



Music Listening Intervention vs Local Anaesthetic Cream for Pain Management in Infants Undergoing Venepuncture: A Collaborative Trans-Disciplinary Research

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ABSTRACT

Aim: Local anaesthetic cream (EMLA) is often used for paediatric procedural pain management. However, there are concerns about dependency on pain medication. A healthier alternative would be to use music listening intervention instead. This study aimed to test the effectiveness of music listening intervention in managing pain for infants undergoing venepuncture procedures in comparison to using EMLA.

Materials and Methods: The research was conducted in two phases-in the first phase, surveys were conducted to determine the spectrum of popular Malaysian folk songs for children in nursery schools, and the selection of songs was then rearranged in an instrumental form to be played in the experimental phase. The experimental phase is the second part which involved the focus and control groups of infants that required venepuncture procedures. The focus group was given music listening intervention during the procedure while the control group was given EMLA.

Results: The results revealed that there was no statistical difference between the two groups in pain management.

Conclusion: This study shows that music listening intervention is comparable to EMLA cream in the management of venepuncture pain based on physiological response and pain behavioural score.

Keywords: Music listening intervention, local anaesthetic cream, venepuncture, pain management, infants

Introduction

Human beings are surrounded and nourished by music from the moment of conception particularly through the strong rhythmic beat of the maternal heartbeat (1). Nature has also given mankind music through the sounds of rain and wind, running waters and rustling leaves, thus music and rhythm are inherent in our very being (2). Hence, our lives are invariably connected to some form of music (3). This very fact explains why music can be used as a form of therapy to soothe and calm the human momentum in experiencing stress or pain (4). Children are a vulnerable group (5). They are easily affected by their environment in many ways (6).

Pain is an aspect where children tend to suffer because of their lower tolerance level (7). Thus, parents, medical doctors and caregivers should adopt child-friendly approaches which can help to lower the impact of pain on children whenever possible, especially during medical procedures (8). Some side effects of pain are acute while others are subliminal or even chronic (9). Side effects of pain can take a toll on parents especially when their young children become stressful and restless (10). Based on the observations of previous medical experiences, it is noted that every child carries his/her own complex recollection of pain, imagination, worries, and misinterpretation (11). As a result, the child's behaviour can cause family members a lot of anxiety (12). To

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alleviate this momentum, medical practitioners may apply a local anaesthetic cream (EMLA) known as EMLA cream on paediatric patients in order to reduce their pain during medical procedures (13). According to the Gate Control Theory of Pain (14), physical pain often occurs in nerve endings throughout the entire body. However, the interpretation and awareness of the stimulation takes place in the central nervous system (CNS). Whilst this is happening, the CNS also takes in other stimuli which include auditory and visual stimuli. The CNS can only process a limited amount of information at any one time, and all these sensations are simultaneously competing with the pain stimulus for attention (15). As a result of this competition, the human perception of pain can be reduced due to the limited capacity of the conscious awareness. If the positive conscious awareness can be enhanced, the perception of pain can be weakened (16). In music listening intervention, the CNS can be positively enhanced by the music, thereby leading to a weakened perception of pain (17). According to Davis et al. (18), music can be used as a cognitive pain control strategy in the following ways: as a stimulus for active focus or distraction, as a cue for relaxation response, as a masking agent, and as a positive environment stimulus.

Music in the medical field has always existed in many forms in different cultures for centuries. It was around the mid-20th century that dependence on music as an alternative therapeutic intervention increased. Growing interests in music as an alternative for medical therapy has progressed through recent years (19-22). Music is often considered as a complementary therapy (23). Studies (20,21,24) have shown successful results of music intervention in a wide variety of clinical settings such as pain therapy, surgery and anaesthesia (25). The reason for music being used as an alternative intervention for pain therapy is that there are connections between music and the pain experienced by humans. Eagle and Harish (15) explained that both music and pain are alike in terms of frequency/pitch, intensity/loudness, wave form/timber, duration/time, and location/localization. By manipulating music in accordance with the connections, the body can be tricked to suppress pain and assist in pain therapy. This research aimed to investigate the effectiveness of music listening intervention for alleviating pain among children in comparison to the use of the EMLA cream, a eutectic mixture of lidocaine and prilocaine (26). One of its main characteristics is that it has good skin absorption making it a popular topical analgesic (27). Since the 1980's, EMLA has been a focus for medical and nursing research because of the concerns regarding paediatric procedural pain (28). Several studies have shown EMLA to be an effective local anaesthetic for paediatric venepuncture pain and for intramuscular injections (29). In a study conducted by Rogers and Ostrow (30), EMLA cream was compared with a placebo (31), iontophoresis, and amethocaine cream in decreasing venepuncture pain in children. The study showed that EMLA cream was an effective local anaesthetic for paediatric venepuncture pain during both intravenous cannulation and

