

Research**OAE high noise examination result profile of tinnitus patients at the UGM Academic Hospital**

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ABSTRACT

Background: Tinnitus is a hearing disorder in the form of sound sensation without external stimulation. It can affect a person's quality of life. The number of patients with tinnitus is expected to increase. Not many hospitals have a High Noise Otoacoustic Emission (OAE) device for examining tinnitus in patients. Tinnitus research is still limited in Indonesia, especially in Yogyakarta. **Purpose:** This study aimed to describe the results of the OAE High Noise examination in tinnitus patients at the Electromedical Clinic of UGM Academic Hospital. **Method:** A non-experimental study with a descriptive observational approach using secondary data. The sampling technique used was a total sampling technique of tinnitus patients who were examined for (OAE) High Noise from January 1st, 2019, to December 31st, 2021. **Result:** Respondents who met the inclusion and exclusion criteria were 292 subjects. Most respondents were more than 60 years old (27.05%), and female (51.71%). The OAE High Noise examination results showed that most of them were abnormal (85.61%). Most of the respondents experienced bilateral tinnitus and experienced disturbances in more than six frequencies (46.60%). The primary diagnosis that had been found in the respondents was tinnitus (87.67%). **Conclusion:** The OAE High Noise examination results at the Electromedical Clinic of UGM Academic Hospital were mainly abnormal.

Keywords: tinnitus, Otoacoustic Emission (OAE), OAE High Noise, tinnitus bilateral, tinnitus unilateral

ABSTRAK

Latar belakang: Tinitus merupakan salah satu gangguan pendengaran berupa sensasi suara tanpa adanya rangsang dari luar. Tinitus dapat mempengaruhi kualitas hidup seseorang. Jumlah pasien dengan tinitus diperkirakan akan semakin meningkat. Tidak banyak rumah sakit mempunyai alat Otoacoustic Emission (OAE) High Noise untuk pemeriksaan penunjang pada pasien tinitus. Penelitian tentang tinitus masih terbatas di Indonesia, khususnya di Yogyakarta. **Tujuan:** Untuk mengetahui gambaran hasil pemeriksaan OAE High Noise pada pasien tinitus di Klinik Elektromedik Rumah Sakit Akademik Universitas Gadjah Mada (RSA UGM). **Metode:** Berupa penelitian non eksperimental dengan pendekatan deskriptif observasional menggunakan data sekunder. Teknik pengambilan sampel dengan total sampling pada pasien tinitus yang dilakukan pemeriksaan OAE High Noise pada tanggal 1 Januari 2019 sampai 31 Desember 2021. **Hasil:** Responden yang memenuhi kriteria inklusi dan eksklusi berjumlah 292 orang. Sebagian besar responden berusia lebih dari 60 tahun (27,05%), dan berjenis kelamin perempuan (51,71%). Hasil pemeriksaan OAE High Noise menunjukkan sebagian besar tidak normal (85,61%). Sebagian besar responden mengalami tinitus bilateral dan mengalami gangguan pada lebih dari 6 frekuensi (46,60%). Diagnosis utama yang didapati pada responden penelitian ini adalah tinitus (87,67%). **Kesimpulan:** Hasil pemeriksaan OAE High Noise di Klinik Elektromedik RSA UGM sebagian besar tidak normal.

Kata kunci: tinitus, Otoacoustic Emission (OAE), OAE High Noise, tinitus bilateral, tinitus unilateral

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INTRODUCTION

Tinnitus is the perception of sound that does not have an external source. These “phantom sounds” are produced inside the hearing canal, in your head, or in your neck. Tinnitus is often referred to as a “ringing in the ears.” The word tinnitus comes from the Latin word “tinniere” which means “to ring”.¹

Tinnitus can affect your way of living. Nugroho et al.² (2015) stated that there was a relationship between the frequency and intensity of tinnitus on a patient’s quality of life. The higher the frequency endured by the patient, the more the patient’s quality of life would be affected.

Prevalence estimated from various epidemiological studies suggested that about 10-15% of adults experience tinnitus. Bath et al.³ (2016) state that the prevalence of tinnitus in the United States is approximately 1 in 10 adults.

The Electromedical Clinic of UGM Academic Hospital was inaugurated in 2019. One of the available examinations at this hospital includes the examination of Otoacoustic Emission (OAE). OAE is a fast and simple non-invasive examination. Not many hospitals have OAE High Noise devices to support the examination of tinnitus in patients. Research on tinnitus is also still limited in Indonesia, especially in Yogyakarta.

