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Use of white noise-emitting devices in infants and small children as assessed by their parents

Stosowanie urządzeń wytwarzających biały szum u niemowląt i małych dzieci w ocenie ich rodziców

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Abstract

Introduction: Crying and anxiety in an infant are not only a defence reaction informing of a health problem, but also a signal of hunger, fatigue or difficulties falling asleep. There are many methods of reducing a child's adaptation problems. Various positions, breastfeeding, rocking and contact with the mother's skin are used. Currently, white noise-emitting devices are increasingly popular. White noise consists of monotonous sounds without volume changes, similar to the sounds of nature (rain, the sea), heard by the child during foetal life (the hum of large maternal blood vessels), which has a calming effect and masks the sounds of external environment. **Aim of the study:** The aim of the study was to assess the motives, efficacy and correctness of the use of white noise-emitting devices. **Material and methods:** A survey was conducted among 580 parents who used white noise-emitting devices (Szumiś, Whisbear, applications on personal electronic devices). The survey collected data on the parent population, the prevalence of the method, the reasons for choosing this method to relieve the child's problems, the device's efficacy and manner of use and users' awareness of potential hazards associated with incorrect use of such devices. **Results:** The results indicate a widespread use of white noise-emitting devices for helping children fall asleep and reducing their anxiety or colic pain, particularly in infants. Parents made a frequent use of these devices and left them switched on for a long time in close proximity to their children. They did not notice any negative effects of their use and would recommend them to other parents. **Conclusions:** White noise-emitting devices may be helpful in taking care of a restless child. However, they may be recommended by medical professionals provided that they comply with appropriate technical criteria and the rules for their use have been established considering the unknown long-term impact of such devices on the child's development.

Keywords: white noise, Szumiś, infants, children, crying, falling asleep

Streszczenie

Wstęp: Płacz i niepokój u niemowlęcia nie tylko stanowią reakcję obronną informującą o zagrożeniu zdrowotnym, ale są też sygnałem głodu, zmęczenia czy trudności w zasypianiu. Istnieje wiele metod redukujących problemy adaptacyjne dziecka. Wykorzystuje się różnego typu pozycje ułożeniowe, karmienie piersią, kołysanie czy kontakt ze skórą matki. Coraz popularniejsze są obecnie urządzenia wytwarzające biały szum, czyli monotonne dźwięki bez zmian głośności, podobne do odgłosów natury (deszcz, szum morza), słyszane przez dziecko w życiu płodowym (szum wielkich naczyń krwionośnych matki), mające działanie uspokajające i maskujące odgłosy środowiska zewnętrznego. **Cel:** Celem pracy była ocena motywów, skuteczności i prawidłowości używania urządzeń wytwarzających biały szum. **Materiał i metody:** Ankietowe badanie przeprowadzono wśród 580 rodziców używających urządzeń wytwarzających biały szum (Szumiś, Whisbear, aplikacje w personalnych urządzeniach elektronicznych). Miało ono na celu ocenę populacji rodziców, ocenę rozpowszechnienia tej metody, ocenę powodów, dla których opiekunowie wybrali ten sposób łagodzenia dolegliwości dziecka, oraz ocenę skuteczności, sposobu stosowania i świadomości potencjalnych zagrożeń wynikających z niewłaściwego używania takich urządzeń. **Wyniki:** Wyniki wskazują na powszechne stosowanie tego typu urządzeń w celu ułatwienia dzieciom zasypiania, łagodzenia niepokoju czy bólu kolkowego, zwłaszcza u niemowląt. Rodzice korzystali z tych urządzeń często, włączając je na długi czas i umieszczając blisko dzieci. Nie zauważyli negatywnych skutków ich używania i polecaliby je innym rodzicom. **Wnioski:** Urządzenia emitujące biały szum mogą być przydatne w opiece nad dzieckiem niespokojnym. Warunkiem ich rekomendowania przez personel medyczny musi być jednak spełnienie odpowiednich kryteriów technicznych i ustalenie zasad ich stosowania, ze względu na nieznaną długofalowy wpływ używania tych urządzeń na rozwój dziecka.

