male and female ratio was 10.37:1. The youngest of both sexes was 20 years old. The oldest male was 49 and the oldest female was 45. Before testing their hearing acuity, all subjects were processed, personal histories recorded, and a complete ear, nose and throat examination provided. The hearing measurements were taken by three well trained, fulltime audiotechnicians, using a standard audiometer, calibrated to I.S.O. 1964, at the frequency 250, 500, 1,000, 2,000, 3,000, 4,000, 6,000 and 8,000 Hertz, in a sound proof room at Pramongkutklao and Ramathibodhi Hospitals, from January 1990 to January 1995.



	Air conduction threshold							
	250	500	1000	2000	3000	4000	6000	8000
Z test left ear	NS	NS	**	***	**	***	***	***
right ear	NS	NS	***	*	*	**	**	***

Critical region for two tails Z test at
α =0.1, Z≥ 1.64 (*)
α =0.05, Z≥ 1.96 (**)
α =0.01, Z≥ 2.57 (***)
NS= not significant

Fig. 3. Comparison between air conduction threshold among sportshooters with 5-10 years' experience shooting to that among sportshooters with more than 10 years' experience.

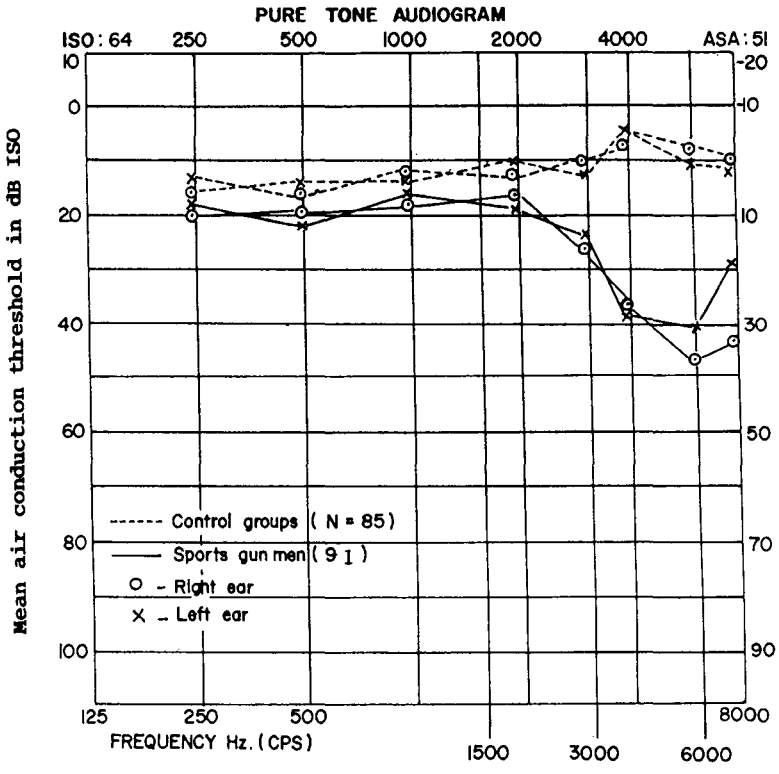
RESULT

Ninety-one sportshooters were tested for their hearing ability. It was shown that 7 of them had mild degree of hearing loss in their right ears and 8 in their left ears (26-40 dB loss, at 3,000 and 6,000 Hertz) i.e., 8.24 per cent of 182 ears. One patient showed mild to moderate loss in the left ear and two in their right ears (40-55 dB loss) i.e., 1.1 per cent of 182 ears. Therefore 9.34 per cent of sportshooters had a mild to moderate degree of hearing loss at 27- 55 dB, at the level of 3,000 and 6,000 Hertz. (Table 1).

Figures 1, 2 and 3 show the comparison between the groups that had been shooting for a period of 1-5 years, 5-10 years and more than 10 years. By using a Z test to determine the level of confidence (α=0.1, 0.05, 0.01), the results are as follows:-

1. When comparing the group with 1-5 years of exposure to the group with 5-10 years of exposure, there was a statistically significant difference in terms of mean frequency in all groups with regard to the right ear except at 250 cps to 3,000 cps. The left ear showed no statistical difference.

2. When comparing the group with 1-5 years of exposure to the group with more than 10 years of exposure, there was a statistically significant difference in terms of mean frequency in all groups with regard to the right ear, except at 250



Air conduction threshold

	250	500	1000	2000	3000	4000	6000	8000
Z test left ear	**	***	***	***	***	***	***	***
right ear	***	***	***	***	***	***	***	***

Critical region for two tails Z test at
α =0.1, Z≥ 1.64 (*)
α =0.05, Z≥ 1.96 (**)
α =0.01, Z≥ 2.57 (***)
NS= not significant

Fig. 4. Comparison of mean air conduction threshold between all sportshooters and control groups.

cps. The left ear showed a statistically significant difference.