phlebotomy. It is safe and has relatively few side effects. Manufacturers recommend an application time of 60 minutes (13), applied in a mound over the venepuncture site, covered with a semi-permeable dressing. This process facilitates skin absorption which allows the anaesthetic agent to hinder initiation and conduction of nerve impulses that cause pain (32). Although EMLA cream is effective in reducing venepuncture pain in infants, its side effects include transient local blanching followed by erythema at the injection site (33). It is also time, energy and money-consuming (34). Unlike EMLA, music is a form of melody that surrounds the human activity and it is easily accessible through various forms of the media. If used as a substitute to alleviate pain, music, in comparison to EMLA, is low in cost, readily available and has no adverse effects (35,36). In the context of this study, pain experienced by the infant is medically treated with a topical cream, the EMLA cream. This cream is placed on the spot where the infant is deemed to be experiencing the pain. If music therapy is considered, then music will be played to the infants undergoing venepuncture procedure and as the rhythm plays, it will automatically replace the rhythm of the pain experienced by the infant.

Materials and Methods

Subjects

All the subjects involved in this study (n=30) were paediatric patients aged between 2 to 24 months. They were admitted to the general paediatric ward or day-care of a tertiary medical centre requiring venepuncture. Since the memory of children at that age is still at a developing phase, it is possible that they may be naive towards the procedures. It is because of this, Oehler (as cited in 37) suggests that music listening intervention may be able to calm them down more easily. Nonetheless, once they reach beyond 2 years of age, these children may become more aware of their surroundings, thus increasing their consciousness of the inadvertent pain during venepuncture (37). For this reason, only paediatric patients aged 2 to 24 months were selected for this research.

This study was approved by the Research Ethics Committee (REC) of University Kebangsaan Malaysia (UKM) (approval number: FF-264-2011). Consent was filled out and given by the parents and guardians of the participants.

Measure Instrument

Faces Pain Scale

According to Wong and Baker (38), the Faces Pain scale (FPS) is the most widely-used pain score for the assessment of pain via self-report. It comprises a single straight 100 mm line, and the extremes of the line denote the level of pain experienced with indications of "no pain" to "worst possible pain". Observer ratings of pain using the FPS showed good intra and inter-rater reliability, from 0.69-0.91 and 0.55-0.97 respectively. In the case of young children, the FPS was

developed in order to make it possible to score on the widely accepted 0 to 10 metric scale. There is a high correlation between FPS and the many different versions of the Faces scale; the Wong-Baker Pain scale is the most popular among both children and parents (39). The FPS has in fact been used in infants from 2 months up to 4 years old, and has been validated against the Modified Behavioural Pain Scale (MBPS) (40). Pain scoring for this study was done by using the Wong-Baker FPS, a scale consisting of 6 faces equivalent to a visual analogue score on a 10 cm numeric pain intensity scale. This instrument has been validated and is widely-used as a pain assessment scale (41). Figure 1 shows the standard measure for the FPS.

Modified Behavioural Pain Scale

According to Taddio et al. (40), the MBPS is a behavioural pain measure that examines responses from 3 domains: facial expression, crying, and body movements. The overall score (range, 0-10) comprises the sum of individual scores obtained from each domain. The reliability and validity of the MBPS for measuring acute pain in infants have been well demonstrated (42). Figure 2 shows the standard measurements for the MBPS.