Słowa kluczowe: biały szum, Szumiś, niemowlęta, dzieci, płacz, zasypianie

INTRODUCTION

During the neonatal and infant period, the child adapts to the surrounding environment. Crying, which is common in this period, is a defence reaction. Crying is indicative of a health problem and is a reaction to pain (intestinal colic, vaccinations), fatigue, hunger or discomfort⁽¹⁾. It always worries parents and is often the reason for premature discontinuation of breastfeeding. Apart from the need to identify medical causes of crying, methods of comforting the child are sought in order to reduce its and the parents' stress. Various positions, cuddling, rocking, kangaroo care and breastfeeding are used or sweet



Fig. 1. Szumiś



Fig. 2. Whisbear the Humming Bear

drinks are administered to relieve the baby's symptoms^(2–13). Acoustic stimuli such as maternal voice, calm music^(14,15) and white noise are also utilised^(1,2,16–19).

White noise is a type of monotonous sound in the form of acoustic resonance whose spectrum is balanced across the majority of audible frequency range, without rapid changes in volume. White noise is similar to the sounds of nature such as rain, snowstorm or the sea. It can also be compared to the sound emitted by a quietly working dryer or vacuum cleaner. It is believed that the child experiences such a monotonous acoustic phenomenon already in the mother's womb (her heartbeat, blood flow in large blood vessels)^(13,20). These sounds are the white noise of foetal life^(13,20). Similar sounds heard during the neonatal and infant period may have a soothing and calming effect; in addition, they may mask other sounds and external environmental noise^(13,20).

There are plush mascots available which contain white noise-emitting devices inside such as Szumiś or Whisbear (Figs. 1, 2). Applications for a mobile phone, tablet or laptop have also been developed.

From the parents' point of view, the use of this method seems promising; however, there are a number of medical doubts about it. This is because there is an insufficient number of studies confirming the safety of white-noise emitting devices (concerning their impact on hearing and psychological development of the recipient, among other problems). Should the paediatrician recommend or discourage from the use of such devices?

AIM OF THE STUDY

The aim of the study is to investigate whether and in what situations parents use white noise-emitting devices, what their efficacy rating is and whether they are used correctly.

MATERIAL AND METHODS

An anonymous survey was conducted using electronic means. The survey was directed at parents who used white noise-emitting devices. The subjects were selected at random. The survey was conducted from 01.01.2018 to 31.03.2018 via social media and forums and topical groups for young parents. The survey was developed by the present authors and included single and multiple choice questions and comprised three parts. The questions concerned demographical data, indications and efficacy rating of white noise-emitting devices, conditions of their use and their impact on the child's behaviour. Due to the fact that the white noise-emitting devices used by the respondents did not have a sound intensity scale, the respondents were asked to rate the volume on a scale of 1–5 (1 indicated very quiet and 5 very loud sound emission). In total, 580 individuals took part in the study. The respondents came from all Polish provinces. The majority of answers were received from the Mazowieckie province (168 surveys) and Śląskie province (107 surveys). Women accounted for 99.3%

Assessed parameter	Number of parents <i>n</i> = 580	%
Period of use		
Over the first month of life	63	10.9
Over the first 3 months of life	102	17.6
Over the first 6 months of life	181	31.2
For a year	99	17.0
For longer	135	23.3
Frequency of use		
Once a day	95	16.4
Twice a day	140	24.1
3 or more times a day	143	24.7
A few times a week	68	11.7
Sporadically	134	23.1
Time of single session		
Up to 5 minutes	65	11.2
Up to 15 minutes	143	24.7
Up to 30 minutes	142	24.5
Up to an hour	171	29.5
More than one hour	59	10.1
Device placement		
In the cot	279	48.1
On the night table	231	39.8
>2 m from the cot	70	12.1
Volume level set		
1	104	17.9
2	208	35.9
3	183	31.6
4	62	10.7
5	23	3.9

