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A Comparative Study on The Effectiveness of Soft Tissue Work and Transcutaneous Electrical Nerve Stimulation: In Patients with Non-Specific Lower Back Pain

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Abstract:

In Pakistan, one of the primary causes of the reduced functional activities output at work is the lower back pain (LBP) which are in general non-specific. In physiotherapy clinical practice multiple treatments for non-specific lower back pain (NSLBP) are available including soft tissue work (STW), transcutaneous electrical nerve stimulation (TENS), exercise and heat therapy. This study focused to compare the effectiveness of STW and TENS in patients suffering from NSLBP. A RCT with two-groups pre & post-test was conducted at Physiotherapy OPD, JPMC, Karachi. A total of 40 NSLBP patients in the 15 - 45 years of age were included through non-probability purposive sampling method. Baseline screening was performed Through systematic random sampling allocation of subjects were taken place into two groups. A-group received STW with standardized exercise protocol (SEP) while B group received TENS with SEP. Calculated data were entered into SPSS V-16.0. For categorical variables percentages and frequencies were computed. Results are expressed in mean and standard deviation. Each group was compared with the final measure after four weeks of data collection as pre and post by using paired t-test and independent t-test. Pain, tenderness and functional disability were assessed using Numeric pain rating scale (NPRS), Tenderness index (TI) and Oswestry Disability Index (ODI) respectively. Pre & post treatment scores were documented. A maximum rate of drop-out 20% was presumed. This study showed a significant decline at the end of treatment sessions in Pain scale, TI and ODI scores in both groups (A & B), although a more obvious reduction was observed in ODI of group-A in comparison to the group-B. It spotlights that STW along with SEP should be used in patients with NSLBP.

Keywords: Non-specific lower back pain, TENS, Soft Tissue Work

Introduction:

Back ache is one of the most prevalent musculoskeletal complaints and most of the people in their life-time experiencing pain in back (Walker, 2012). Occupational and work-related problems reported as the main cause of low back pain among many peoples (Allan, & Waddell, 1989 and Lis et al., 2006). About 75-84% of low back pain complaints were recorded in the general population and severe morbidity growing health care costs, sick leaves and individual endure as a result of low back pain (LBP) reported around 5-10% (Heliövaara, et al., 1989, Cassidy, 1988 and Dagenais, 2008). The term non-specific low back (NSLBP) pain is elucidated as pain in the back that is not linked with specific pathology. Anatomically the source is unfitted to link with NSLBP in about 80% people (McIntosh, & Hall, 2011). In primary care higher prevalence (85-90%) of NSLBP in patients is observed (Deyo, & Phillips, 1996). The NSLBP patients seen by physical therapists, help in the proper diagnosis (Wand, & O'Connell, 2008). Worldwide, more disability is observed due to back pain rather than any other condition (Rudy, et al., 2007). In developing countries years lived with disability (YLDs) about 59% of global burden in adults age 50-69 due to back pain reported in 1990, but by 2010 this proportion had increased to 67%. Moreover, it is ranked by Global Burden of Disease Study as the highest number of YLDs and sixth in terms of disability-adjusted life years (DALYs) (Brooks, 2006, Hoy, et al., 2014 and Woolf, & Pfleger, 2003). One of the studies reports that in LBP cases, over 90% are NSLBP (Mirza Baig, et al., 2018). In Pakistan, 19.5 % prevalence of LBP has been found and its third leading cause of YLDs (Buchbinder, et al., 2013). On the contrary, in other countries like China, Bangladesh, Iran, the United Kingdom and India prevalence of LBP has been reported as 34.1, 20.1, 14.8, 9.0 and 8.4% respectively (Hoy, et al., 2012). One of the surveys shows that Men and women are equally affected by LBP. Moreover, 50% of adults and 30% of adolescents at least once (Papageorgiou et al., 1995). Likewise, incidence of LBP among many young adults (18-50%) and children also raising (Diepenmaat, 2006). Karahan, et al., (2009) studied the frequency of back pain among hospital staff and found that 65.8% had suffered from back pain and about 61.3% within the previous 12 months. Additionally, the Bradford-Hill causation criteria in relation with systematic reviews from workers studies summarizing the independent contributing factors of low back pain were, improper occupational sitting (Langevin, & Sherman, 2007), postural instabilities, (Roffey, et al., 2010a), standing and walking (Roffey, et al., 2010b), inappropriate patients handling (Roffey, et al., (2010c) pulling or pushing, avoidance of ergonomically positioning during bending, twisting, lifting and carrying (Roffey, et al., 2010d, Wai, 2010a and Wai, 2010b). Among the various treatment options evidences to compare the effectiveness between STW and TENS in NSLBP has not been evaluated. Research from the past advocate that STW decreases pain threshold and improves activities of daily living (ADL) by applying the proper modalities that direct towards the muscle and fascia (Marzouk, 2012). The TENS is a therapeutic non-invasive modality mainly used for pain relief by electrically stimulating peripheral nerves via skin surface electrodes (APTA Anthology, 1993). Milne et al., in (2022) conducted a meta-analysis suggest that TENS does not have clinically important benefit on pain in patients with chronic LBP. Regardless of the evidence of efficacy of TENS in treating chronic LBP, it is a common modality for treating LBP due to higher demand for noninvasive, nonpharmacologic interventions. It is highly prescribed due to low cost and low occurrence of side effects (Williams, 2010). In addition to this, Paley et al., (2021) conducted a comprehensive review in which there were no examples of meta-analyses with 'sufficient data' regarding TENS demonstrating no benefit. Therefore, this study evaluates TENS to be considered or not as a treatment option.

Materials and Methods:

Location, Design and Duration:

This study was conducted at the outpatient department of Jinnah postgraduate medical center, Karachi, Pakistan. This was a self-controlled trial with two-groups in pre and post study design among patients of NSLBP was used. Those patients willing for participation were selected for this study after written informed consent. The total duration of this study was 6 months from March 3, 2019 to August 3,2019.

Inclusion and Exclusion criteria:

The patients included were 15-45 years old with a history of non-specific lower-back pain. Negative modified Schober's test. Negative SLR (Straight leg raise). Localized pain or either radiate up to gluteal folds. Those who were not fitting to the aforementioned criteria were excluded from the study i.e., patients age less than 15 and more than 45, having lower-back pain that radiate to the lower limbs and

having other complications like, cauda equina syndrome, malignancy, a pregnant woman with cardiac pacemaker were excluded from this study.

Sample Size:

The total patients consented for the study were 40 both genders including 30 male 10 female. They were randomly equally divided into two groups (A & B) through non-probability purposive sampling technique having 20 participants. The patients were precisely explained about the study.

Study Protocol:

The group A received soft tissue work (STW) including, Myofascial release (to and fro mobilizations or oscillations, alternate up and down stokes on either side). Three sets of 30 stokes/oscillations were applied at the rate of three oscillation per second. Localized stretching of erector spinae muscles. The generalized stretch of para-spinal muscles of low back simultaneously.

The group B received a program of electrotherapy using Trans electrical nerve stimulator (TENS) for 20 minutes on continuous mode in the prone lying position.

Additionally, both groups received the program of standardized exercise protocol (SEPs) as supportive treatment include: Stretching Ex: through alternate quadruped position, pelvic tilting, bridging, wall squatting with 10 cycles (repetitions).

Outcome Measurements:

Outcome were measured in all participants at the first and last treatment session by using Numeric pain rating scale (NPRS), which is a valid and reliable scale to measure the intensity of pain with higher reliability (Dailey et al., 2017).

The Tenderness Index (TI), which is ranging from 0 - 4 (no pain, patient (pt) winces, pt winces and withdraw, pt not allow the joint to touch) (Basford, 1987 and Childs, 2005).
Oswestry Disability Index (ODI), is a principle lower-back functional outcome tool and is considered as the Gold Standard (Childs, 2005, Jensen et al., 1993, Rodriguez, 2001 Ferraz, 1990 and Hawker, 2011). Each subject received a total of 12 treatments sessions (three sessions per/week) for four consecutive weeks.

The duration of each session given to group A (STW and SEPs) and group B (TENS and SEPs) was 30 minutes.

The Appendix 1 provides further detailed treatment procedure adopted in this study at the end of this manuscript.

Justification for the use of SEP

According to Ganong, (1978), the release of fascial tension is a more efficient biomechanical function. Moreover, muscles and bone both are structures that work dynamically in response to exercises therefore, all the participants were given SEP within joint range. Exercise training program help in restoring the loss of muscle mass due to disuse. Therefore, it is put forwarded that SEPs should be included as a crucial component of treatment and prophylaxis. Through SPSS-version 16.0 data were scrutinized, results are expressed in mean and standard deviation and are displaced graphically as well in tables. Following are some pictures with explanation of treatment procedures and protocols.

Statistical Analysis

The collected data on the various aspects was compiled key in into SPSS (Version 16.0). In this mainly descriptive statistics and paired t-test was performed. The differences in the mean were regarded significant at $P<0.05$ of confidence interval.

Results:

As mentioned earlier, that the total numbers of patients suffering from non-specific lower back pain (NSLBP) were 40. The means were analyzed for numeric pain rating scale"(NPRS) at pre and post-treatment. The "tenderness index"(TI) at pre and post-treatment and "oswestry disability index"(ODI), for pre and post-treatment of both groups (A &B). To compare the mean levels for pre and post treatment of NPRS, TI and ODI between Soft tissue work and TENS. The results are presented in the following section;

The Table 1 summarizes the data on patients various aspect i.e. numbers, percentages, age, gender and the numbers in the treatment groups (STW & TENS).

Table 1: Mean age by gender and groups of STW and TENS

Age (Years)	Numbers	Percent	Mean ± SD
15-20	3	7.5	3.63 ±1.275
21-25	5	12.5	
26-30	9	22.5	
31-35	10	25.0	
36-40	13	32.5	
Gender			
Male	30	75	
Female	10	25	
Group			
STW	20	50	
TENS	20	50	

The mean, standard deviation and comparisons of "Numeric Pain Rating Scores" of soft tissue work and TENS in patients at pre and post level of treatment shows that there was significant (P<0.001) difference in the NPRS score of soft tissue work and TENS after treatment. The pre and post treatment is shown in the Table 2.

Table 2: Comparisons of "Numeric Pain Rating Scores" of soft tissue work and TENS in patients at pre and post level of treatment

	Pre	**Post**	**p-value**
	Mean ± SD	**Mean ± SD**	
STW Patients (n=20)	4.40 **±** 1.635	0.80 **±** 1.152	P<0.001
TENS Patients (n=20)	4.40 **±** 1.314	0.90 **±** 0.968	P<0.001
*p<0.05 was considered significant using Paired Sample t-test			

The data on the mean & standard deviation comparisons of "Tenderness Index" of soft tissue work and TENS in patients shows that there was significant (P<0.05) effect as well at pre and post level of treatment. The results shows that there was significant (P<0.05) difference in the TI score of soft tissue work and TENS after treatment with as shown in the Table 3.

Table 3: Comparisons of "Tenderness Index" of soft tissue work and TENS in patients at pre and post level of treatment.

Tenderness Index (TI)	**Pre**	**Post**	**p-value**
	Mean ± SD	**Mean ± SD**	
STW Patients (n=20)	1.30 ± 0.733	0.20 ± 0.523	P<0.001
TENS Patients (n=20)	1.15 ± 0.589	0.25 ± 0.444	P<0.001
*p<0.05 was considered significant using Paired Sample t-test			

The data on comparisons reveals some interesting effects of the STW modality on the "Oswestry Disability Index" of soft tissue work in patients at pre and post level of treatment. This modality shows that ODI value of soft tissue work greatly improved after treatment being the effect was highly significant (P<0.001) as shown in the Figure 1.

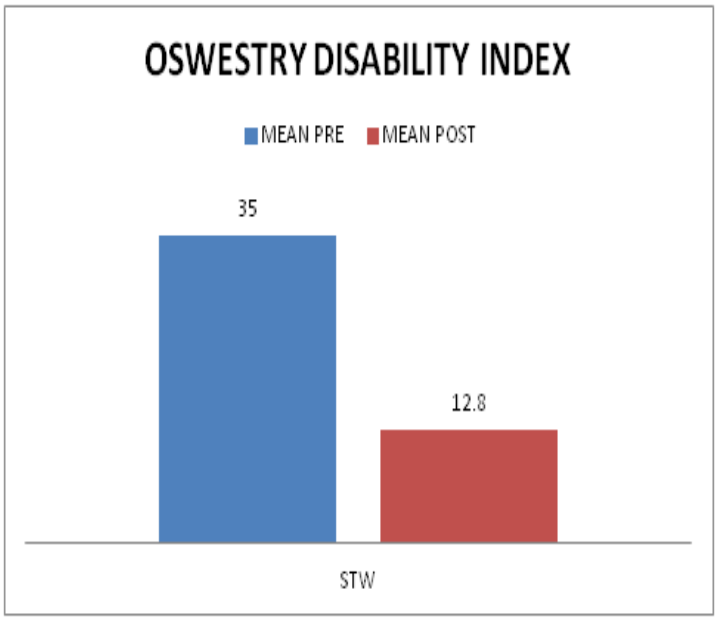

Figure 1: Comparisons of "Oswestry Disability Index" of soft tissue work in patients at pre and post level of treatment

Similarly, the effect TENS modality followed the same trend of effect on ODI in patients at pre and post level of treatment. This modality shows that ODI value greatly improved after treatment. There were significant (P<0.001) differences in the pre and post period as shown in the Figure 2.