Process

To develop this research, a survey of several local nursery schools in Malaysia was conducted. Out of these, six were randomly picked for the music selection process by JavaScript random number generator. Permission was obtained to visit these nurseries. The selection of the genres of songs was chosen based on two aspects; the teaching syllabus of all six nursery schools, and interviews with the teachers. The genres were first identified from the teaching syllabus and then the different genres of nursery songs were played to the nursery teachers in order to determine which of these were usually used by the teachers as teaching materials in their respective nursery schools. The genres of the children's songs played included rhythm and blues (R&B), western, classical, Malaysian folk songs (Malay and Chinese), and blues. Upon the conclusion of interviews with the nursery teachers, the researcher then played music from

all four genres during school activities, curricular, games, and lunch time, with the assistance of the teachers. The children were then asked to vote (identify) for their favourite songs by raising their hands when the songs were played. The researcher shortlisted the top songs with the highest number of votes. A discussion was subsequently held between the researcher and a certified music therapist before the Malaysian folk songs were arranged and recorded. According to the music therapist, infants are naive, simple and innocent (43,44). This means that simple melodies would have better benefits on them than complicated music structures. The simpler the music, the better the results will be in reducing the level of pain in infants (45). Approval from the Research Ethics Committee of UKM was obtained prior to the recruitment of patients to the team conducting the investigation, including the researchers, UKM Medical Centre nurses, and a board certified therapist. Exclusion criteria included infants with neurological diagnoses or syndromes, (e.g. cerebral palsy, hydrocephalus, Rett syndrome) which may suggest an impaired or abnormal pain response, multiple congenital abnormalities that may present difficulties in pain scoring, failed oto-acoustic emissions or automated auditory brainstem response testing on their neonatal hearing screening at birth, infants who were given any analgesics prior to the procedure (e.g. paracetamol, morphine or midazolam), infants with delayed speech and language development for their age as this might affect their hearing. From the criteria set, thirty patients were selected and written informed consent was obtained from the parents. The selected patients were then randomized by using a JavaScript random number generator to produce customized sets of random numbers into either the music listening intervention group or the EMLA group (Figure 3). In the study, the EMLA group was given an application of EMLA which was applied onto the dorsum of the hand over the intended venepuncture site. Application was done in accordance with the manufacturer's instructions. A thick layer of one to two grams was applied under an occlusive dressing 60 minutes prior to the venepuncture (46). In the music group, a placebo cream (Aqueous cream) was applied to the subjects instead of the EMLA cream and the same method was employed for the EMLA group. By using non-invasive pulse oximetry, a baseline monitoring of the patients' heart rates (HR) was obtained, and oxygen saturation (SpO_2) was obtained using a SpO_2 machine 10 minutes before the venepuncture procedure. Headphones were placed onto both groups 5 minutes before the procedure. The music group had music played on the headphones while the EMLA group did not have any music in their headphones. Venepuncture procedures were then carried out as per standard ward protocol. A video recording of the patients was made during the procedure and reviewed independently for the assessment of pain score using the FPS and MBPS by two paediatric registrars i.e. they were blinded to the type of therapy received. The subjects' faces, limbs and postures were exposed during venepuncture so as to allow for the proper assessment of pain scores. In

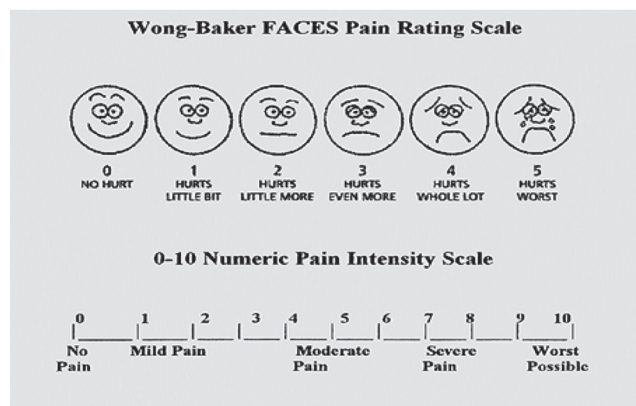


Figure 1. Faces Pain scale (38)

In addition to this, the researcher also evaluated the infants' physiological response to pain during the venepuncture procedure by means of HR and pulse oximetry monitoring (SpO₂). During the venepuncture process, the HR, SpO₂ and pain score was documented from baseline i.e. 5 minutes before the start of venepuncture (T=0), first prick (T=1), 2.5 minutes (T=2.5), 5 minutes (T=5) and 7.5 minutes (T=7.5) for every patient. Any number of venepuncture attempts was allowed during the 7.5 minutes. If the venepuncture procedure was unsuccessful and had exceeded 7.5 minutes, the vital signs and pain score were no longer documented. A summary of both parts of the research is shown in Figure 3.