Tab. 1. Data regarding the use of white noise-emitting devices by the respondents

of the respondents. The mean age of the subjects was 29.3 years. The largest group were individuals aged 25–30 years (39.1%). Parents aged 31–35 years accounted for 32.1% of the respondents. There were 19% of individuals aged 18–25 years and 9.8% aged over 35. 64% of the subjects had one child, 30% had two children and 6% had three or more children. The numbers of boys and girls were comparable (302 vs. 278, respectively). The children were aged from 1 to 24 months. 49.1% of the respondents lived in a city of more than 100,000 inhabitants and others lived in smaller towns and in rural areas. There were 68.9% of respondents with higher education, 27.4% with secondary-level education and the remaining ones had vocational education.

Based on routine screening tests, 97.6% of children had a normal hearing. In 2.4% of neonates the result was abnormal, no test had been performed or risk factors for hearing damage had been found. 96.2% of parents declared that their children were vaccinated in accordance with the official vaccination schedule.

Statistical analysis was performed using Statistica version 12 software; descriptive statistics methods and Spearman's test were utilised.

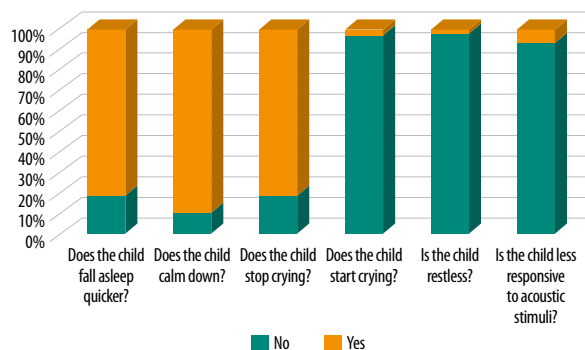


Fig. 3. Children's behaviour during the use of white noise-emitting devices

RESULTS

The most frequently used white noise-emitting devices were Szumiś (40.3%), Whisbear (32.8%) and recordings of sounds imitating electrical appliances (30.9%).

The primary aim of using white noise-emitting devices was to put the child to sleep (86.9%). In addition, parents used these devices when the child was restless (24.3%) or during an attack of intestinal colic (14.1%).

50% of the respondents chose white noise-emitting devices, since traditional methods of comforting the child turned out to be ineffective. 58.6% of parents learnt about white noise-emitting devices from the Internet and one third from friends. Among the subjects, 27.0% bought this type of device based on a fashion for using them and 20% received it as a present. 80.3% of parents had previously used other acoustic methods of putting the child to sleep or comforting it such as lullabies or classical music. Other parents (19.7%) decided to use white noise-emitting devices in the first place.

Data regarding the manner of use of white noise-emitting devices by the respondents are presented in Tab. 1.

The devices were most often used over the first six months of the child's life (31.2%). In the first month, the devices were used by 10.9% of parents. In 17.6% of cases the devices were used over the first 3 months of life. 17.0% of the respondents used the devices for one year, while 23.3% of parents used them for longer.

Among the surveyed parents, 24.7% used the devices 3 and more times daily, 24.1% used them 2 times a day and 23.1% switched them on sporadically. Other respondents used such devices once a day or a few times a week. The time of a single sound session was up to one hour (29.5% of the respondents), up to 30 minutes (24.5%) or shorter (35.9%). Others (10.1%) switched on the device for more than one hour at a time.

More than half of parents (48.1%) placed white noise-emitting devices in the child's cot; 39.8% of devices were put on a night table next to the cot.

The subjects set the volume of the devices to low (35.9%) and medium (31.6%). Based on Spearman's test, no relationship was demonstrated between the placement of the device and the volume set ($r_s = 0.009$).

In the third part of the survey, parents were asked about their child's behaviour during the use of white noise-emitting devices (Fig. 3).

When asked a yes/no answer about a positive influence of white noise-emitting devices (falling asleep quicker, calming down, stopping crying), the majority of the respondents (over 80%) chose the affirmative answer.

The majority of parents did not notice any negative effects of using white noise-emitting devices. Almost all of them (94.0%) chose the "no" answer to questions regarding signs of fear and anxiety, crying or parents' subjective impression of hearing deterioration in the children.