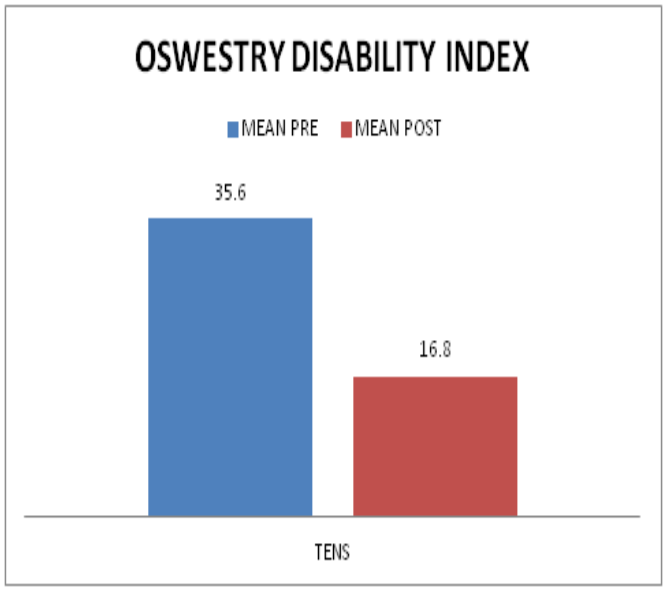

Figure 2: Comparisons of "Oswestry Disability Index"(ODI) with TENS in patients at pre and post level of treatment

Looking at the mean comparisons of NPRS, TI and ODI scores between the two modalities (STW & TENS) all the three parameters' values significantly (P<0.001) equally improved for both groups. Therefore, was no difference between STW and TENS on the NPRS and TI scores of patients (Table 4).

Table 4: Comparisons of TW and TENS on the NPRS, TI and ODI scores

Post-Treatment	STW Mean ± SD	TENS Mean ± SD	p-value
NPRS	0.80 ± 1.151	0.90 ± 0.968	0.721
TI	0.20 ± 0.523	0.25 ± 0.444	0.729
ODI	12.80 ± 7.606	16.80 ± 12.007	0.078
*p<0.05 considered significant using independent sample t-test			

Discussion:

In this study, it was observed that either STW or TENS are effective in treating patients with non-specific lower back pain. In this study, significant dropping was observed in the intensity of pain, tenderness and disability at the end of treatment sessions, but the decline in ODI was more marked in participants receiving STW in comparison with TENS. Remarkable difference in pain intensity and functional disability were observed in data collection after 4 weeks. Additionally, NPRS, TI and ODI were having significant differences in pre and post treatment scores for group A & B were noticed. In comparison with this study, Nesrin Yağcı conducted a study on 122 participants on the effects of soft tissue mobilization on pain, disability level in patients with chronic low-back pain (CLBP). A significant difference between pain intensity and disability level (p<0.005) was observed. Soft tissue techniques in manual therapy applications are described in the text of muscle energy technique, trigger point relaxation, myofascial relaxation and post isometric relaxation technique Nesrin et al., 2020). Ziyan Chen et al in 2021 conducted a meta-analysis which showed that myofascial release (MFR) has a significant effect on reducing back disability in patient with back pain (Ziyan et al., 2021). Core stability has reached a wide spread in recent years, considering that several studies have observed in CLBP. The purpose of core stability exercises is to recreate normal muscle function in order to increase spinal stability, neuromuscular control within the lumbopelvic region, induce inter-segmental stiffness and prevent shear force that causes injury to the lumbar spine (Frizziero, et al., 2021). In a study of Cleland et al., (2006) explained that SEP for managing NSLBP should include pelvic tilting, bridging, wall squats and quadruped alternate arm and legs activities in patients were asked to perform 3 sets of 10 repetitions of each exercise within pain free range that result in clinically meaningful improvement in dysfunctions (Cleland, et al., 2006). Although the current study findings of pain reduction with application of STW, are congruous with the study finding of Antony Leo Aseer. P et al, signified lessen pain in CLBP through STW (Antony Leo Aseer, & Iyer, 2013). Wu zugui et al conducted a systemic review and meta-analysis in 2021. Improvement in pain and physical function were observed for CLBP after receiving myofascial release. Pain (SMD=0.37, 95% CI (-0.67, -0.08), I^2 =46%, P=0.01 and physical function as (SMD=0.43, 95% CI (-0.75, -0.12), I^2 =44%, P=0.007. On the contrary, the present study findings and undoubtedly evidence related to the effectiveness of STW along with exercise were found (Wu, et al., 2021). Jauregui, (2016) conducted a meta-analysis of TENS for CLBP. Demonstrated noticeable pain reduction. The standardized mean difference in pain from pre-post treatment for TENS was 0.844 which is much similar to current study in which mean difference in pain from pre-post treatment for TENS reduced from4.4000 to 0.9000. In addition to this, Thiesis with fellows, conducted a 12 weeks double blinded RCT on electrical stimulation for CLBP. In that they assessing the therapeutic effectiveness of TENS in NSCLP which relatively small as compare to other modalities (Thiese, et al., 2021). This study affirms significant effects of STW than TENS along with SEP in NSLBP. In contrast, both the treatments had prominent effects in generating remarkable improvement in pain intensity and disability. In LBP

wide range of cases are NSLBP, which is a paramount health issue which socially augment the burden of disease. Therapeutic procedures that are economical and safe like STW and TENS combined with exercise (SEP) possibly will show substantial value.

Limitations of the Study

This study was unable to address the long-term benefits of STW and TENS because the duration since the duration of the treatment is short around 4 weeks for the non-specific lower back pain (NSLBP) management.

Conclusion:

In summing up, the current study reveals that physical therapy interventions such as STW and TENS have remarkable results in dropping pain intensity and ameliorating disability in NSLBP patients. It is suggested that STW along with SEP should be used in the patients with NSLBP.

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Appendix 1 Detailed Treatment Procedure and Protocol

Figure 1A. Application of TENS in patient

The patient lay down on treatment table in a prone position comfortably. Then TENS electrodes were accustomed to its mode of treatment was set for duration, intensity according to the patient bearing threshold. The treatment mode continuous, with 20 minutes on alternate days for four weeks

Figure 1B. Soft tissue work treatment-1 (Myofascial release)

The patient lay down on treatment table in a prone position comfortably. Therapist apply analgesic for pain relief and to get skin smoother to apply the soft tissue mobilization. In this figure therapist firmly grasp the patient lower back soft tissues and start giving mobilization in to and fro

Figure 1C. Soft tissue work treatment-2 (Myofascial release)

In this figure therapist firmly grasp the patient lower back soft tissues and start giving mobilization in rotational or alternate upward and downward direction

Figure 1D. Soft tissue work treatment-3 (Friction).

The therapist applying small localized stretching on the sideways of spinal bony prominences

Figure 1E. Soft tissue work treatment-4 (Stretching).

The therapist firmly gives generalized stretch in epsilateral side of lower back

Figure 1F. Soft tissue work treatment-5 (Stretching).

The therapist firmly gives generalized stretch in both sides of lower back

Figure 1G. Standardized Exercise protocols (SEPs) (Quadruped Position-1)

In this figure, the patient was taught to perform alternate arm and leg raise in

Figure 1H. (Quadruped Position-2).

In this figure, the patient was taught to perform pelvic tilting while tighten the muscles of stomach and hip. Straighten the back and press the floor. Bend the

Figure 1I. Pelvic Tilting.

In this figure, the patient was taught to perform trunk stability exercise (bridging). Patient lie down and bend the knee. keep the soles of the feet flat on the

a quadruped position. Firstly, start with no hold but after few sessions as pain threshold decrease start holding with counting of 5 - 10

Figure 1J. Bridging

In this figure, the patient was taught to perform wall squats. The patient stands and back supported with the wall. The patient is guided to bend his/her knee while keeping the back straight and supported with the wall. Whereas, keep the soles of feet in complete contact with the ground. Firstly, start with no hold but after few sessions as pain threshold decrease start holding with counting of 5 -10

legs at the knees and keep soles of the feet touching the floor. Firstly, start with no hold but after few sessions as pain threshold decrease start holding with counting of 5 than 10

Figure 1K. Wall Squatting. 10.

In this figure, the patient was taught to perform wall squats. The patient stands and back supported with the wall. The patient is guided to bend his/her knee while keeping the back straight and supported with the wall. Whereas, keep the soles of feet in complete contact with the ground. Firstly, start with no hold but after few sessions as pain threshold decrease start holding with counting of 5 than 10.

ground. slowly try to lift the body low back and keeping the both hands on the side touching the ground. Firstly, start with no hold but after few sessions as pain threshold decrease start holding with counting of 5 than 10

Optimization of Auditory Brainstem Response (ABR) Test Time Using Level Specific (LS) CE-CHIRP®

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Abstract:

Introduction: The duration of the auditory brainstem response (ABR) test is influenced by the time taken to acquire the ABR signals. The ABR acquisition time has the potential to be reduced by using Level Specific (LS) CE Chirps® stimulus as it possesses better spectral synchrony than the traditional click stimulus. Objective stopping criteria such as those based on the signal-to-noise ratio (SNR) can be employed to evaluate the time efficiency of the LS CE Chirps® stimulus. Using this technique, the test time for both the ABRs elicited by LS CE Chirps® and click stimuli can be compared based on the fastest stimulus to reach an appropriate SNR. To date, only one study has scientifically investigated the use of LS CE Chirps® to reduce the ABR test time. **Aim:** This study aims to compare the number of averages required to reach the specified SNRs between the ABRs elicited from LS CE Chirp® and click stimuli in normal-hearing adults. **Methodology:** A repeated measures research design was used involving 15 adult subjects. ABRs were acquired at four intensity levels (80, 60, 40, and 20 dB nHL) and two stimuli (LS CE Chirps® and click stimuli). The ABR signal averaging was stopped when the multiple points F-ratio (Fmp) value reached 3.1.

Results: The number of averages between the ABR elicited from LS CE Chirps® and click stimuli were statistically compared. The number of averages to reach Fmp at 3.1 was lower in the ABRs elicited using LS CE Chirps® to those produced by click stimuli at all intensity levels. **Conclusion:** This study demonstrated that ABRs arising from LS-CE-Chirps® stimuli could be acquired faster than ABRs elicited from click stimuli. **Implication:** The use of LS-CE-Chirps® stimulus has the potential to reduce the ABR acquisition time in comparison to the traditional click stimulus.

Keywords: LBP, sedentary lifestyle, university students

Introduction:

Auditory brainstem response (ABR) is one of the useful tests to estimate hearing in infants or difficult-to-test populations and to determine any lesions in the central auditory nervous system. Since its first discovery, the ABR has been typically elicited using a brief stimulus, such as a click (Jewett & Williston, 1971). ABR has been widely used in various aspects of audiology applications but the ABRs elicited from click stimulus have a limitation given that the stimulus is only effective to stimulate the basal region of the cochlear that corresponds only to high-frequency hearing (Gorga et al., 1988). To overcome this issue, a few studies have attempted to develop an alternative stimulus in ensuring the neural synchrony responses that could include the entire cochlear region (Dau et al., 2000; Shore & Nuttall, 1985).

Currently, the ABRs from chirp stimuli have become one of the most popular strategies to estimate thresholds due to their benefits in improving neural synchrony over the traditional click stimulus (Kristensen & Elberling, 2012). Chirp stimulus was developed by Dau et al. (2000) as an extension of the original works of Shore and Nuttall (1985) who used tone bursts that exponentially increased the frequencies in compound action potential (CAP) testing. The equation to produce the rising tone-burst stimulus was based on a linear cochlear model which resulted in a larger CAP amplitude. Given the larger CAP amplitudes (wave I and II) reported by Shore and Nuttall (1985), Dau et al. (2000) developed a chirp stimulus using a travelling wave-delay approach in which the onset of the frequency components was arranged based on the tonotopicity at the cochlear. The low frequencies that are tuned towards the apical region require a longer distance to achieve the travelling wave peak than the high-frequency component which is presented first. This is followed by the mid and high-frequency components possessing the shortest distance to travel to the basal region, which is to be presented next. This time-delay approach aims to ensure that all stimuli arrive at the cochlear concurrently, thus ensuring a simultaneous displacement of the basilar membrane. These events will produce optimum neural synchrony from the auditory nerve fibres that hypothetically lead to an increase in the ABR wave amplitudes.