Statistical Analysis

The IBM SPSS (version 22.0) was used for the data analysis of the findings obtained which was used to apply both descriptive (mean, standard deviation and frequency tables) and inferential statistics. The analysis of data involved the mean of 4 parts of the research-the HR, the SpO₂, the FPS, and the MBPS, within the three (3) stages (pre, post and follow-up) between both groups (i.e. experimental and control). Prior to data analysis for quantitative data, normality test was done. Mean comparison for continuous variables between two groups was done using a two-way

repeated measure ANOVA followed by Bonferroni test. The significance level in this study was $\alpha=0.05$ level.

Results

The First Phase of Research-Music Selection

During the song selection process, the majority of nursery children began to perform simple hand gestures while they sang and danced along to the Malaysian folk songs for children. However, when it involved songs in the R&B, western, classical, and blues genres, these were not popular with the children. This is probably because these genres were foreign to them as they were not within their own cultures. On the other hand, Malaysian folk songs have been their companion while growing up, and these songs are easy to comprehend and have simple arrangements. Thus, songs often played such as P. Ramlee's songs and some traditional songs are more favourable to the children (47). In looking at P. Ramlee, it can only be said that as a renowned artiste and song writer, P. Ramlee was a household name that catapulted the growth of Malaysian music and film industry during the 1950's (48). To date, his films and songs are still appreciated by Malaysians of every generation whether young or old.

Observed behavior	Score (0-10)	Operational definitions
Facial expression		
Definite positive expression.	0	Smiling.
Neutral expression.	1	
Slightly negative expression: for example grimace.	2	Brow bulge, naso-labial furrow.
Definite negative expression: i.e. furrowed brows, eyes closed tightly	3	Brow bulge, naso-labial furrow, eyes closed tight, open lips with or without reddened face.
Cry		
Laughing or giggling.	0	
Not crying.	1	
Moaning, quiet vocalizing, gentle or whimpering cry.	2	
Full lunged cry or sobbing.	3	
Full lunged cry, more than baseline cry.	4	To be scored only if infant is crying during baseline.
Movements		
Usual movements/activity, or resting/relaxed.	0	
Partial movement or attempt to avoid pain by withdrawing the limb where the puncture is done.	2	Squirming, arching, limb tensing/clenching.
Agitation with complex movements involving the head, torso or the other limbs, or rigidity.	3	Generalized limb and/or body movements, or rigidity.

Figure 2. Modified Behavioural Pain scale (40)

Some songs have remained a favourite because the melodies are simple. Thus, when the children were approached and asked to sing individually, it was noted that many of the songs they serenaded were mostly Malaysian folk songs for children, which have often been aired on radio and television (49). The children's parents were also interviewed as a way to obtain further insight into the child's music preferences. Most of the parents responded that they preferred to teach their children Malaysian folk songs at home because of the rhythm of the songs, which according to them, is simple and easy to memorize (50). They also claim that their children found it easier to comprehend this type of music as compared to others. This information implies that children who are exposed to Malaysian folk songs for children from an early age continue to learn them throughout their childhood. Based on the information gathered from the nursery teachers and from the responses drawn from the children and their parents, the list below shows the most voted (favourite) songs:

- Terbang Burung Terbang (P. Ramlee)
- Getaran Jiwa (P. Ramlee)
- Adik Manis (P. Ramlee)
- Ni Wa Wa (Luo Zhong)
- Xiao Mi Feng (Wang Shi Quan)
- Shi Shang Zhi You Ma Ma Hao (Lin Guo Xiong)