METHOD

The study was an observational descriptive study research. This method was carried out by collecting secondary data in the form of medical records and OAE High Noise results of tinnitus patients at the Electromedical Clinic of UGM Academic Hospital. The OAE High Noise examination was carried out by using the Biologic Scout

OAE v4.0 tool, based on protocol of the Ototoxic Test - High Noise 1.5-10 kHz. The patient was given a sound stimulus of 12 frequencies from 1,500 Hz to 10,000 Hz through ear probes that were attached to each ear alternately. The Otolaryngology-Head and Neck (ENT-HN) specialists observed the Distortion Product (DP) - Noise Floor (NF) ratio, or Signal to Noise Ratio (SNR) from the examination.

The population of this study was all patients who were subjected to OAE High Noise assessments at the Electromedical Clinic of UGM Academic Hospital from January 2019 to December 2021. Samples were obtained by using the total sampling method. The inclusion criteria in this study were tinnitus patients without outer and middle ear disorders, and were at least 18 years old at the time of examination. While the exclusion criteria were patients who had been previously examined for OAE High Noise. This study received permission from the hospital where the data was collected, and received approval from the Ethics Commission of the Faculty of Medicine, Public Health and Nursing (FKKMKK) UGM.

RESULT

The population of this study was 341 samples, while those who met the inclusion and exclusion criteria amounted to 292 samples. The age of respondents in this study varied between 18 to 89 years. Most respondents were over 60 years old (27.05%) and the least were under 20 years old (2.74%). The results could be seen in Figure 1.

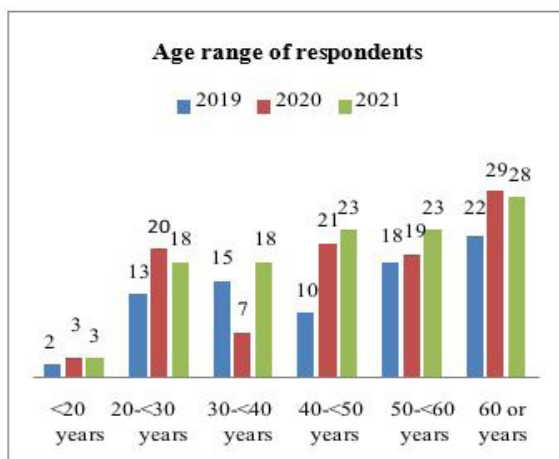


Figure 1. Age range of respondents

Most of the respondents in this study were female, as many as 151 (51.71%) subjects. The gender distribution of subjects each year could be seen in Table 1.

Table 1. Gender of subjects

| Year | Female | | Male | | Total |
|-------|--------|-------|------|-------|-------|
| | n | % | n | % | |
| 2019 | 39 | 48.75 | 41 | 51.25 | 80 |
| 2020 | 46 | 46.47 | 53 | 53.53 | 99 |
| 2021 | 66 | 58.40 | 47 | 41.60 | 113 |
| Total | 151 | 51.71 | 141 | 48.29 | 292 |

Source: Primary Data

The results of this study showed that most of the results of OAE High Noise examinations conducted at the Electromedical Clinic of UGM Academic Hospital were abnormal, amounting to 250 (85.61%) respondents. Data for each year could be seen in Table 2.

Table 2. OAE High Noise examination results

| Year | Normal | | Abnormal | | Total |
|-------|--------|-------|----------|-------|-------|
| | n | % | n | % | |
| 2019 | 6 | 7.50 | 74 | 92.50 | 80 |
| 2020 | 14 | 14.14 | 85 | 85.86 | 99 |
| 2021 | 22 | 19.47 | 91 | 80.53 | 113 |
| Total | 42 | 14.39 | 250 | 85.61 | 292 |

Source: Primary Data

Of the 250 respondents with abnormal OAE High Noise results, 202 (80.80%) subjects experienced interference in both ears (bilateral). Complete results could be seen in Table 3.

Table 3. Abnormal ear

| Year | Right | | Left | | Both | | Total |
|-------|-------|-------|------|-------|------|-------|-------|
| | n | % | n | % | n | % | |
| 2019 | 11 | 14.86 | 5 | 6.76 | 58 | 78.38 | 74 |
| 2020 | 7 | 8.24 | 6 | 7.06 | 72 | 84.70 | 85 |
| 2021 | 8 | 8.79 | 11 | 12.09 | 72 | 79.12 | 91 |
| Total | 26 | 10.40 | 22 | 8.80 | 202 | 80.80 | 250 |

Source: Primary Data

From 250 patients with abnormal OAE High Noise test results, we carried out a more in-depth examination on the number of abnormal OAE High Noise frequencies (SNR or DP-NF values less than 6). This could be seen in Table 4.