Among the surveyed parents, 82% would recommend this method of soothing children to other young parents.

DISCUSSION

Crying and anxiety in a child, even after all potential somatic causes have been excluded (gastrological, allergic, cardiac, neurological and other) always raise negative emotions in parents. Even though it is believed that approximately 20% of infants cry frequently for no apparent reason over the first 4 months of life, parents of a crying child may feel anxiety, depression, helplessness and even anger and frustration⁽¹⁻⁵⁾. Parents may be afraid that they are hurting their own child by not being able to help it and experience a feeling of guilt and shame⁽⁵⁾. This may have a negative impact on parental bonds and parental perception of the child⁽⁵⁾. The caregivers are often not able to cope with the problem on their own and need the help of qualified healthcare professionals^(4,5).

Since time immemorial, ways of comforting an anxious or crying child have been sought. Intuitive methods used for centuries (e.g. taking the child for a walk in a pram or giving it a warm bath) have found scientific explanation and are still recommended in caring for a restless child⁽¹⁾.

Rhythmical rocking of an infant induces the secretion of endorphins by stimulating the vestibular system, which reduces the duration of anxiety and crying and relieves pain caused by infantile colic, for example^(17,21).

Research results emphasise the beneficial effects of breastfeeding on soothing a child and on pain reduction during procedures such as injections (e.g. vaccinations), fingerstick or heel lance for diagnostic blood collection^(7,12,22). The mechanism involved is of multifactorial nature. It includes the sucking reflex, skin-to-skin contact, warmth, rocking, the sound of the mother's voice, maternal scent and the effects of endogenous opioids contained in breast milk^(7,12). In addition, it has been found that olfactory stimulation by the smell of the mother's milk also has a soothing effect⁽²³⁾. A similar and in some studies even stronger analgesic effect is observed when sugar solutions are administered to the child via the oral route⁽⁸⁻¹¹⁾.

Appropriate positioning of the infant has also resulted in reducing the child's anxiety and crying. In a method called THB (The Happiest Baby) conditions of foetal life are

reproduced: the child is placed on the side with its head downwards and it is wrapped tightly with a diaper cloth (but loosely enough to allow movement in the hips and avoid overheating). Monotonous sounds are played and the child is rocked in a rhythmical fashion^(2,24).

Skin-to-skin care (SSC), also called kangaroo mother care (KMC), is a method that has been used for a few decades at neonatal wards and has been recommended for everyday infant care: for soothing anxiety and crying and helping the child fall asleep^(6,8,9,13,25).

Chirico et al. conducted an interesting study investigating the sensation of pain during blood drawing in preterm infants who were listening to their mother's recorded voice. The child's behaviour, heart rate, blood pressure, O₂ saturation and adverse reactions such as apnoea or vomiting were assessed. The study results showed this method to be effective⁽²⁶⁾.

A positive effect of listening to music was also demonstrated (a melody hummed by parents or calm classical music) in similar situations for soothing pain and crying in preterm infants and relieving infantile colic^(13-15,20,21).

White noise is an acoustic phenomenon whose spectrum is balanced across the majority of audible frequency range, without rapid changes in intensity, monotonous, repetitive and usually similar to the sounds of nature such as the sound of the sea, stream or rain. The child is subjected to white noise already in the womb: it can hear its mother's rhythmical heartbeat, flow of blood in large vessels and the sounds of uterine and gastrointestinal tract movements^(17,20). This results in the child becoming accustomed to these phenomena⁽²⁷⁾. Therefore, such noise comforts the neonate/infant, reduces the duration of crying, relieves pain, including iatrogenic pain, helps the child fall sleep and prolongs sleep duration^(17,19,20,27,28). The use of white noise masks other sounds and noises of the external environment^(13,19).