3. When the group with 5-10 years' exposure was compared to the group with more than 10 years of exposure, there was a statistically significant difference with regard to mean frequency in all groups of the right ear except at 250 and 500 cps. The left ear also showed a statistically significant difference except at 250 and 500 cps.

By postulating that the mean decibel level at different sound frequencies for the control group equals the mean decibel level at respective frequencies for the target group, we used the statistical formulas above and determined the level of confidence as follows : $\alpha = 0.01$

At all frequencies mean decibel level for the control group is significantly different from that of the study group, except for the left ear at 250 Hertz, where there is a significant difference at the levels of confidence : α = 0.05 (Fig. 4).

DISCUSSION

Gun shooting as a sport may cause hearing impairment in many ways. We studied the cor-

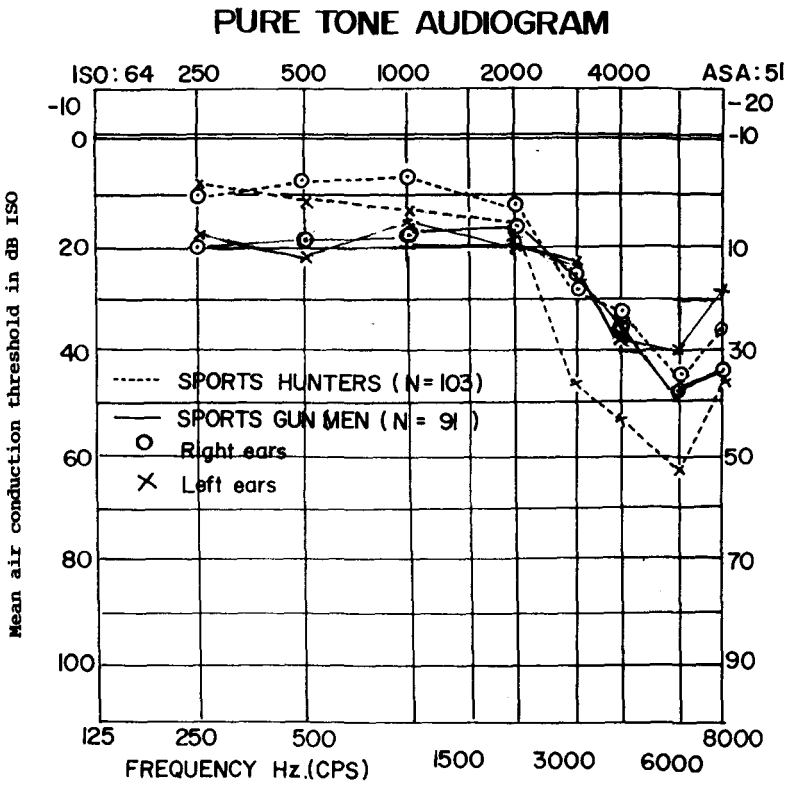


Fig. 5. Comparison of mean air conduction threshold among sportshunter (Taylor & Williams) and Thai sportshooters at all age.

relation between the time spent in practising shooting and air conduction threshold. The majority of gun enthusiasts had practised shooting for a period of only 1 to 5 years, while the other two groups had more extensive experience of the sport. The degree of hearing loss at a high frequency level (3,000 to 8,000 Hertz) among the group with 1-5 years experience was not clearly substantiated and the losses were close to those of the normal range of 27 dB.As the shooting time spent increased from 5 to 10 years and over 10 years, the degree of losses then increased at all high frequency levels (3,000 to 8,000 Hertz).

Theoretically loss of hearing from gunfire is characterized by high frequency sensorineural hearing loss, especially at 4,000 Hertz. In our study, hearing loss at the speech frequency of range is not shown, but most cases showed a high frequency sensorineural hearing loss ranging from 4,000 to 8,000 Hertz.

Hearing loss peaked at 6,000 Hertz, as mentioned in the study of Taylor and William[5] and Keim[6]; our study achieved the same high frequency hearing loss (Fig. 5). The difference between the hearing loss in left ears in Keim's study and right ears in our study was due to the difference of the gun used in the studies. In Keim's study, the gun used was a rifle, the shooter had to straighten his arm so that his right shoulder covered his right ear.The bared left ear was then unprotected from the blast noise, then hearing impairment occurred (Fig. 6). Whilst in our study, the gun used was a pistol. The shooter straightened his right arm, with his shoulder below his right ear, and he angulated his body and his head so that the right ear was exposed to more of the blast (Fig. 7).