Table 4. Total abnormal frequencies

| Year | 0 | | 1-6 | | 7-12 | | Total |
|-------|----|-------|-----|-------|------|-------|-------|
| | n | % | n | % | n | % | |
| 2019 | 16 | 10.81 | 64 | 43.24 | 68 | 45.95 | 148 |
| 2020 | 13 | 7.65 | 79 | 46.47 | 78 | 45.95 | 170 |
| 2021 | 18 | 9.89 | 77 | 42.31 | 87 | 47.80 | 182 |
| Total | 47 | 9.40 | 220 | 44.00 | 233 | 46.60 | 500 |

Source: Primary Data

In this study, data were also obtained on the main diagnosis in patients who complained of tinnitus and carried out OAE High Noise tests. Most indicated that respondents' primary diagnosis was tinnitus (87.67%). The results could be seen in Figure 2.

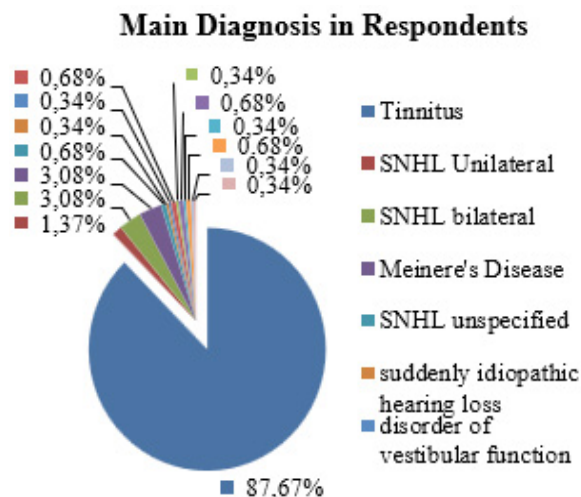


Figure 2. Main Diagnosis in Respondents

DISCUSSION

The total number of tinnitus patients who had a OAE High Noise examination carried out on them at the Electromedical Clinic of UGM Academic Hospital was 341 subjects. Out of them, 292 met the inclusion and exclusion criteria to become study respondents. Of these 292 respondents, most were in the age range of more than 60 years, and the youngest were in the age range of less than 20 years. These results were in accordance with surveys conducted in the United Kingdom (1980-1986), Sweden (1989), the United States (1990), and Norway (1996-1998) which reported that the percentage of the prevalence of self-reported tinnitus in adults aged 60 years and over was greater than that of other age ranges. Various studies revealed that tinnitus increases with age, but it was not known whether age-related changes in the ears and nervous system, or age-related hearing loss led to an increase in the prevalence of tinnitus.⁴

Research by Oosterloo et al.⁵ (2021) in the Netherlands showed that in the elderly population in general, there were 1 in 5 subjects experiencing tinnitus. Tinnitus disrupts the daily lives of 1 in 10 subjects who suffer from it. In this study it was also

mentioned that the age range of 65-69 years was the age range that experienced the most tinnitus (21.4% of 6,098 respondents with a minimum age of 50 years).

The world's population is currently entering the era of an ageing population where the number of subjects over 60 years old exceeds 7% of the total population. According to Aditomo and Mujahid (2014) in Profil Kesehatan RI 2017,⁶ the population is termed as 'an old population' when the proportion of the elderly population (≥ 60 years) had reached 10%. Indonesia had been predicted to become one of the countries that would enter the old population structure as the percentage of the elderly population reached 7.6% of the total population in 2010 (Population Census, BPS 2010), and would continue to increase between 2020-2035 in line with Indonesia's life expectancy, which was projected to continue to increase from 69.8 years (2010) to 72.4 years in 2035 (Bappenas, BPS, UNFPA 2013).

This phenomenon of population aging occurs in all countries, especially in developing countries. According to the Law of the Republic of Indonesia in 1998 concerning the Welfare of the Elderly, an elderly person is someone who has reached the age of 60 years and over. The elderly population continues to increase along with advances in the health sector marked by increasing life expectancy and declining mortality rates. By 2020 there were already six provinces that had an old population structure, where the elderly population reached 10 percent, including DI Yogyakarta (14.71%).^{6,7,8}

The results of this study were different from the research of Purnami and Thriesnarsandhi⁹ (2020) which stated that most tinnitus patients who sought treatment at the Neurotology Unit of Dr. Soetomo Hospital Surabaya were mostly aged 31-40 years, namely 232 (55.2%) from 420 respondents.