The influence of white noise on children falling asleep started to be investigated in the nineties of the previous century. Spencer et al. demonstrated positive effects of white noise in 80% of infants⁽¹⁸⁾. The impact of such sounds on shortening the period of adaptation of a neonate to the external world during the postpartum period has been investigated multiple times. This includes, for example, early breast sucking, which translates into a longer duration of natural feeding. Very promising results were achieved^(20,28). In a multicentre, randomised, controlled clinical trial, Sezici and Yigit checked whether using white noise-emitting devices reduces the time of crying and increases sleep duration in children suffering from colics. Their assumptions concerning the effects of white noise compared to other methods such as rocking, for example, were confirmed. The study revealed that white noise caused a statistically significant reduction in crying and the time it took the children to fall asleep, particularly when the method was used for many days⁽¹⁷⁾. Karakoç et al. found that white noise is an effective, non-pharmacological method of pain relief, crying time reduction and improvement in vital signs of hospitalised neonates

subjected to blood drawing and vaccinations⁽¹⁶⁾. Similar results were observed in a group of preterm infants⁽¹³⁾. The present study shows that white noise-emitting devices are often used by parents with higher education in particular in everyday care of children of various ages. Such devices are mainly used to help the child fall asleep (86.9%) or calm it down (24.3%). It is surprising that only 14.1% of parents use white noise-emitting devices to relieve pain in intestinal colic.

In the context of informed care over a child, the statement of more than half of the respondents that they chose such a device when other methods of soothing the child's anxiety proved ineffective is a positive finding. What is characteristic for the contemporary times is acting upon information found on the internet and following trends, such as the one for having white noise-emitting devices, which is confirmed by the results of the survey.

The knowledge of the right manner of use of white noise-emitting devices is a very important issue. Canadian authors demonstrated that too high intensity, long duration of single exposure or too close placement of the device may have a negative impact on the child's hearing (hearing damage, impaired development of the hearing system and speech)⁽¹⁹⁾. They suggest that this type of devices should be placed as far away from the child as possible, the lowest sound intensity should be applied and time of use should be as short as possible. These conclusions were based on objective study of volume (in decibels) and the distance between the device and the child (in centimetres). Unfortunately, the devices used by the respondents from the present study (both Szumiś and online applications) do not have volume levels expressed in decibels provided. Therefore, the present authors had to use a scale of 1–5 to investigate this aspect of white noise influence on the child. The majority of the subjects prefer using quiet or moderately loud sounds. Unfortunately, half of the respondents put the device near the child, usually in the cot. The duration of a single session is 15–60 minutes with a trend to prolong this time to as much as a few hours. There is also the worrying fact of using such devices at least twice a day by nearly half of the respondents. 82% of the respondents, who believe that the device is useful in taking care of their child, would recommend this method of soothing children to other parents. In the era of long working hours, in situations where grandparents do not participate in childcare and considering the widespread use of new equipment and technologies, improving the comfort of parents' and children's lives with white noise-emitting devices seems to be justified. However, these devices need to be medically safe (limited volume level and operation time, preferably with an automatic switch). Parents should be informed of the correct manner of use of the devices by instruction manuals and medical professionals. The problem is all the more important since more than half of the respondents learnt about white noise-emitting devices from the Internet, while in one third of cases it was friends who recommended this method to the respondents

without making them aware of the potential risks of using such devices. Thus, a new task has emerged for general practitioners taking care of children as part of health prevention education.

The Canadian study mentioned above includes recommendations for parents regarding the use of white noise-emitting devices⁽¹⁹⁾. Such recommendations, developed by paediatricians, neonatologists and paediatric ENT specialists, should be provided to all users of the devices.

CONCLUSIONS

1. White noise-emitting devices may be useful as one of the methods for calming down infants and helping them to sleep.
2. Medical professionals may recommend white noise-emitting devices on condition that they are compliant with appropriate technical criteria (standardised volume, operation time meter) and the rules for their use have been established.
3. The long-term effects of using white noise-emitting devices placed too close to a child are unknown; therefore, a safe distance should be kept and the time of operation should be limited. Users should be made aware of this aspect of the use of the device in particular.

Conflict of interest

The authors do not report any financial or personal affiliations to persons or organisations that could adversely affect the content of or claim to have rights to this publication.

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