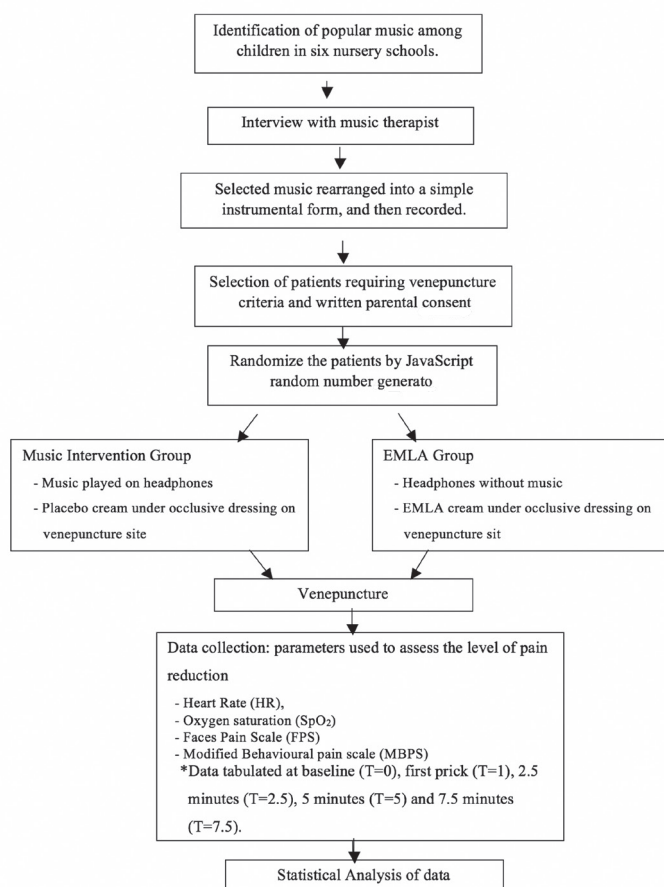


Figure 3. Flow chart of research methodology

All the above songs were used in this research. The melodies of all these songs remained in their original form but the harmonies were rearranged into instrumental form (51). The American Hearing Research Foundation (52) states that pitch higher than 80 decibels is harmful to the human ear. Thus, it is noteworthy that the pitch of the instrumental songs in this research was set at a medium level, which would be more suitable for infants and young children because their physical organs have yet to be fully developed and a high pitch can be harmful to their ears and cause them irritations. One of the criteria set for this study was that the duration of the instrumental music be longer than or equal to the venepuncture procedure to ensure that the music is played long enough to distract the infants throughout the procedure so that they would not be anxious or aware of the procedure (53). Simple instrumental music which incorporates piano, percussion and nature sounds is beneficial to mental and physical health (54). In the context of this study, the piano was chosen based on the professional experience of the music therapist who says that children favour sparkling sounds, and the piano is capable of producing orchestra-like sounds with its wide range of 88 keys. Moreover, the piano and percussion are instruments constantly used in the nursery schools making these sounds a familiar one to nursery children. It is theorized that the versatility of the piano in accommodating many styles of music is the most tangible quality in providing the healing effect for people of all ages in music listening intervention. At the New York's Nordoff-Robbins Centre for Music Therapy, the piano is used in helping children and adults to overcome their emotional and physical problems (55). Thus, instrumental songs are played randomly at a continuous pace during the venepuncture procedure.

The Second Phase of Research-Music Listening Intervention

The IBM SPSS Statistics (version 22.0) was used for data analysis. A total of 30 infants were recruited based on their age group and the aforementioned exclusion criteria. The median age of the infants in the music group was 9 months with a median weight of 7.6 kg, while those in the EMLA group had a median age of 8 months and a median weight of 7.5 kg. The analysis of the data involved the mean of 4 parts of the research the HR, the SpO₂, the FPS, and the MBPS, within the three (3) stages (pre, post and follow-up) between both groups (i.e. experimental and control). The sphericity assumption for each part was measured via the Mauchly's test. The differences in the mean of each part were assessed through a two-way repeated measure ANOVA. Prior to data analysis, all variables were subjected to a normality test, and results showed that the data were distributed normally. In the HR section, the sphericity assumption for HR was violated $\chi^2(2)=10.15$, $p=0.006$ therefore, the F-value was adjusted by a Greenhouse-Geisser correction ($\epsilon=0.76$). The results of repeated measure ANOVA on HR showed that the interaction between the control group and test was not statistically