The degree of hearing loss in sportshooters should depend on many other factors, such as;

1. Number of bullets used, during each shooting session.

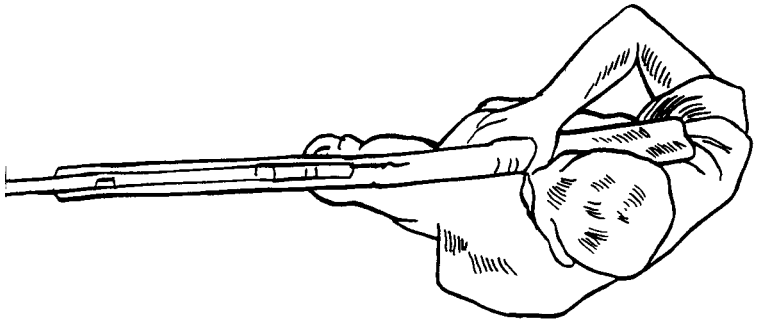


Fig. 6. Top view of proper position for firing a shoulder weapon. Note angulation of head with dissimilar exposure of ears to noise source.

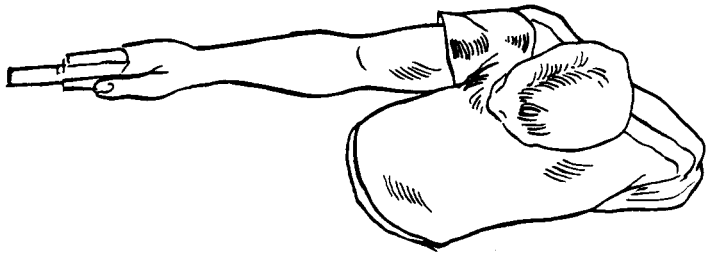


Fig. 7. Top view of proper body position for firing a pistol.

2. The noise produced by the weapon.

3. Other environmental factors (group practice sessions outdoors).

4. The frequency of ear protective devices used.

The amount of the stated factors to damage hearing capacity are to be explored.

It can be concluded that the more years spent in shooting, the greater the handicap.

SUMMARY

From 91 sportshooters, i.e., 182 ears, it was determined that 9.89 per cent had hearing impairment. 8.24 per cent were classified as having mild degree of hearing loss (26 to 55dB) (Table 1). None of those with hearing defect had trouble in oral and aural communication.

Sportshooters in Thailand are not professional but join a club simply for a short period in order to practice. Therefore, they are not aware of any hearing trouble that might happen.

In conclusion, it is suggested that the National Environmental Board on Noise Pollution, the Royal College of Otolaryngologists of Thailand and other related organizations take responsibility for noise protection. A law on protection against excessive noise should be introduced and implemented on the practice.

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การสูญเสียการได้ยินในนักกีฬายิงปืนชาวไทย : การศึกษาเบื้องต้น

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ผู้วิจัยได้ศึกษานักกีฬายิงปืนจากสมาคมนักยิงปืนหลายสมาคม จำนวน 91 ราย มีอายุตั้งแต่ 20-49 ปี เป็นเพศชายต่อเพศหญิงในอัตราส่วน 10.37:1 โดยเปรียบเทียบกับกลุ่มควบคุมจำนวน 85 ราย พบว่า นักกีฬายิงปืนจำนวน 9.34% สูญเสียการได้ยินที่ระดับความถี่ 3,000-8,000 เฮิรทซ์ นักกีฬาที่ใช้เวลายิงปืนยิ่งนานปีจะยิ่งมีการสูญเสียการได้ยินมากขึ้นตามลำดับ (กลุ่มที่ยิงปืนนานกว่า 10 ปีสูญเสียการได้ยิน > กลุ่ม 5-10 ปี > กลุ่ม 1-5 ปี), ในทุกกลุ่มมีหูข้างขวาได้ยินน้อยกว่าหูข้างซ้าย อย่างมีนัยสำคัญทางสถิติ (α = 0.1) และที่ทุกความถี่ การได้ยินของกลุ่มควบคุมมีความแตกต่างจากกลุ่มนักกีฬายิงปืนอย่าง มีนัยสำคัญทางสถิติ (α = 0.1) สรุปได้ว่า คณะกรรมการป้องกันมลภาวะทางเสียง และราชวิทยาลัยโสต ศอ นาสิกแพทย์แห่งประเทศไทย ควรเอาใจใส่ ให้การศึกษาและให้คำแนะนำแก่นักกีฬายิงปืนให้มากยิ่งขึ้น เพื่อป้องกันการสูญเสียการได้ยินในนักกีฬายิงปืนชาวไทย

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