Various types of chirp stimuli have been described in the literature, including intensity-dependent chirp known as level-specific (LS) chirp (Elberling et al., 2010; Elberling & Don, 2008; Kristensen & Elberling, 2012). LS chirp, also known as LS CE Chirps®, was invented by Claus Elberling (CE). This term was used throughout the paper as reported in recent publications (Cargnelutti et al., 2017; Di Scipio & Mastronardi, 2018; Dzulkarnain et al., 2020; Dzulkarnain et al., 2018; Dzulkarnain et al., 2017). The ABRs from LS CE Chirps® reflect an improvement of the traditional chirp stimuli in which the duration of the chirps depends on the intensity levels. In the previous version of-chirp stimulus, the long duration of presenting the chirp stimuli resulted in the reduction of the earlier ABR waves (waves I and III). The ABRs wave V amplitudes were also smaller than the ABRs to click stimuli at suprathreshold levels (Rodrigues et al., 2013; Sabet et al., 2014). In the ABRs to LS CE Chirps® stimuli, the duration of stimulus presentation is adjusted, where it is very brief for high-intensity levels and longer for mid and lower-intensity levels (Elberling et al., 2010; Elberling & Don, 2008; Kristensen & Elberling, 2012). The use of LS CE Chirps® was reported to increase both ABR wave V amplitude at low, moderate, and high-intensity levels (Cargnelutti et al., 2017; Di Scipio & Mastronardi, 2018; Dzulkarnain et al., 2020; Dzulkarnain et al., 2018; Dzulkarnain et al., 2017). Likewise, the ABRs elicited from LS CE Chirps® stimuli were also able to elicit reliable waveforms consisting of waves I and III (Dzulkarnain et al., 2020; Dzulkarnain et al., 2017; Kristensen & Elberling, 2012). Specifically, the ABRs to LS CE Chirps® reportedly generated robust ABR wave I and III amplitudes in comparison with the ABRs generated by a click stimulus (Dzulkarnain et al., 2017) while offering promising findings for neurodiagnosis and neuromonitoring (Cargnelutti et al., 2017; Di Scipio & Mastronardi, 2018).

Despite the potential of LS CE Chirps®, their test-time efficiency in generating ABRs in comparison to the traditional ABRs using click stimulus is not supported by scientific evidence. To date, only one study has scientifically investigated the abilities of the ABRs elicited from LS CE Chirps® in reducing the ABR test time (Dzulkarnain et al., 2020). Auditory brainstem response testing was stopped based on the fixed residual noise level at 40nV as recommended by Don and Elberling (1996). The findings revealed no difference in the test time (calculated based on the number of averages) between the ABRs elicited from LS CE Chirps® and click stimuli at various stimulus repetition rates. Dzulkarnain et al. (2020) proposed that the lack of differences in the ABR test time could be due to the usage of residual noise level as the stopping criterion in recording the ABR. If the residual background noise of the recording is the same during recording, the time to acquire the ABR signals would technically be the same regardless of the stimulus types. One of the best methods to decide on stopping the ABR testing is by continuing the signal averaging process until a specified signal-to-noise ratio (SNR) is achieved (Don & Elberling, 1994; Elberling & Don, 1984). This is based on the fact the ABR test time depends on the number of averages during the signal averaging processes that are proportionate to the signal-to-noise ratio (SNR). F-ratio at single points or multiple points (Fsp or Fmp) is an SNR estimation technique that has been discussed in the literature and used clinically (Don & Elberling, 1994; Elberling & Don, 1984). When using F-ratio, the signal averaging will be continued until the F-ratio reaches a certain specified value indicating that the ABR signals are well above the residual noise level. For instance, F-ratio that is equalled to 3.1 indicates 99% confidence that the ABR is present above the noise floor. The F-ratio of 3.1 is considered a conservative SNR estimation stopping criterion and the ratio can be adjusted to a 95% or 90% confidence level with a less conservative SNR estimation (Elberling & Don, 1987). Given the ability of ABRs to LS CE Chirps® in producing higher wave V amplitude, hypothetically it will be able to reach the appropriate SNR faster than the ABRs to click stimulus. Hence, this study aims to compare the number of averages required to reach the specified SNR based on the Fmp values between the ABRs elicited from LS CE Chirps® and click stimuli in normal-hearing adults.

Materials and Methods:

Participants

A total of 15 adult subjects (nine males and six females), aged between 19 to 25 years, participated in this study using a convenient sampling method. Only participants up to 25-year-old were recruited in line with previous findings reporting that ABR results may change as a function of age after 32 years old (Konrad-Martin, Dille, McMillan, Griest, SMcDermott, Fausti et al., 2012). All participants had normal hearing, with Type A tympanogram and normal acoustic reflex thresholds at 500, 1000, and 2000 Hz at all stimulations bilaterally.

Procedure

The study protocol received unconditional approval from the Research Ethics Committee with reference identification approval (IREC 2018-286). Each participant's ABR was recorded in a sound-treated electrophysiology room at an audiology clinic of IIUM. The ABR tests were conducted with a two-channel Interacoustics Eclipse module using ipsilateral and vertical montages. Participants' skin was cleaned using Nu-Prep skin preparation gel and Ambu Neuroline 720 disposable. Silver chloride electrodes were placed using ipsilateral and vertical electrode configurations. The first channel recorded responses of the right ear ipsilateral configuration while the second channel recorded responses from the vertical configuration. Only the ABRs from the ipsilateral configuration were taken for analysis while the ABRs from the vertical configuration were used to cross-check the location of the wave V. Participants were advised to either sleep or avoid substantial body movements throughout the testing to ensure a consistent background noise during the recording.

The impedance level was examined and maintained below 5 kΩ for each electrode site and not exceeding 2 kΩ for inter-electrode impedances. The ABRs were recorded by presenting 0.1 ms alternating polarity of the click and LS CE Chirps® stimuli to the right ear at the intensity of 80, 60, 40, and 20 dB nHL through Eclipse ER-3A insert phone. Offset contralateral masking noise was presented to the left ear at 40 dB lower than the tested ear stimulus presentation level. The stimulus repetition rate to elicit ABRs for both stimuli was set at 33.3 Hz. The sequence of the tests was randomised using a random generator application software. The ABRs were recorded in 14 milliseconds time window for all the stimuli and intensity combinations. The ABRs were averaged using the Bayesian averaging technique until the recording reached the target Fmp of 3.1. The number of averages for each ABR recording to reach the target Fmp values at 3.1 (99% confidence level) were then noted for each participant. The Fmp formula was calculated from the ratio of the variance in the ABR total signal (noise and ABR) while the variance of the residual noise was computed at multiple points

(Elberling & Don, 1984). The ABRs were filtered using a 100–3000 Hz band-pass filter and a 12-decibel (dB)/octave slope function to remove any unwanted activities unrelated to ABRs. The sensitivity of the amplifier was set at ± 50 µV artefact rejection level of ± 20 µV.

Waveform analysis

All recorded ABRs were verified for their presence or absence using the Fmp stopping criterion by a consensus agreement from two qualified audiologists. The main variable in this study was the number of averages needed for each ABR to reach the target Fmp value at 3.1. Thus, the main variable was determined by observing the signal averaging process for each of the ABR recordings. The Eclipse evoked potential system performed the signal averaging process for every 100 stimulus presentation instead of for every single or smaller sub-averages. As a result, the number of averages needed to achieve Fmp = 3.1 observed in the present study was rounded to the nearest hundredth, indicating the possibility of overestimating the actual number of averages. Apart from the quality estimation from the Fmp values, SNR was also computed from the ratio of ABR wave V amplitude and the residual noise levels. All the ABR waveforms from each intensity level achieved SNR either equal to or higher than 3:1, thus indicating that the Fmp values were consistent with the SNR calculation.

Data Analysis

The statistical analysis was conducted using IBM Statistical Package for Social Science (SPSS) version 20. The data for the number of averages were not normally distributed, thereby violating the assumptions of employing parametric statistics. Additionally, this issue could not be addressed by data transformation. Hence, the Wilcoxon signed-rank test was conducted at a 95% confidence level to identify significant differences in the number of averages between the ABRs to click and LS CE Chirps® stimuli at each intensity level. The effect size for non-normally distributed data was also computed to support the p-value. The effect size (r-value) was computed from the ratio of the z-score divided by the square root of the sample size (Rosenthal et al., 1994). Effect sizes of moderate (r > 0.3) to large (r > 0.5) were considered significant to indicate that differences existed between the two variables.

Results:

Table 1 summarizes the median, interquartile range (IQR) and effect sizes of the number of averages for both ABRs from click and to LS CE Chirps® to reach Fmp of 3.1. Figure 1 illustrates the ABR waveforms from both stimuli obtained from one of the participants. Resultantly, the number of averages to reach Fmp of 3.1 was higher in the ABRs to click than those obtained from LS CE Chirps® stimuli at 60 and 40 dB nHL (z = -2.85 to -3.06, p < 0.05) with a large effect size (r > 0.5). No significant differences were identified for ABRs at 80 and 20 dB nHL (z = -1.794 to -1.792, p > 0.05) but the effect size was moderate (r = 0.46). Both p-values and effect sizes of the analyses demonstrated that the number of averages required to reach the target Fmp of 3.1 was less in the ABRs from LS CE Chirps® compared to those from click stimulus. The differences were relatively small at suprathreshold levels (80 and 60 dBnHL) with only 100 average differences. The differences were relatively higher at lower intensity levels with 400 and 800 number of averages differences at 40 and 20 dBnHL, respectively.

Discussion:

The present study aimed to compare the number of averages required to reach the specified signal-to-noise ratio (using Fmp) between the ABRs elicited from LS CE Chirps® and click stimuli in normal-hearing adults. The finding indicated that the ABRs to LS CE Chirps® recorded a less number of averages to reach the specified Fmp in comparison to those from click stimuli at both high and low-intensity level

Table 1 Median number of averages to reach Fmp= 3.1 for both ABR LS CE Chirp® and click stimuli. Inter-quartile range (IQR), 75th and 25th percentiles (pctl) are included. The statistical analysis is on the two last columns.

Intensity (dBnHL)	Median	IQR	75th pctl	25th pctl	Median	IQR	75th pctl	25th pctl	Z - score	P – value	Effect size (r)
	CLICK ABR				LS CE CHIRPS ® ABR						
80	200	200	400	200	100	100	200	100	-1.79	0.07	0.46
60	300	600	800	200	200	100	200	100	-2.85	0.00	0.75
40	500	1000	1200	200	100	200	300	100	-3.06	0.00	0.79
20	1300	1000	1700	700	500	1600	1800	200	-1.79	0.07	0.46

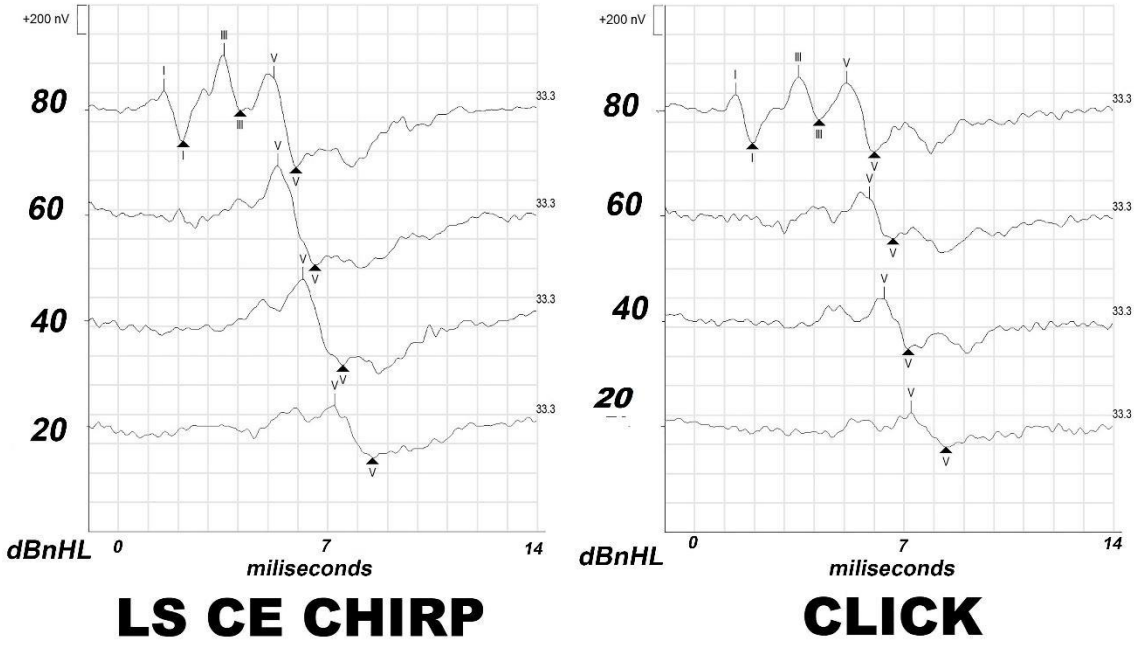

Figure 1: Example of auditory brainstem response (ABR) waveforms at multiple intensity levels for LS CE Chirps® (left panel) and click (right panel) one of the study participants.

The number of average differences was relatively small at suprathreshold levels and higher at lower intensity levels. Based on the stimulus repetition rate used in this study (33.3 Hz), time savings of 3 and 24 seconds per recording could be expected for suprathreshold levels and lower intensity levels, respectively. Despite the modest time savings provided at suprathreshold, the present findings support the use of LS CE Chirps® with Fmp analysis in the audiology clinic for a threshold-seeking approach as this strategy could save time, especially when testing difficult-to-test populations.

The finding also supports the notion by Dzulkarnain et al. (2020) that the use of SNR as an ABR stopping criterion has the potential to obtain time-efficiency of ABRs to LS CE Chirps® as compared to the fixed residual noise level. Specifically, their study involved 13 normal-hearing adults that were tested using both ABRs to click and LS CE Chirps® stimuli at multiple intensities and stimulus repetition rates. By using SNR as the stopping criterion, the test can be stopped as soon as the optimum SNR is reached. The tester is not required to continue extra averaging in obtaining a very minimal residual noise level (e.g., 40 nV) or a fixed number of averages that are being used traditionally (e.g., stop until 4000 averages). Dzulkarnain et al. (2020) used fixed residual noise level as a stopping criterion and no significant differences in the number of averages were noted between ABRs to LS CE Chirps® and click stimuli. This finding might be due to the use of residual noise level, which does not consider the improvement in the SNR provided by the LS CE Chirps®, but rather the amount of residual noise in the ABRs elicited by both stimuli. If the background noise is the same, there is a high possibility that the time to reach the specified residual noise level could be the same between the ABRs elicited from both stimuli.