significant $F(1.52, 42.64)=0.4$, $p=0.62$, $\eta^2=0.014$. The Post Hoc test (Bonferroni) results in Table I shows that the effect of music listening intervention group was not statistically different from the EMLA group ($p>0.05$). Similarly, using the Mauchly's test showed that the sphericity assumption for SpO_2 is significant $\chi^2(2)=0.067$, $p=0.97$ therefore, the F-value was used within Huynh-Feldt estimates of sphericity assumption ($\epsilon=1.0$). The results of repeated measure ANOVA on SpO_2 showed that the interaction between the group and test was not statistically significant $F(2, 56)=2.02$, $p=0.14$, $\eta^2=0.07$. The post hoc revealed that the effect of music listening intervention group was not statistically different from the EMLA group ($p>0.05$), except for the pre-test. In the FPS, the sphericity assumption for this part was significant at $\chi^2(2)=1.78$, $p=0.41$ therefore, F-value was used within Huynh-Feldt estimates of sphericity assumption ($\epsilon=1.0$). The results of repeated measure ANOVA on FPS showed that the interaction between the group and test was not statistically significant $F(2,56)=1.3$, $p=0.28$, $\eta^2=0.04$. However, the effect of music listening intervention group was only statistically different in the post-test. The sphericity assumption for MBPS was significant at $\chi^2(2)=0.4$, $p=0.82$, therefore, F-value was used with Huynh-Feldt estimates of sphericity assumption ($\epsilon=1.0$). The results of repeated measure ANOVA on MBPS showed that the interaction between the group and test was not statistically significant $F(2,56)=0.12$, $p=0.9$, $\eta^2=0.004$. Thus, the effect of music listening intervention group was not statistically different from the EMLA group ($p>0.05$). The analyses of data $T=5$ and $T=7.5$ were omitted in this research as most patients (22 out of 30) completed the venepuncture procedure before 5 minutes. As a result, only the analysis of data $T=2.5$ is valid for this research. The level of agreement between the two paediatric registrars as reflected by the high Cronbach Alpha scores revealed that their clinical observations and assessments were independent (83.9% to

96.4%), reliable and not influenced by a third party. Based on the above results, music is thus said to have similar effects of EMLA cream in alleviating pain. In other words, music can be used during a venepuncture procedure instead of the EMLA cream. Furthermore, music has many advantages compared to EMLA cream. Firstly, it is of a lower risk and is cost effective as it can be used repeatedly. Secondly, music is readily available and in itself is a form of natural therapy. On the other hand, EMLA cream is time consuming as it has to be applied 60 minutes prior to the procedure. EMLA cream may also incur high expenses as 5 g of EMLA cream costs about RM30 (£5.19) (56). If a doctor fails to locate an infant's blood vessel during the venepuncture procedure after the application of EMLA, reapplication on other intended sites is needed, thereby, incurring additional costs and stress. Furthermore, EMLA cream may also cause short term local blanching effect followed by local erythema. Music as a therapy is better and more suitable for infants for the above reasons (36).

Discussion

This study was a randomised controlled trial study. The results were analysed based on observed behavioural responses by using the two instruments, FPS and MBPS, and through clinical interpretations of vital signs as physiological responses. The results of this research indicate that pain management through the application of EMLA cream or music listening intervention has similar effects in alleviating pain experienced by paediatric subjects who were infants aged between 2 to 24 months old. During the music selection process, nursery teachers and parents were interviewed and the children who were able to comprehend and listen to their preferred choice of music were observed through the layer process as discussed in Figure 3. From the results of the

Table I. Mean difference in heart rate oxygen saturation, Faces Pain scale and Modified Behavioural Pain scale for music and EMLA group

Measures	Time	(I) Music or EMLA group	(J) Music or EMLA group	Mean difference (I-J)	SE	p value
Heart rate	Pre-test	EMLA	Music	11.867	7.069	0.104
	Post-test	EMLA	Music	17.733	9.679	0.078
	Follow up	EMLA	Music	10.467	7.831	0.192
Oxygen saturation	Pre-test	EMLA	Music	2.416*	0.937	0.015
	Post-test	EMLA	Music	1.6	2.242	0.481
	Follow up	EMLA	Music	1.733	2.323	0.462
Faces pain scale	Pre-test	EMLA	Music	0.4	0.559	0.48
	Post-test	EMLA	Music	1.133*	0.53	0.041
	Follow up	EMLA	Music	0.4	0.362	0.278
Modified behavioural pain scale	Pre-test	EMLA	Music	0.933	0.879	0.297
	Post-test	EMLA	Music	1.267	0.924	0.181
	Follow up	EMLA	Music	1.267	0.702	0.082

Based on estimated marginal means, adjustment for multiple comparisons: bonferroni