Although in small numbers, the incidence of tinnitus in adolescents still exists. This might be possible because of the increase in the usage of earphones along with the development of audiovisual technology. Zain et al.¹⁰ (2016) showed that most (83.6%) high school students in Padang City use earphones. Research by Velaro and Zahara¹¹ (2021) showed a relationship between earphone use and tinnitus incidences. Freitas et al.¹² (2022) also reported a relationship between knowledge, attitudes and patterns of earphone use in students of SMA Negeri 7 Kota Kupang, where most of the attitudes and patterns of using earphones of these students were categorized as risky. The result of this study showed that most of the respondents were female with a percentage of 51.71%, while male respondents came to a percentage of 48.29%. The difference in the number of respondents related to gender in this study is not significant. If you look closer at the data every year, in 2019 and 2020 most of the respondents were male, namely (51.25% and 53.53%). Meanwhile, in 2021, most of the respondents were female with a total percentage of 58.40%.

This result was similar with the research by Nugroho et al.² and Oosterloo et al.⁵ Nugroho et al.² reported that out of the 31 patients with subjective tinnitus who went to the ENT-HN Clinic of Dr. Karyadi Hospital, 51.6% were female, and 48.4% were male. Oosterloo et al.⁵ stated that based on the Rotterdam Study from 2011 to 2016, there were 6,098 respondents with tinnitus, where 53.5% were female, and 46.5% were male.

The results of this study were different from that of the research of Elmoazen et al.¹³ conducted in Egypt in 2020. This research showed that patients who had their hearing tested and had tinnitus amounted to 14 subjects, 12 (80%) were females and 3 others were males. The results of Elmoazen et al.¹³ research coincide with the research of Soelistijani et al.¹⁴ (2018) conducted in

Surabaya, which reported that out of 14 patients with tinnitus, 10 (71.43%) subjects were female. Similar research results were also found in Malaysia. Abdullah et al.¹⁵ (2020) stated that of the 88 subjects with tinnitus who sought treatment at the outpatient unit of the Ear Neck Throat, Head and Neck Surgery (ENT-HN) Universiti Kebangsaan Malaysia Medical Centre (UKMMC), 35 were males and 53 were females. Purnami et al.⁹ also stated that 75% of patients who sought treatment at the Neurotology Unit of Dr. Soetomo Hospital Surabaya were mostly male, namely 315 (75%) out of 420 patients.

Overall, most of the results of OAE High Noise examinations conducted on tinnitus patients at the Electromedical Clinic of UGM Academic Hospital were abnormal, namely 250 (85.61%) patients from 292 patients. Of the 250 patients with abnormal OAE High Noise results, 202 (80.80%) patients experienced disorders in both ears (bilateral), and the rest experienced disorders in 1 ear (unilateral).

Several other studies had shown a variation in results. Research by Soelistijani et al.¹⁴ showed that of 14 patients with tinnitus, 6 (42.86%) subjects experienced bilateral tinnitus, while the rest experienced unilateral tinnitus. Research by Abdullah et al.¹⁵ showed that of 88 tinnitus patients who sought treatment at the ENT-HN UKMMC department, there were 62 (70.50%) subjects whom experienced unilateral tinnitus, while 26 (29.50%) other subjects experienced bilateral tinnitus. Research in 2015 conducted by Nugroho et al.² in Semarang showed that patients with tinnitus in one ear (right 41.9% and left 38.7%) were more than that of patients who experienced tinnitus in the head (6.5%) and both ears (12.9%). Purnami et al.⁹ research in Surabaya showed that 394 (94.8%) patients experienced unilateral tinnitus and 22 (5.2%) experienced tinnitus in both ears.

Our study results were further diverged based on the range of interfered/abnormal

frequencies in each ear of the 250 patients whose OAE High Noise test results were abnormal. Out of the 500 ears examined, there were 47 ears with no frequency interference, 220 ears with interference at 1-6 frequencies, and 233 ears with interference at more than 6 frequencies. The more frequencies that experienced interference, the greater the degree of damage to the outer hair cell cochlea.

The main diagnosis of patients who underwent OAE High Noise examinations was mostly tinnitus, with a percentage of 87.67%. This percentage was almost the same as the percentage of patients with abnormal OAE High Noise test results (85.61%). This showed that tinnitus patients who sought treatment at UGM Academic Hospital were most likely to experience interference with their cochlea outer hair cells.

Most of the results of OAE High Noise examinations conducted on tinnitus patients at the Electromedical Clinic of UGM Academic Hospital were abnormal, namely as many as 250 (85.61%) patients out of 292 patients. Of the 250 patients with abnormal OAE High Noise results, most (80.80%) patients experienced bilateral tinnitus. The main diagnosis of patients was tinnitus (87.67%).

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