The present study also reiterates the previous recommendation by Madsen et al. (2018) on either stopping the ABR test based on a fixed SNR or a fixed residual noise level. According to Madsen et al. (2018), both techniques could produce accurate ABR findings. Nevertheless, stopping based on a fixed residual noise level could lead to further improvement in the ABR wave V amplitude accuracy, whereas stopping based on the fixed SNR could result in further improvement in the ABR wave V latency accuracy. Indirectly, this implies that one may choose to use fixed SNR as stopping criteria for the threshold-seeking approach as it only relies on the presence or absence of the ABR rather than its amplitude or latency accuracy that are typically used for neurodiagnostic purposes. The idea to stop based on SNR for the threshold-seeking approach is further substantiated by the time savings provided as demonstrated in this study. The time savings provided further support for the use of LS CE Chirps® in audiology clinics in addition to other benefits reported in the literature, such as the ABRs to LS CE Chirps® producing larger wave I, III, and V

amplitudes compared to those from click or other types of chirp stimuli (Dzulkarnain et al., 2020; Dzulkarnain et al., 2018; Dzulkarnain et al., 2017; Kristensen & Elberling, 2012).

Conclusion:

In summary, the ABRs to LS CE-Chirps® are advantageous to optimise the ABR testing time when Fmp is employed as a stopping criterion to determine the number of averages for signal averaging. In future, the same technique (LS CE-Chirps® and Fmp) can be further investigated in children to measure the time savings provided in a larger sample size. Notably, the number of averages does not solely depend on the type of stimuli but also on the amount of background noise, particularly from the subjects. The variation of noise had the potential to influence findings. The background noises were not systematically controlled across the stimulus and intensity combinations. For instance, the amount of background noise could be inconsistent when testing for different stimuli and intensity combinations. Hence, the number of averages to reach Fmp can be possibly lower or higher depending on the level of background noise. In addition, the number of averages to reach Fmp of 3.1 reported in the present study were rounded to the nearest hundredth. This might explain the slightly higher number of averages, thereby indicating a likelihood of an extra signal averaging process for certain stimuli and intensity combinations. These 100 sub-average step sizes for signal averaging imply a possible deviation of 1 to 3 seconds in the actual test time given the 33.3 Hz stimulus repetition rate used in this study. Conclusions drawn from this study are limited only to the participants, equipment, stimuli, and recording parameters used in the research. Caution must be taken before extrapolating these findings beyond the research participants and all the factors mentioned earlier.

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Knowledge, Attitude and Practice (KAP) Towards Visual Impairment and Visual Rehabilitation Among Teachers in Malaysia

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Abstract:

Introduction: One of the most pressing public health issues in the world is visual impairment. It has more negative effects on children and their family members, especially in terms of their career, education, and overall personal and social-emotional status. If proper vision care and rehabilitation services are not prioritised, there will likely be a considerable annual increase in the number of blind children. **Aim:** This study aimed to assess the knowledge, attitude, and practice (KAP) among school teachers in Malaysia, towards visual impairment and visual rehabilitation. **Methodology:** A total of 384 respondents were recruited in this study, and all respondents completed the validated and reliable self-administered questionnaires on their KAP towards visual impairment and visual rehabilitation. **Results:** Most teachers in Malaysia have good KAP on visual impairment and visual rehabilitation despite only 4.2% of them having had attended formal low vision course or training. There was a significant association between low vision training attendance and KAP among the teachers. **Conclusion:** The study gives an insight into the need for a low vision course to be offered in school teachers curriculum in order to improve students' learning experience and academic performance.

Keywords: LBP, sedentary lifestyle, university students

Introduction:

One of the biggest public health problems in the world is visual impairment which could impact both children and their family members (Zelalem, Abebe, Adamu & Getinet, 2019). If the emphasis and improvements in the healthcare services are not rendered, it is estimated that the number of blind people will skyrocket to 75 million in 2020. Ten years ago, it was estimated that 1.4 million children were blind globally although visual impairment and blindness were reported to be less common among children than adults (Courtright, Hutchinson & Lewallen, 2011). Although it is said to be less common, the complication of blindness and visual impairment is higher among children and will encounter a lifelong effect of visual impairment.

According to Dandona and Dandona (2006), there are three definitions of visual impairment as proposed by the International Statistical Classification of Diseases and Related Health Problems (ICD) based on the guidelines of the World Health Organization (WHO) Study Group in 1972. Firstly, the definitions are based on the best-corrected visual acuity, excluding uncorrected refractive error as the cause of visual impairment. Secondly, ICD is defined by the cut off level that defines blindness (visual acuity less than 3/60 in the better eye)

Thirdly, ICD uses 'low vision' as the term for a visual impairment level that is less than blindness. On the other hand, the term 'low vision' describes a person who suffers visual impairment even with treatment and/or standard refractive correction, has a visual acuity less than 6/18 to light perception or visual field less than 10 degrees from the point of fixation (Dandona & Dandona, 2006; Layton & Lock, 2001). Even with the prescription of corrective lenses, individuals with low vision can still have difficulty in completing their visual tasks that may lead to learning disabilities whereby Silberman and Sowell (1998) reported that learning disabilities and low vision might occur concurrently (Layton & Lock, 2001).

An example of a learning disability that may affect children's performance is the alteration in reading speed. Gompel, Van Bon and Schreuder (2004) reported that children with low vision have slower reading speed and thus have difficulty in the component of syntactic reading comprehension because their brain needs some time for the decoding process to keep the decoding sentences longer in their memory. Despite their condition, most children with severe visual impairment are persistent in reading until they manage to decode and understand words successfully in the same way as normal sighted children. Still, their reading speed may be much slower than normal sighted children. Therefore, it would be best to provide the best education for them since the children have the determination to read.

Additionally, teachers play an important role in assisting children at school as the children spend most of their time at school which is approximately more than 6 hours per day. Generally, there are two types of primary and secondary schools: a school with one session only (in the morning) and a school with two sessions (morning and evening sessions) (Kementerian Pendidikan Malaysia, 2013). A study revealed that a close teacher-student relationships could improve academic performance (Mason, Hajovsky, McCune & Turek, 2017). They also noted that supportive teacher-student relationships are crucial in developing and sustaining a sense of school belonging that facilitates positive academic and behavioural performance. Thus, apart from a good relationship with a student, a teacher should also have a good understanding of visual impairment and the use of low vision devices that a student with low vision may use. In short, the teacher should learn how to handle and take care of students with visual impairment to teach them how to use the assistive devices confidently. Thus, in this study, the knowledge, attitude and practice towards visual impairment and visual rehabilitation of school teachers were assessed using a validated and reliable questionnaire.

Materials and Methods:

A total of three hundred eighty-four respondents were recruited in this study based on Cochran's sample size formula (Ahmad & Halim, 2017). Each respondent completed the self-administered questionnaire validated by Mohd-Zahir and Musa (2015) which consisted of five sections: participant's consent, demographic data, knowledge, attitude, and practice. The questionnaire was distributed as a Google Form to the teachers using common social media platforms (such as Facebook and WhatsApp). The participants self-rated this questionnaire to identify their knowledge, attitudes, and practices toward visual impairment and visual rehabilitation. Initially, 416 completed questionnaires were received, however after taking into consideration the inclusion and exclusion criteria, 384 respondents were analysed. The respondent's inclusion criteria were qualified government school teachers from both primary and secondary schools with more than 1-year of teaching experience and those who could give informed consent. The respondent's exclusion criteria were newly enrolled teachers with less than 1-year of teaching experience, clinical diagnosed with a mental illness and unable to give consent, and unwilling to participate. The questionnaire was scored on a Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree).

The data was analysed using IBM SPSS version 26 (SPSS v26.0; IBM, Armonk, NY, USA). The respondents who fulfilled the criteria were recruited into the study. The data were computed in SPSS to identify teachers' knowledge, attitude, and practice towards visual impairment and visual rehabilitation. For each domain, scores were grouped into 'poor' and 'good' categories. For Knowledge, scores of 0-35 were categorised as poor knowledge and scores of 36-70 as good knowledge. For Attitude, scores of 0-23 were categorised as poor attitude and 24-45 as good attitude. As for practice, scores of 0-25 were categorised as poor practice and 26-50 as good practice.

Chi-Square test and odds ratio were used to determine the association between categorical variables. The association was tested at 95% confidence interval. Statistical significance level was set at $p < 0.05$.

Results:

The majority of respondents were female (75.3%), aged between 44 to 53 years old (37.8%) and had a bachelor degree as their highest level of education. There were 95.8% of respondents who had not undergone any formal low vision training program; as such only 13 teachers had undergone low vision training course [Table 1].

Table 1: Socio-demographic characteristics of participants *(n=384).*

Characteristics		Value	
		N	%
Gender	Male	95	24.7
	Female	289	75.3
Ethnic	Malay	338	88.0
	Indian	9	2.3
	Chinese	14	3.6
	Others	23	6.0
Age Group (years old)	24 – 33	76	19.8
	34 – 43	114	29.7
	44 – 53	145	37.8
	54 – 63	49	12.8
Education level	Diploma	23	6.0
	Bachelor	352	84.6
	Master	36	9.4
School location (States)	Perlis	3	0.8
	Kedah	23	6.0
	Pulau Pinang	3	0.8
	Perak	7	1.8
	Selangor	38	9.9
	Negeri Sembilan	9	2.3
	Melaka	5	1.3
	Johor	75	19.5
	Pahang	41	10.7
	Terengganu	45	11.7
	Kelantan	54	14.1
	Federal Territory Kuala Lumpur	37	9.6
	Federal Territory Putrajaya	5	1.3
	Federal Territory Labuan	3	0.8
	Sabah	27	7.0
	Sarawak	9	2.3

Table 2: Teachers knowledge, attitude and practice towards visual impairment and visual rehabilitation.

	Questions	*Responses (n = 384)*				
		Strongly Disagree	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*
A1	Low vision and blindness are categorised as visual impairment.	13	27	56	205	83
A2	Low vision people have better vision than blind people.	18	19	39	199	109

A3	Blind people have light perception only.	23	45	114	147	55
A4	Cataract can cause blindness.	18	22	71	192	81
A5	Visually impaired students need magnification aids such as handheld magnifier and spectacle magnifier.	25	24	61	200	74
A6	Refractive error is the major cause low vision.	18	41	108	174	43
A7	All low vision students need a Braille.	23	57	111	138	55
A8	Contrast, Bold and Brighter of the reading material is importance for teaching the visually impaired students.	19	27	152	129	57
A9	Visually impaired students need magnification aids to see better.	21	27	84	185	67
A10	Blind students use auditory and tactile modes such as Braille for their learning needs.	18	16	42	178	130
A11	Reading too close is harmful to visually impaired students.	21	60	148	120	35
A12	Blindness can be inherited.	59	95	140	71	19
A13	All visually impaired students need extra attention and care.	17	17	47	191	112
A14	Visually impaired students must be registered as persons with disabilities at the Department of Social Welfare.	18	23	38	149	156
B1	If I were given a chance to teach visually impaired students, I will do it.	26	75	141	109	33
B2	If my student has difficulty to see at distance and near, I should advise them to seek for eye exam.	14	16	25	137	192
B3	I will encourage the visually impaired students to be placed in the same class with normal students.	89	126	70	75	24
B4	I am aware that visually impaired students can learn and manage themselves independently.	12	28	67	195	82
B5	I like to surf website to get the latest information regarding visually impaired students.	13	50	107	171	43
B6	Visually impaired students need support and motivation from the teachers.	13	13	27	133	198
B7	I will try to fulfill the needs of each student depend on their situation.	13	15	40	183	133

B8	I feel more confident to teach the visually impaired students by using visual aids.	12	21	51	181	119
B9	All teachers should have general knowledge about visually impaired students.	18	23	38	149	156
C1	I need experience and extra knowledge in order to teach visually impaired students.	15	8	28	166	167
C2	I need a formal training for teaching visually impaired students.	16	9	35	153	171
C3	I will ensure that visually impaired students will have extra attention than normal students.	16	16	25	193	134
C4	I update myself with the latest technology that might require by visually impaired students.	15	23	96	156	94
C5	I speak and write while teaching.	17	12	24	197	134
C6	I used teaching aids (demonstration and projector) for different kind of students which depend on their abilities.	18	14	51	201	100
C7	I will make sure a good lighting and environment in the class.	18	10	25	177	154
C8	I always update the academic performance each of the students to their parents.	17	16	43	214	94
C9	I able to control my emotion when dealing with visually impaired students.	20	10	98	181	75
C10	I always discuss and refer to other teachers how to improve my teaching style in order to become more effective.	19	11	35	198	121

*A: Knowledge, B: Attitude and C: Practice.

Out of 384 respondents in the study, 92.4% had good knowledge of visual impairment and visual rehabilitation, 92.7% had a good attitude and 93.5% had good practice towards visual impairment and visual rehabilitation [Table 3].

Table 3: Percentages on level of knowledge, attitude and practice towards visual impairment and visual rehabilitation among teachers in Malaysia.

Table 3: Percentages on level of knowledge, attitude and practice towards visual impairment and visual rehabilitation among teachers in Malaysia.