*: Significant at 0.05 level

observation, Malaysian folk songs for children were more favourable compared to the songs in genres depicting R&B, western, classical, and blues amongst children in Malaysian nurseries. The former was preferred over the latter choices possibly due to cultural differences. It may also be attributed to the fact that Malaysian children have been exposed to these songs so often that these have become their constant companion whilst growing up (57). Consequently, these songs are more familiar to them and it makes it easier for them to understand (58). This study has shown that there was no statistical significance between the EMLA cream, and music listening intervention group, thereby; both forms of interventions are comparable. The elevated HR and SpO₂ indicate that the subjects were anxious and in pain during the venepuncture procedure. An increase in the patient's HR and SpO₂ indicate that the moods of the patients are at stress levels. The results of this research showed that a patient's HR and SpO₂ in the music listening intervention group can be lowered to a comparably similar rate as that of the EMLA group by merely using non-invasive music therapy. The p-value for the HR and SpO₂ is more than 0.05, there by, proving that music has a similar effect to EMLA in decreasing the pain level.

Observations conducted in this research began from the moment the patients were prepared for the venepuncture procedure. The HR of the patients aged between 1 to 2 years old increased as they entered the procedure room. Their baseline resting HR was between 80 to 130 beats per minute but this increased to beyond 130 beats per minutes there after, which showed that as age increases, the awareness of surrounding also increases. Doctors allowed the patients' mothers to enter the procedure room to provide comfort to the child. Based on our observations, it was noted that the patients became calmer upon hearing their mothers' voices (59). The patients' being able to recognise their mothers' voices, indicates that they may also recognise the music frequently played at home (60). It is possible that playing this music during the venepuncture process will provide better distraction for the infants, thus providing better comfort. Based on our observation, the patients appeared to be anxious due to the unfamiliar environment they were in as well as the medical procedure itself. It was interesting to note that all the patients started to cry as they entered the procedure room. However, four patients in the music listening intervention group stopped crying when the music began to play; proof that music successfully diverted their attention, reducing the level of pain experienced (61). One of the biggest problems encountered during the research was the different levels of pain tolerance between the patients (62). It was noted that some patients under one year old did not realise that they had entered the procedure room, hence, they were neither nervous nor stressed. On the other hand, some patients aged between 1 to 2 years old got extremely nervous and stressed the moment they entered the procedure room, and this affected the baseline data collection. Two patients also became more nervous and anxious after listening to the

music because they started crying and their HR increased. In order to obtain more accurate results, a baseline reading of the patients who were induced into a relaxed state before the venepuncture procedure should be acquired. Results, however, showed that the children aged one year old and younger appeared to benefit more from the music than the older ones. According to Oehler (as cited in 37), this is because distraction among older children who are cognitively more advanced is different from the distraction experienced by infants. Some of the parents were intrigued when it was explained to them how music listening intervention would help their children during the venepuncture procedure as they were very new to this concept. After listening to the explanation, most of the parents consented and agreed to participate in the research. However, there were also parents who refused to give permission, fearing untoward effects on their children. This impact could be interpreted in many ways, one of which suggests that music listening intervention is new and peculiar to them, thus they were not receptive. Another factor which affected the venepuncture procedure was the patient's familiarity towards the songs (63). Several patients from the music group enjoyed the music once it was played. One patient even danced along to the music. Fifty percent of the parents requested that the patients' favourite music be played. It is possible that the provision of music videos for patients in the music listening intervention sessions may produce an even greater decrease in the pain levels experienced by the patients during a venepuncture procedure because music videos are visually attractive compared to music alone. According to Valkenburg and Vroone (64), young children's attention to television is determined by the auditory, visual, and content features of the programme and by programme difficulty. Their results showed that among infants, salient auditory and visual features (e.g. applause, visual surprises) particularly attract their attention. Results also suggest that history of previous venous cannulation may also affect the patient's response in the procedure. If the patient's blood vessels are fine and difficult to locate, this can result several attempts to administer venepuncture procedures (65). This means that the patient would have to endure more pain, and consequently develop a bad recollection of the procedure. In this research, it was noted that almost half of the patients had had to go through more than one attempt, and it appears that the calming effect of the music is less effective if the patient is already fearful of the procedure. The age of the patients may also be another factor contributing to the effectiveness of music in alleviating pain. The younger the patient the more effective the music is (66). Patients who have yet to develop bad experiences related to the venepuncture procedure were easily calmed by the music as they were unaware of the procedure. It appears that the patients aged over one year old would already know of the venepuncture procedure and thus, be more likely to be aware of the pain. The environment of the procedure room is also another factor affecting the impact of music listening intervention in pain management (67). When patients were

brought into the procedure room, they were already aware of what they were about to experience. Some of the patients started to cry and struggle even before the procedure. This caused an increase in their HRs. Their reaction resulted in difficulty in getting them to put the headphones on. This situation may have been avoidable if music were played to them before they entered the procedure room. Although EMLA cream may be the first choice of the doctors when addressing paediatric pain management, it is not used in all hospitals because it requires time to take effect. It has to be applied 60 minutes prior to the venepuncture procedure (68). Therefore, under emergency circumstances doctors prefer not to apply EMLA cream. Usually, blood sampling is required immediately for rapid results. Moreover, during the waiting period, patients may smear or remove the EMLA cream from the intended site and this is dangerous as they may consume the cream in view of their developmental age. The EMLA cream will also lose its effect once the occlusive dressing falls off, thus if a doctor fails to locate a patient's blood vessel at the first attempt, he/she would have to reapply the EMLA cream and wait for another 60 minutes. This consumes time, energy and is costly. Based on our study, music listening intervention has a positive effect on infants' venepuncture experience. Results of this study reflect that the use of music in pain management alleviates the pain levels experienced by hospitalized infants and this finding is comparable to EMLA which has been regarded as a clinical gold standard.

Study Limitations

This preliminary research is restricted to the use of music in a medical procedure involving only venepuncture. The possibilities for future research focusing on various aspects of music listening intervention and the factors affecting the effectiveness of pain management are vast and challenging. Further research may be able to identify other ways that can improve pain management in paediatrics for selected clinical procedures and rehabilitation purposes.

Conclusion

When dealing with medication on children, it is important to keep in mind the stage of their physical and developmental growth as well as their maturity level and emotional development. There are various paediatric surgery and medical procedures and therapeutic interventions; venepuncture and venous cannulation are some of the common medical procedures performed on infants (69). It is important to realize that no matter how mature the child appears, he/she still needs to be treated differently from adults (70). This aspect of "child friendly" procedure is especially important amongst chronic paediatric patients. Needles and pain are one of their biggest fears and inappropriate pain management during medical procedures may cause long term pernicious effects (71). Furthermore, it is crucial to take into account the children's interest in music based on their culture, background and age (72). Results of this research show

that children prefer simple, interesting and cheerful music, and this is evidenced by the musical interest of Malaysian children in the Malaysian folk songs for children used in this research. Although music listening intervention may still be a very new concept in Malaysia (73), compared to other therapies or medical treatment, it is a natural way of reducing pain as it does not use any form of medication. Music is low in cost, readily available and has no untoward side effects, thus medical practitioners should support, encourage and promote the benefits of music listening intervention. In addition, it is recommended that the medical professionals work together with rehabilitative personnel and music therapists in the development and advancement of music listening intervention in Malaysia since it is a safe method that can be used to assist children in alleviating pain both physically and mentally in a natural way. Pain is a common issue in paediatrics. Inappropriate pain management during medical procedures may cause long-term detrimental effects that may affect the child's development. These are especially true for infants who are admitted to hospitals and have to undergo many medical procedures, medications, physical and mental exhaustion in an unfamiliar environment. Poor management may result in the child having a phobia towards seeking treatment at the hospital (11). Music is useful as an agent which induces relaxation and reduces anxiety and pain. When played, music can also divert the patient's attention from pain (74). This is the basis of music listening intervention in pain management programs.

Ethics

Ethics Committee Approval: This study was approved by the Research Ethics Committee of University Kebangsaan Malaysia (approval number: FF-264-2011)

Informed Consent: Consent was filled out and given by the parents and guardians of the participants.

Peer-review: External and internal peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Z.A.L., W.J.T., Concept: W.F.B., M.N.H., Design: W.F.B., M.N.H., Data Collection or Processing: W.F.B., W.J.T., Analysis or Interpretation: W.F.B., Literature Search: W.F.B., Writing: W.F.B.

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