Variables	**N**	**%**
Knowledge:		
Poor	29	7.6
Good	355	92.4
Attitude:		
Poor	28	7.3
Good	356	92.7
Practice:		
Poor	25	6.5
Good	359	93.5
Total	384	100

Table 4: Knowledge, Attitude and Practice scores of each domain.

Indicators	Median (IQR)	95% confidence interval	
		Lower bound	Upper bound
Knowledge	52 (8)	49.61	51.62
Attitude	35 (6)	32.89	34.21
Practice	40 (8)	39.19	40.88
Total	128 (16)	122.00	126.39

The odds of having good knowledge towards visual impairment and visual rehabilitation among teacher who had undergone a low vision training were 3.00 (0.81-11.33) times higher than those of teachers with poor knowledge, after adjusting for level of education, teaching experience and age group, with p>0.01 [Table 5].

The odds ratio of teachers reporting good practice towards visual impairment and visual rehabilitation is 4.8 times more than teachers with low vision training (95% CI: 1.43-15.94, p<0.01). Similarly, the odds of teachers with good knowledge having a positive attitude towards visual impairment and visual rehabilitation were 73.00 (26.55-200.96) times those teachers with poor knowledge with p<0.01 [Table 6].

The association of practice towards visual impairment and visual rehabilitation among teachers in Malaysia was found to be significantly associated with teachers who had low vision training and good knowledge with p<0.01. The odds ratio of teachers having good knowledge, 81.40 (28.20-234.68) is greater than the teachers who have low vision training, 5.50 (1.64-18.55) [Table 7].

Discussion:

The findings revealed that most teachers in Malaysia have good knowledge, attitude, and practice towards low vision children, which is more than 90%. Good knowledge is crucial for teachers in general and special schools to teach and guide students with low vision. Good knowledge can help teachers to adjust the academic requirements so that the low vision children can learn along with their normal sighted friends. A good attitude reflects teachers insight into their students' condition. According to de Verdier & Ek (2014), visually impaired students experience frequent fatigue and take a longer to manage certain tasks. Next, despite having no formal training in low vision course, most teachers reported good practice in managing low vision children. Verdier and Ek (2014) also reported that several teachers in their study had insecurities and concerns about the appropriate way in teaching and evaluating students with visual impairments since improper teaching guide can affect the children's grade. However, in this study, teachers showed good knowledge and attitude, specifically confidence and courage in teaching low vision children.

Table 5: Association of education, teaching experience, age group and low vision training with knowledge towards visual impairment and visual rehabilitation among teachers in Malaysia.

Factors	Knowledge		Adjusted analysis	
	Good n(%)	Poor n(%)	OR (95% CI)	*p*-value
Education				0.157
Diploma	23 (6.0)	0 (0.0)	1.087 (1.055-1.121)	
Bachelor/Master	332 (86.5)	29 (7.6)		
Teaching experience				0.880
<15years	152 (39.6)	12 (3.1)	0.943 (0.437-2.033)	
>15years	203 (52.9)	17 (4.4)		
Age group				0.893
Lower age	176 (45.8)	14 (3.6)	0.949 (0.445-2.025)	
Higher age	179 (46.6)	15 (3.9)		
Low vision training				0.083
Yes	13 (81.3)	3 (18.8)	3.036 (0.813-11.331)	
No	342 (92.9)	26 (7.1)		

Table 6: Association of education, teaching experience, age group and low vision training with attitude towards visual impairment and visual rehabilitation among teachers in Malaysia.

Factors	Attitude		Adjusted analysis	
	Good n(%)	Poor n(%)	OR (95% CI)	p-value
Education				0.165
Diploma	23 (6.0)	0 (0.0)	1.084 (1.052-1.117)	
Bachelor/Master	333 (86.7)	28 (7.3)		
Teaching experience				0.987
<15years	152 (39.6)	12 (3.1)	1.007 (0.463-2.190)	
>15years	204 (53.1)	16 (4.2)		
Age group				0.737
Lower age	177 (46.1)	13 (3.4)	0.876 (0.405-1.895)	
Higher age	179 (46.6)	15 (3.9)		
Low vision training				0.005
Yes	12 (75.0)	4 (25.0)	4.778 (1.432-15.940)	
No	344 (93.5)	24 (6.5)		
Knowledge				<0.001
Good	346 (97.5)	9 (2.5)	73.044 (26.550-200.964)	
Poor	10 (34.5)	19 (65.5)		

Table 7: Association of education, teaching experience, age group and low vision training with practice towards visual impairment and visual rehabilitation among teachers in Malaysia.

Factors	Practice		Adjusted analysis	
	Good n(%)	Poor n(%)	OR (95% CI)	p-value
Education				0.192
Diploma	23 (6.0)	0 (0.0)	1.074 (1.045-1.105)	
Bachelor/Master	336 (87.5)	25 (6.5)		
Teaching experience				0.893
<15years	153 (39.8)	11 (2.9)	1.058 (0.467-2.395)	
>15years	206 (57.4)	14 (3.6)		
Age group				0.571
Lower age	179 (46.6)	11 (2.9)	0.790 (0.349-1.787)	
Higher age	180 (46.9)	14 (3.6)		
Low vision training				0.002
Yes	12 (75.0)	4 (25.0)	5.508 (1.635-18.550)	
No	347 (94.3)	21 (5.7)		
Knowledge				<0.001
Good	348 (98.0)	7 (2.0)	81.351 (28.200-234.681)	
Poor	11 (37.9)	18 (62.1)		

This study also explored how teacher's demographic characteristics affect their knowledge, attitude and practice towards visual impairment and visual rehabilitation. It is showed that there is no significant association between knowledge, attitude and practice with the teacher's level of education ($p>0.01$). This resonates with Hsu & Chen's (2018) study that showed that qualifications did not seem to cause substantial differences.

No significant associations were found between age and knowledge, attitude and practice among teachers. Hsu and Chen (2018) relates this lack of association significant to teachers of any age having similar experiences with technology. In this study, the knowledge of technology is beneficial in assisting students with visual impairment. There are many advantages of technology such as aiding teachers in delivering their teaching materials efficiently and

enabling sharing of information globally. Web-based materials have several strengths: Appeal and motivation, consistent content, current and evidence-based context, convenience and accessibility (Smith & Tyler, 2011). Smith and Tyler (2011) mentioned the benefits of Web-based materials to the person with visual disabilities. For instance, it can convert the text portions of Web-based material to a larger print or translate it to print braille or voice output, and transform both font and background to high contrast colour. Similarly, Abner and Lahm (2002) revealed that there are a few technologies that have assisted the visually impaired people in their daily lives, for example, optical scanners, closed circuit television systems (CCTVs), optical magnifiers, note-taking devices and technologies that produce large print, braille or speech.

Lastly, teachers who have attend low vision training showed a significant association with good knowledge, attitude and practice. Likewise, Rahman et al (2011) stated that positive attitude is evident among teachers who had training. Positive attitudes facilitate teaching effectiveness in the classroom, classroom management, evaluation procedures, assignments, and developing human relationships with students, principal and society in general. The key findings of this study justify that teachers should be given formal training on how to engage low vision students. Only with proper training can teachers be able to fully utilise low vision aids and teach student how to use the low vision aids as a way of visual rehabilitation. The primary aim of visual rehabilitation is to improve the quality of life of children with low vision by developing their visual perception and maximise the use of their existing sight by using appropriate methods to achieve an optimum vision so that the children can receive a proper education and adapt to social contexts (Ganesh et al., 2013). Moreover, early visual rehabilitation is crucial since it can decrease the impairments associated with the visual output and lower the risk of developing serious learning disabilities. The complications of early visual impairment includes profound functional and psychological consequences. Thus, in order to improve the vision of the visually impaired person, it is suggested to provide low vision devices (LVDs) along with lamps and reading stands, writing guides, bold-lined note books and large printed books as non-optical devices of LVDs (Ganesh et al., 2013).

The limitation of this study it is time-consuming as it requires the response from teachers around Malaysia which is quite challenging to engage, especially during this Pandaemic era. As for future research, the participant's demographic data in the questionnaire should ask the teachers whether they were from general or special schools to perform an association between types of school that the teachers taught with knowledge, attitude, and practice towards impairment and visual rehabilitation.

Conclusion:

This study determined that the teachers in Malaysia require formal training regarding low vision since some teachers are still not able to provide effective teaching assistance to visually impaired students despite having a high percentage of good KAP. This may warrant the need to include low vision courses in the teacher's academic syllabus. With a comprehensive education, the teachers can further understand their role whenever they encounter visually impaired children. Thus, this study could benefit the education system in both curriculum and co-curricular, primarily for visually impaired children since they need special education to be independent and successful inside and outside the school.

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Utilization of Geographic Information System (GIS) in Mapping the Distribution of Malnutrition Among Primary School Children in Kuantan, Pahang, Malaysia

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Abstract:

Objectives: This study aims to determine the nutritional status among primary school children in Kuantan, Pahang and to map its distribution using the Geographic Information System (GIS).
Materials and Methods: This community based cross sectional study was conducted in Kuantan, Pahang, Malaysia. A stratified random sampling method was used to select 760 primary school children aged 7 to 11 years old from six subdivisions of Kuantan district. The socio-demographics characteristics and anthropometric measurements were collected from the participants. The participants' home coordinates were obtained from the Google map based on their home address and the Geographical Information System (GIS) software was used to map and visualize the distribution of school children nutritional status.
Results and Findings: Based on the three anthropometric measurements, it was found that 16.1% (n=122) of the school children were overweight, 12% (n=91) were obese, 6.1% (n=46) of them were moderately thin and 1.7% (n=13) were severely thin. There were 9.5 % (n=72) moderately stunted and 0.5% (n=4) severely stunted school children respectively. The result of mapping shows that there was a cluster pattern of obesity in some places in the urban area of Kuantan. Likewise, the distribution of stunting was seen to be overlapping with the overweight/obesity distribution.
Conclusion: A high proportion of overweight and obesity among school children was identified in Kuantan and its distribution was mapped using GIS. The findings advocate the need for further investigation to identify the root cause of poor nutritional status in order to develop informed policy, guidelines and intervention program.

Keywords: School children, malnutrition, geographical information system (GIS), obesity

Introduction:

Malnutrition refers to deficiencies, excessive or imbalance intake of energy and/or other nutrients (World Health Organization, 2017). The term malnutrition could be under nutrition which includes stunting (low height-for-age), wasting (low BMI-for-age) and underweight (low weight-for-age), while contrary to that is over nutrition which includes overweight and obesity. The co-existence of malnutrition (over and under nutrition) affects the developed and developing countries including Malaysia (Haddad, Cameron, & Barnett, 2015). Moreover, it is quite common to find under and over nutrition within the same community or even household. Potential contributory factors that may cause malnutrition include environmental factors, household variables, childcare practices, economic condition, and sanitation (Matariya, Lodhiya, & Mahajan, 2016; Tette, Sifah, & Nartey, 2015).

An interesting finding has been reported by Abarca-Gómez et al. (2017) while analyzing the global trends in nutritional status. The authors reported that while the prevalence of obesity among children and adolescents increased worldwide from 1975 to 2016, the trend in the mean BMI has plateaued in many high-income countries, but with accelerating pattern in the Asian region. Surprisingly, it was also found that more children and adolescents are moderately or severely underweight than obese around the world.

In Malaysia, the National Health and Morbidity Survey (NHMS) revealed that the prevalence of childhood obesity (BMI-for-age >+2SD) is nearly doubled within four years, in which it rises from 6.1% in NHMS 2011 to 11.9% in NHMS 2015. Meanwhile, the prevalence of thinness (BMI-for-age <-2SD) had decreased from 12.2% in NHMS 2011 to 7.8% in NHMS 2015 (Institute for Public Health, 2015; Institute for Public Health Malaysia, 2011). These studies show that the double burden of malnutrition does exists in Malaysia. Double burden of malnutrition is characterized by the coexistence of under nutrition, which includes wasting, stunting and micronutrient deficiencies, alongside with overweight and obesity.

The Geographical Information System (GIS) is a computer-based tool that stores, analyses spatially referenced data and interprets the association between the data and the geographical characteristics. GIS involves the application of both the software and hardware that formulate the system of digital databases and layered maps. The mapping of diseases can be used to pinpoint the areas where outbreaks originate and affectively target high-risk areas for early prevention (Samat et al., 2010). Hence, GIS is currently recognized as a set of strategic and analytic tool in public health setting. It has been widely used for the development of epidemiological maps of tropical diseases including dengue and Zika virus (Duncombe et al., 2012; Rodriguez-Morales et al., 2016). In addition to that, GIS is being used globally to identify and analyze the risk of non-communicable diseases (NCD) and mapping out unhealthy risk factors related to NCD (Turnbull et al., 2020, Boda, 2013, Silva, 2016). The ability of GIS to visualize information on a map has indeed facilitate the stakeholders and policy makers for policy development. The results from GIS are also useful for planning and monitoring intervention programs, as well as assessing clusters of cases to help identify possible etiological factors.

Aligned with the WHO aspiration in adopting a resolution proclaiming a United Nations Decade of Action on Nutrition from 2016 to 2025, the world is now triggered to intensify actions to end hunger and eradicate all forms of malnutrition (WHO, 2017). While data and information regarding childhood malnutrition is developing, the capability to spread the data onto a map is still underexplored.

To investigate the usage of GIS in public health nutrition, the present study aimed to assess the nutritional status among school children in the district of Kuantan and to map the distribution digitally using GIS. The study also explored the capabilities and potential of GIS application in nutrition and health related field.

Materials and Methods:

Study design

This cross-sectional study was conducted in Kuantan, Pahang, Malaysia from July to November 2017. The list of schools together with the total number of students from each school in Kuantan were obtained from the Pejabat Pendidikan Daerah Kuantan. There are six sub-districts (mukim) of Kuantan which include Kuala Kuantan, Penor, Beserah, Ulu Lepar, Sungai Karang and Ulu Kuantan. From these sub-districts, eighteen primary schools were chosen based on a stratified random sampling namely Sekolah Kebangsaan (SK) Mat Kilau, SK Felda Sungai Panching Utara, SK Sungai Soi, SK Tanah Puteh Baru, SK Bukit Kuantan, SK Jaya Gading, SK Kampung Padang, SK Bukit Setongkol, SK Sungai Isap, SK Seri

Mahkota, SK Kuala Penor, SK Beserah, SK Lepar Hilir, SK Sungai Lembing, SK Sungai Baging, SK Balok Baru, SK Sungai Ular and SK Cherating.

The number of schools from Kuala Kuantan were more compared to other sub-districts as the proportion of students from the sub-district was the highest. Permission to conduct the study was obtained from the Ministry of Education and Pahang State Department of Education. The ethical approval was also granted from the International Islamic University Malaysia Research Ethics Committee (IREC).

Sampling method

Single mean formula was used to calculate the sample size based on the prevalence of obese school children at 16.4% (Khor et al., 2011). For all 6 sub-districts in Kuantan, a total of 760 participants were needed. Once access to schools were approved by the school principals, the name list of students were obtained. A systematic random sampling was done on the list to select students from the selected school. This study excluded students from Standard 6, boarding schools and schools other than *'Sekolah Kebangsaan'*.

Data collection

This study utilized two types of data, the non-spatial data for nutrition survey and the spatial data for the mapping part.

i. Nutrition survey

The instrument used for the nutrition survey comprises of two components with Part A consisted of the respondent's personal, social and demographic information; and Part B consisted of anthropometric measurements on body weight and height of the respondents.

The anthropometric measurements were taken using standard techniques. The height was measured using a portable height stadiometer (SECA body meter 208). The respondents were barefooted and wore minimal clothing. The respondents stood with their heels together, arm to the side, legs straightened, shoulder relaxed and head in the Frankfort horizontal plane. The heels, buttocks, scapula and the back of the head were against the vertical surface of the stadiometer. Any hair ornamentation was removed. The measurement taken was read twice to the nearest 0.1 cm.

The body weight was measured with a portable weighing scale Rossmax WF260 Body Fat Monitor. The respondents were requested to stood still in the middle of the scale's platform without touching anything with their body weight equally distributed on both feet. The reading was taken twice to the nearest 0.1 kg.

ii. Spatial data

The spatial data in digital form that was used in this study includes demarcations (boundaries), residential; transportation and community facilities obtained from the Malaysian Center for Geospatial Data Infrastructure (MacGDI). Google Maps was used to search and locate the home address. Google Earth and Google Map are gaining reputation as an innovative tool for community mapping (Lefer et al., 2008).

Data analysis

i. Statistical analysis

Data for the anthropometric measurement were derived using the AnthroPlus® software to classify the various categories of nutritional status namely the height-for-age (HAZ) and BMI-for-age (BAZ) z-score in order to identify the prevalence of stunting, overweight and obesity respectively, based on the WHO Child Growth standard. IBM Statistical Package for the Social Science (SPSS) version 22.0 was used for descriptive analysis and Chi-square test.

ii. Spatial analysis

Spatial data were analyzed using the ArcGIS 10.2 software. All spatial data obtained from MacGDI were specifically selected according to the objective of the study. The coordinates of households' addresses were identified using Google Maps, then the coordinates were added into the GIS database to enable mapping of the component of the study. Once geocoded, nutritional data was linked to the GIS Software to create the desired maps. Point density analysis was run to tabulate and visualize the malnutrition cases on the map.

To protect the confidentiality and anonymity of participants, the addresses were only represented on the map using dots and shapes allowing observation of the item distribution in the study area, but no cadaster layer or individualized information were used.

Results:

Nutritional status of schoolchildren

Seven hundred and sixty school children aged 7, 8, 9, 10 and 11 years old were assessed. These included 356 males (46.8%) and 404 (53.2%) females and most of them were Malay (99.2%, n=754). Majority of the children (88.9%, n= 676) were staying with their parents.

The nutritional status of the school children is presented in Table 1. The present study found a high proportion of overweight and obesity among the primary school children in Kuantan. Based on the anthropometric measurements, findings showed that 16.1% (n=122) of primary school children were overweight, 12% (n=91) were obese, 6.1% (n=46) of the respondents were moderately thin and 1.7% (n=13) were classified as severely thin while others were normal (64.2%, n=488). For the height-for-age, 90% (n=684) of the respondents fell into normal category, 9.5% (n=72) were moderately stunted and only 0.5% (n=4) were found to be severely stunted.

Table 1: Nutritional status of school children in Kuantan

Variables	No. of Respondents (%)	
BMI-for-age		
	Normal	488 (64.2)
	Overweight	122 (16.1)
	Obese	91 (12.0)
	Moderately thin	46 (6.1)
	Severely thin	13 (1.7)
Height-for-age		
	Normal	684 (90)
	Moderately stunted	72 (9.5)
	Severely stunted	4 (0.5)

Development of Map using GIS

The development of map using GIS was done in phase two of the study. The digital map of Kuantan was produced through manipulation, standardization, updating, storing and integration using GIS.

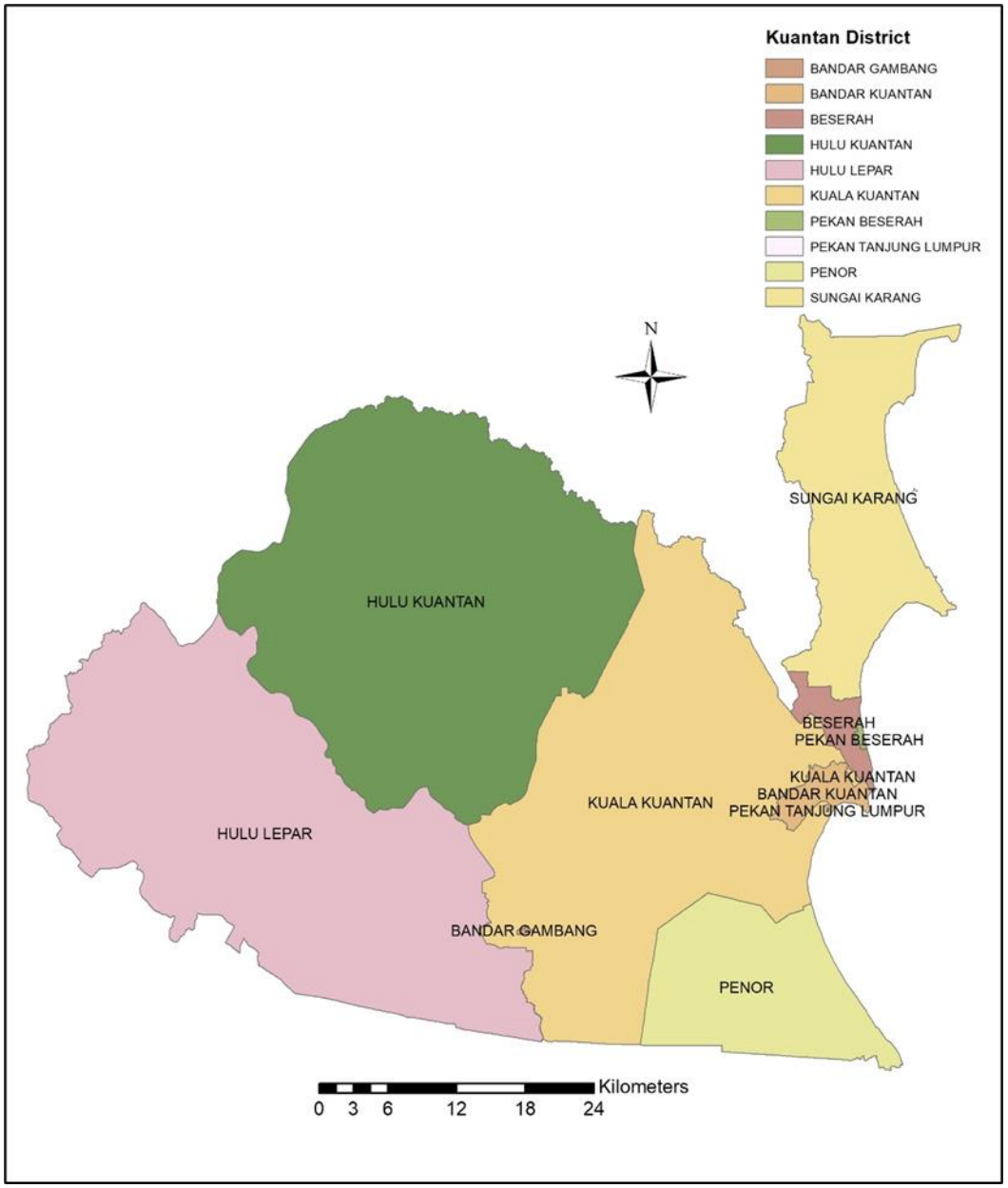

Figure 1: Digital map of Kuantan and its representative areas

The following figures visually presented the distribution of school children according to the BMI-for-age status and height-for-age status. The distribution of school children who were overweight and obese were clustered in the urban region of Kuantan which is Kuala Kuantan while the distribution of underweight was dispersed in Kuala Kuantan and Beserah area (Figure 2). Figure 3 illustrated the distribution of school children based on their height for age status. Both rural and urban area consisted of normal and stunted children. Meanwhile, Figure 4 demonstrated the distribution of obese/overweight and the stunted cases. The distribution of stunting was noted to be overlapping with the distribution of overweight/obesity.

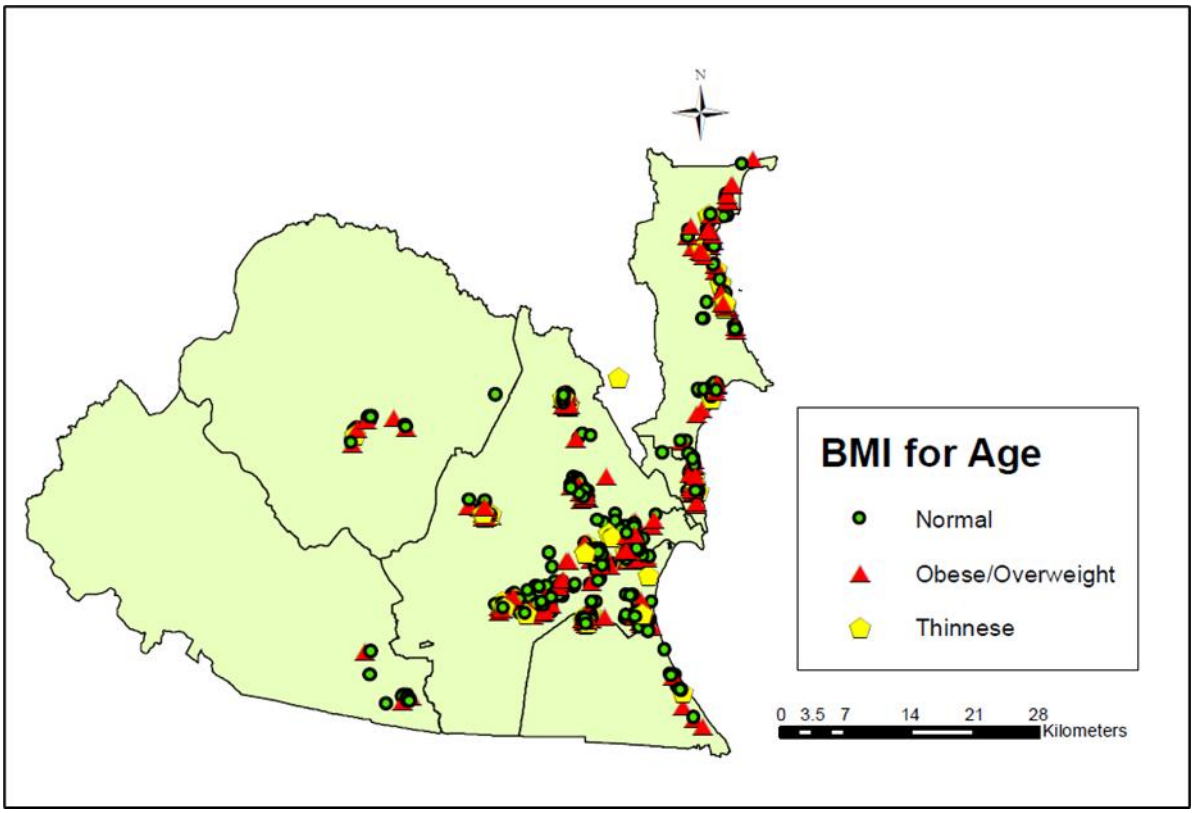

Figure 2: Distribution of school children according to BMI status.

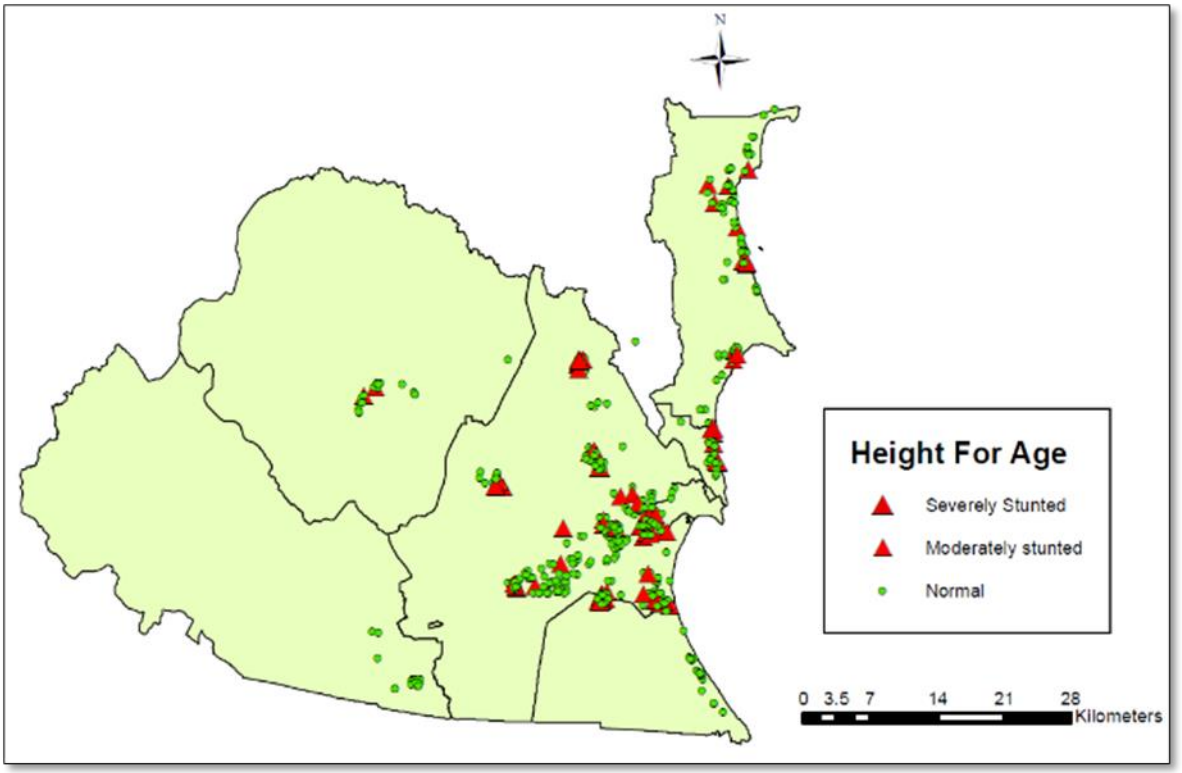

Figure 3: Distribution of schoolchildren according to height-for-age.

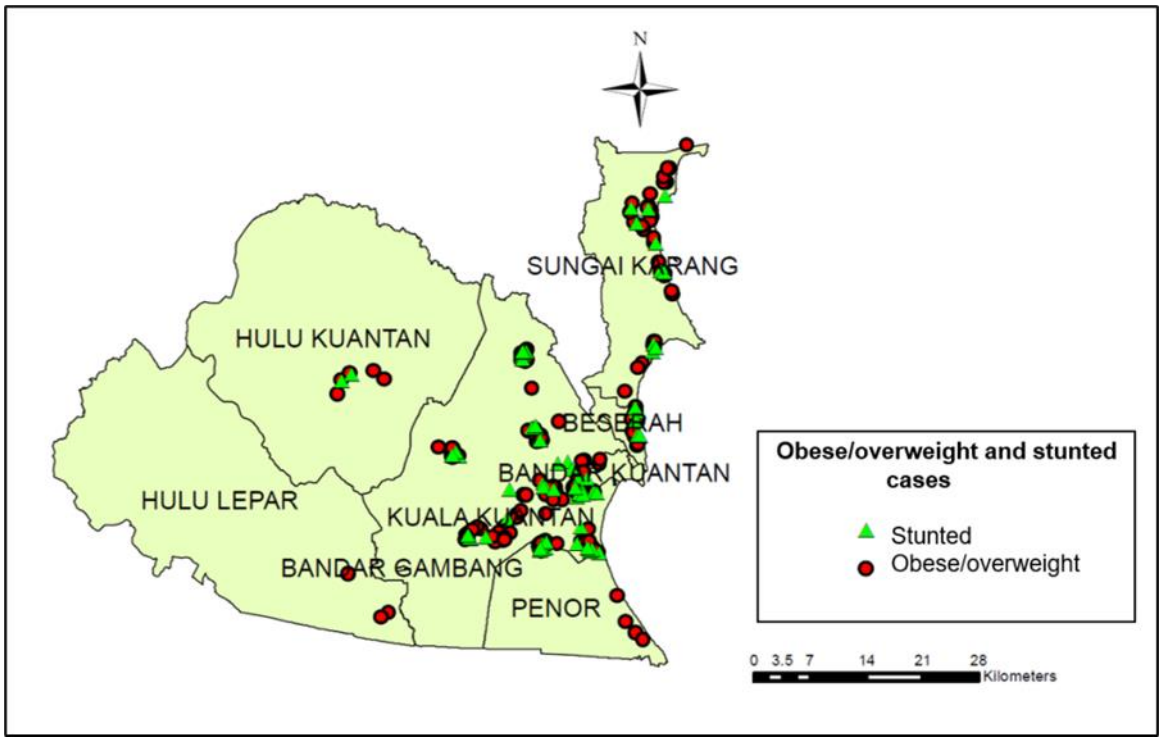

Figure 4: Distribution of stunted and obese/overweight cases.

Discussion:

Nutritional status of school children

From this study, the coexistence of under and over-nutrition has been postulated in a result acquired from the school children nutritional status data. The prevalence of obesity and overweight school children aged 7 to 11 years was 12.0% (n=91) and 16.1% (n=122) respectively. A significant association was found for gender (p=0.004, χ^2=15.426), where the proportion of obesity was found to be higher in male students (62.0%, n=75) compared to female (38.0%, n=46) whereas the proportion of overweight was higher in female (59.3%, n=54) in contrast to male students (37%, n=40.7).

The obesity prevalence among the school children in this present study is comparable to the national prevalence of obesity (11.9%) reported by the National and Health Morbidity Survey 2015.The inclining trend of obesity has been observed in Malaysia. The NHMS 2006, NHMS 2011 and NHMS 2015 have reported that the prevalence of obesity had escalated from 5.4%, 6.1% to 11.9% respectively (Institute for Public Health, 2015).

This study also found contrast findings with the NHMS 2015 which reported that the prevalence of obesity was slightly higher in females than males inferencing that body composition varies based on gender. Significant evidence from previous study demonstrated that males and females are different in terms of the body fat patterns, fat level that impact health, resisting energy expenditure, energy consumption and ability to exercise (Sweeting, 2008). Another study also highlighted similar findings that males and females certainly have different pattern of weight gain, body composition, hormone biology and particularly in certain environmental, genetic, ethnic and social factors (Wisniewski & Chernausek, 2009).

Distribution of school children according to the BMI status

The finding showed that obese cases were distributed throughout Kuantan. Point density analysis was undertaken to evaluate the density of obesity and overweight cases and the cases were found to be densely distributed in Kuala Kuantan. The higher number of obese school children in Kuala Kuantan may be due to the fact that Kuala Kuantan is the center of Kuantan, where most people choose to reside and work. Kuala Kuantan consists of two sub boundaries which are Kuantan City and Bandar Indera Mahkota. Both Kuantan City and Bandar Indera Mahkota are considered as urban area (Rancangan Tempatan Daerah Kuantan, 2015). The high prevalence of overweight and obesity in urban area was parallel to the findings in NHMS 2015.

Kuantan City is the center of services, business, recreation, commercial and trading whereas Bandar Indera Mahkota is known as the administration center with many government office, schools, clinics and other facilities. Moreover, Majlis Bandaraya Kuantan (MBK) is planning to build Bandar Indera Mahkota 2 as the transport hub and technology city in the near future (Rancangan Tempatan Daerah Kuantan, 2015). The rapid development has transformed and modernized Kuala Kuantan. Recently, the introduction of the Malaysia's First Special Economic Zone (SEZ) in Kuantan is designed to boost the regional economy, tourist and growth (Rancangan Tempatan Daerah Kuantan, 2015). This means Kuantan will have a great deal of development projects.

Urbanization leads to inadequate social environment and buildings that are not suitable for walking around causing children and adolescent to be physically inactive (Ahmed, Shah, & Kshirsagar, 2016; Pirgon & Aslan, 2015). As for now, Kuala Kuantan is rapidly developing and occupied with shopping malls and restaurants including fast food outlets, supermarkets and convenience stores that may contribute to obesity (Mehboob, Safdar & Zaheer, 2016, Malik, Willet & Hu, 2013). Bridevaux-Peytremann et al. (2006) claimed that people living in urban area are more prone to be overweight than those living in rural area. Diminished access to sporting activities and other means of physical exercise due to improper urban planning reduces suitable pathways for walking and play areas for children. This undoubtedly will force families living in inner city areas to have their children staying indoors and practice sedentary lifestyle such as playing on a computer or watching television (Pirgon & Aslan, 2015). Physical inactivity if not prevented early, will become a habit that eventually may lead to obesity.

Distribution of school children according to height-for-age

The distribution of stunting was seen to be overlapping with the overweight/obesity distribution. The reason why these school children might be overweight or obese is not because of the excess in body weight, but probably the condition is confounded by low height for age. Zalilah et al. (2016) reported that higher dietary energy intake was associated with stunting instead of overweight among urban children. Interestingly, the distribution of stunting is more prominent in the urban area but still few cases were seen to be dispersed in rural area. The United Nation Children's fund (UNICEF) stated that although children living in poor urban area has close proximity to amenities, they are found to have less access to nutritious foods, live in unsafe areas and have less opportunity to play and be active (UNICEF, 2018).

Conclusion:

The creation of map to visualize the distribution of children nutritional status has the potential to clearly demonstrate the pattern and areas of malnutrition. This information may be useful for the Ministry of Health together with the Ministry of Education to monitor malnutrition cases among children in Malaysia. Based on these findings, further research is needed to investigate the complex interaction between the children's nutritional status and geographical factors. Intervention programs such as nutrition education and promotion should be designed to streamline with the targeted areas.

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Assessments and Outcome Measures for The Management of Patients with Dysarthria: A Scoping Review

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Abstract:

This is a scoping review for the specific purpose to ascertain the availability of assessment and patient-reported outcome measurements (PROM) tools for dysarthria. Five databases were searched extensively using keywords related to dysarthria assessment and PROM i.e., PubMed, CINAHL, ProQuest, Springer, and Scopus. The articles were screened at the title, abstract and full text levels. The data was descriptively analysed to create a map of the available evidences, based on the eligibility criteria e.g., paper must be in English published within 1980-2018 involving patients. Seventy-three studies met the inclusion criteria 35.62% (n=26) utilised formal assessments for dysarthria, whereas 64.38% (n=47) used informal assessments. In terms of outcome measurement tools, 46.57 % (n=34) of the studies used these assessment tools whereas 53.43% (n=39) of the studies did not use any of these tools. The Assessment of the Intelligibility of Dysarthric Speech (ASSIDS) and Frenchay Dysarthria Assessment (FDA) were the most frequently used assessment tools. The FDA-2 has been validated for participants with dysarthria in the European-Portuguese version. The Dysarthria Impact Profile (DIP) and the Voice Handicap Index (VHI) were the most frequently used PROMs. It was discovered that the DIP is validated and not the VHI for dysarthria patients. Additionally, the DIP has been validated for dysarthria in French and European Portuguese. The number of validated assessment and PROM tools are limited, however, those that are accessible have been demonstrated to have high validity and might be adapted for use in different languages.

Keywords: Scoping review, dysarthria, Patient Reported Outcome Measure (PROM), assessment, dysarthria

Introduction:

Dysarthria refers to a group of motor speech disorders that result from a disturbance in neuromuscular control affecting respiration, phonation, resonance, articulation, and prosody(Pam Enderby, 2013). Although the "gold standard" for clinical dysarthria assessment is the auditory perceptual assessment (Bunton et al., 2007), assessments for dysarthria may vary from having a brief conversation with the patient, perceptual assessments, to carrying out complete clinical assessment (Wannberg et al., 2015). To establish a differential diagnosis, the assessments may cover all aspects of speech production, the severity of dysarthria, management, and assessment of functional change in dysarthria (Bunton et al., 2007; Wannberg et al., 2015). The assessment and management of dysarthria are usually conducted by a Speech-Language Pathologist (SLP). It has been found that formal and informal assessments have been used among practising SLPs in assessing patients with dysarthria. Most SLPs in the United Kingdom use the Frenchay Dysarthria Assessment (FDA; Enderby, 1980) and Robertson Dysarthria Profile for formal assessment (Collis & Bloch, 2012). While in Saudi Arabia, most SLPs used informal assessments and non-standardised translated versions of the FDA (Khoja, 2019). Meanwhile, in a survey in Australia among SLPs in managing non-progressive dysarthria, most of the respondents assess at least one speech subsystem when working with patients with non-progressive dysarthria (Rumbach et al., 2019). The studies from these three countries showed different practices in different settings and countries.

Apart from assessment, the approaches used to monitor progress have changed, i.e., from the treatment plan to various outcome scales. These include checklists for tracking therapy progress, effectiveness, and outcomes (Walton, 2012). Patient-reported outcomes (PROM) tools potentially benefit patients since they may assess patients' perceptions of their condition and therapy (Arpinelli & Bamfi, 2006). In the future, PROMs will play a greater role in clinical treatment of patients than other clinical and physiological outcomes tools (Deshpande et al., 2011; Øvretveit et al., 2017), as PROMs assess patients' views of their overall health or health related to a specific condition (Kingsley & Patel, 2017). There are three reasons reported in the literature for the implementation of PROMs: i) Patients are the best judges of the impact of their treatment on their pain, function, symptoms, and quality of life; ii) PROMs are a valuable support for patient-centred care; iii) Systematic collection of PRO data informs efforts to improve quality and safety. Thus, PROMs will become the key to providing an excellent service to patient-centred care (Kingsley & Patel, 2017).

A survey by American Speech and Hearing Association (ASHA) found that SLPs in rehabilitation hospitals used outcome measures most frequently compared to other settings such as general medical hospitals, outpatient clinics, or paediatric hospitals (American Speech-Language Hearing, 2013), and that might be because of the limitation of the validated therapy outcome tools available for allied health professionals (Perry et al., 2004).

The following are the research questions for this study:

1. What are the assessments and patient-reported outcome measure (PROM) tools for patients with dysarthria available in the literature?
2. Were the adapted assessments and PROM tools validated for patients with dysarthria?

Materials and Methods:

Overview

Assessment and outcome measurement tools used in dysarthria management were explored by using a scoping review guided by Arksey and O'Malley (2005) and Peters et al., (2015). The protocol for scoping review was created to guide the process.

Search strategy and keywords

An extensive search of the published studies was conducted using two steps. First, a preliminary search using Google search engine and keywords "dysarthria", "dysarthria assessment", "outcome measure", and "cross-cultural validity and reliability testing" was conducted. The initial search resulted in few papers related to dysarthria. Second, the keywords contained in the title and abstract of the papers were analysed. The finalized keywords for search strategy are ("dysarthria" OR "non-progressive dysarthria" OR "acquired dysarthria") AND ("scale" OR "assessment" OR "severity") AND ("self-assessment" OR "outcome" OR "psychosocial" OR "patient-reported outcomes" OR "quality of life") AND ("reliability" OR "validity" OR "cross-cultural comparison"). A second search using all the identified keywords has been done through five databases (i.e., PubMed, CINAHL, ProQuest, Springer, and Scopus) via the IIUM library portal and gathered a list of titles together with abstracts.

Inclusion criteria

The eligible criteria for the sources (i.e., participants, concept, and context of the study) were decided based on the guidelines by Peters et al. (2015). First, the types of participants in the studies were either related to the following conditions: a) adults who were diagnosed with dysarthria; or, (b) participants with a medical condition that was related to motor speech disorder; or, (c) the participants of the studies had any disorder related to a motor speech disorder. Second, the concept of the studies, i.e., the studies must include the usage of any assessment or outcome measures for dysarthria. Finally, the context of the studies was the studies were published in English; dated between the year 1980 to February 2018, and involved only real patients. All studies included were primary research studies only. Articles were excluded if they were published in other languages than English. Any abstract paper, review paper, short report, or conference report were excluded.

Data extraction

Two steps of screening of previously published papers were involved in the study selection phase: "title screening" and "abstract screening". Both steps were conducted by two reviewers independently. The screenings were conducted based on the eligibility criteria listed above. Any discrepancies in the study selection decisions were discussed via phone and email until consensus was reached among the reviewers. After the abstract screening, the full texts of the studies were obtained via the IIUM Library portal or from the authors of the studies if the full texts were unavailable online.

Data charting

The data extracted from the full texts were recorded onto an excel document. The data included were (a) the name of the author(s); (b) year of publication; (c) study location; (d) intervention type, comparator (if any) and duration of the intervention; (e) study populations (carer group; care recipient group) and the number of participants; (f) methodology; (g) assessment tool; (h) outcome measures; (i) intervention (if available); (j) translation and adaptation process (if available); and (h) any validation processes involved in the studies.

Results:

Eligible studies

The total number of titles generated from the databases was 701 titles. These titles were first screened by two researchers independently. Among these 486 titles were excluded due to the eligibility criteria and 212 titles were included in the abstract screening. From the abstract screening, 131 abstracts were further excluded. Therefore, the total articles left for full-text retrieval were n=81. From the full-text to be searched eight more articles were found to be not eligible. Among this non-availability of full-text (n=1), a review paper and not primary research study (n=1), and the studies were not for dysarthria patients (n=6), therefore leaving only n=73 papers for further analyses. The Figure 1 summarises the flow of the identification of the eligible studies.

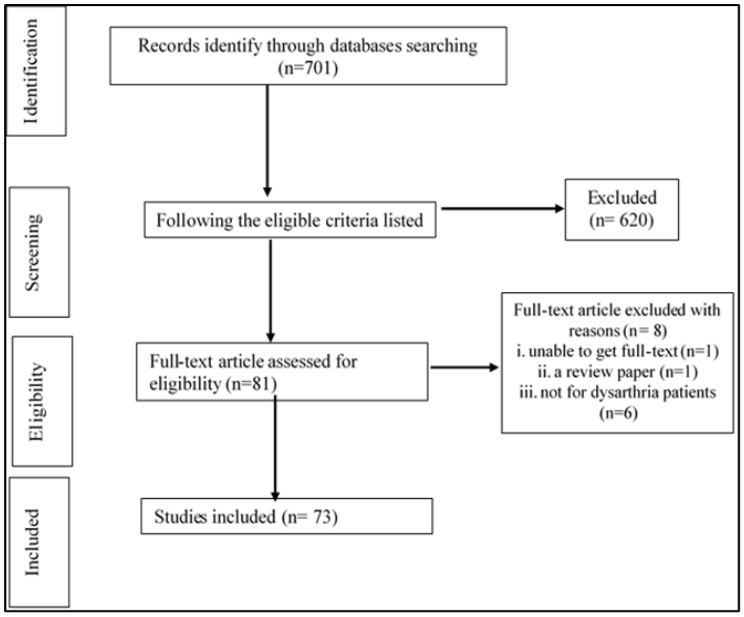

Figure 1 Flow chart for the identification of the eligible studies

Articles features

The 73 unique articles from five databases, published from 1998-2018. From these studies 35.62% (N=26) used formal assessment for dysarthria, and 64.38% (N=47) used informal assessment. For outcome measurement tools, only 46.57% (n=34) studies used outcome measurement tools in their study, and 53.43% (n=39) studies did not include any outcome measurement tools. From the thirty-four studies with outcome measurement tools, 21 studies used responses from patient-reported outcome measure (PROM), and the rest 13 studies used other types of outcome measurement tools.

The first authors of included articles represented 19 different countries. The highest numbers were the United State of America (28.77%; [21/73]), Australia (17.81%; [13/73]), and the United Kingdom (15.07% [11/73]). The lower numbers were France (n=5), The Netherlands (n=3), Belgium (n=3), Italy (n=2), Czech Republic (n=2), Portugal (n=2), Sweden (n=2). The rest were one article from the following countries, i.e., Austria, Canada, Croatia, Cuba, Germany, Ireland, Japan, Republic of Korea, and Poland.

Availability of the standardised assessment tools for dysarthria

As aforementioned, 26 studies (35.6%) used formal assessment for dysarthria in their study, either one or two assessment tools per study. The findings showed the most frequently used standard assessment tool was Assessment of the Intelligibility of Dysarthric Speech (ASSIDS; Yorkston et al., 1984). The Figure 2 showed the number of studies that used the formal assessment tools for dysarthria in their studies. The Assessment of the Intelligibility of Dysarthric Speech (ASSIDS;Yorkston et al., 1984) was used in seven studies on its own and was pair with the Dysarthria Rating Scales (DRS; Yorkston, Beukelman, Strand, & Bell, 1999) and the Sentence Intelligibility Test (SIT; Yorkston, Beukelman, & Tice, 2011) in one study. The Frenchay Dysarthria Assessment (FDA) (Enderby, 1980) was used in five studies alone and in four research in conjunction with other assessment methods. Other assessments tools were Radboud Oral Motor Inventory for Parkinson's Disease (ROMP) (Kalf et al., 2011), Robertson Dysarthria Profile (RDP), Radboud Dysarthria Assessment (RDA) (Knuijt et al., 2018), Dysarthria Rating Scale (DRS), Adapted Dysarthria Score (ADS) (Eigentler et al., 2012) and European Portuguese version of Frenchay Dysarthria Assessment (EP-FDA) (Cardoso et al., 2017).

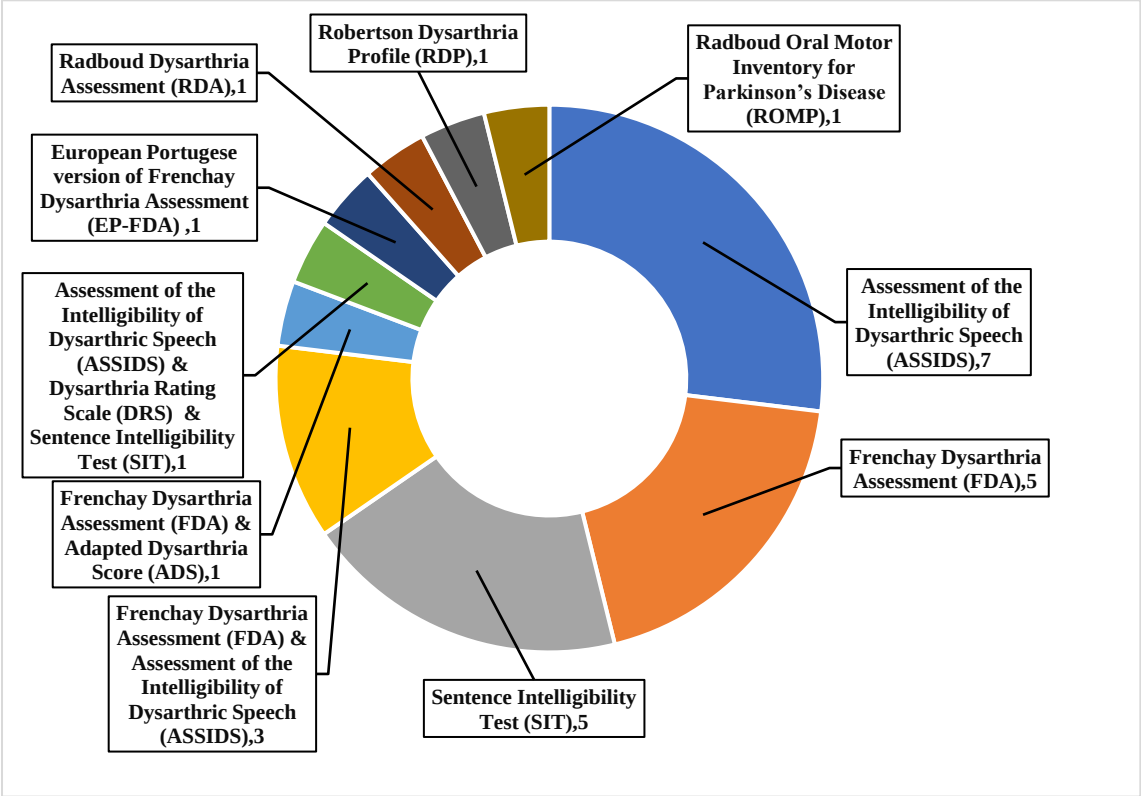

Figure 2 Formal assessment tools recurrence in previous studies with dysarthria participants.

Adapted dysarthria assessment in other languages

From the analysis, one assessment tool was adapted from English to another language and validated for participants with dysarthria. The tool is the FDA and was adapted into the European Portuguese version of the Frenchay Dysarthria Assessment (EP-FDA) (Cardoso et al., 2017). The EP-FDAhas undergone a standardisation process and was validated to be used with dysarthria patients. Based on the studies, EP-FDA was adapted from Frenchay Dysarthria Assessment 2nd edition (FDA-2) and was proven to have good validity to be administered for patients with dysarthria. The EP-FDA has been reported as has high reliability of the total score (0.94), an excellent inter-rater agreement for the total score (0.96), and moderate to large construct validity for 81 % of its items (Cardoso et al., 2017).

Availability of standardised patient-reported outcome measure (PROM) for dysarthria

From the total of 73 studies, 39 studies did not use any outcome measurement tools. Only 34 studies used outcome measurement tools which consist of formal (n=29) and informal (n=5) measurement tools. From the 29 studies that used formal outcome measurement tools, only 25 studies used patient-reported outcome measurement tools that were validated for communication, voice, and dysarthria.

About 12 patient-reported outcome measure (PROM) tools were identified among the 25 studies. The 3 showed the most frequent tools used as PROMs from the previous studies. The Dysarthria Impact Profile (DIP; Walshe et al.,2009) was the most frequent outcome measurement tool used by researchers, i.e.(n=6/25), followed by the Voice Handicap Index (VHI; Jacobson et al., 1997) in English version (n=5/25), the Communication Outcomes After Stroke (COAST; Long et al., 2008) scale (n=4/25), followed by the Communication Effectiveness Survey (CES; Donovan et, al., 2008) (n=2/25). The rest of the PROMs only occurred once each among the studies.

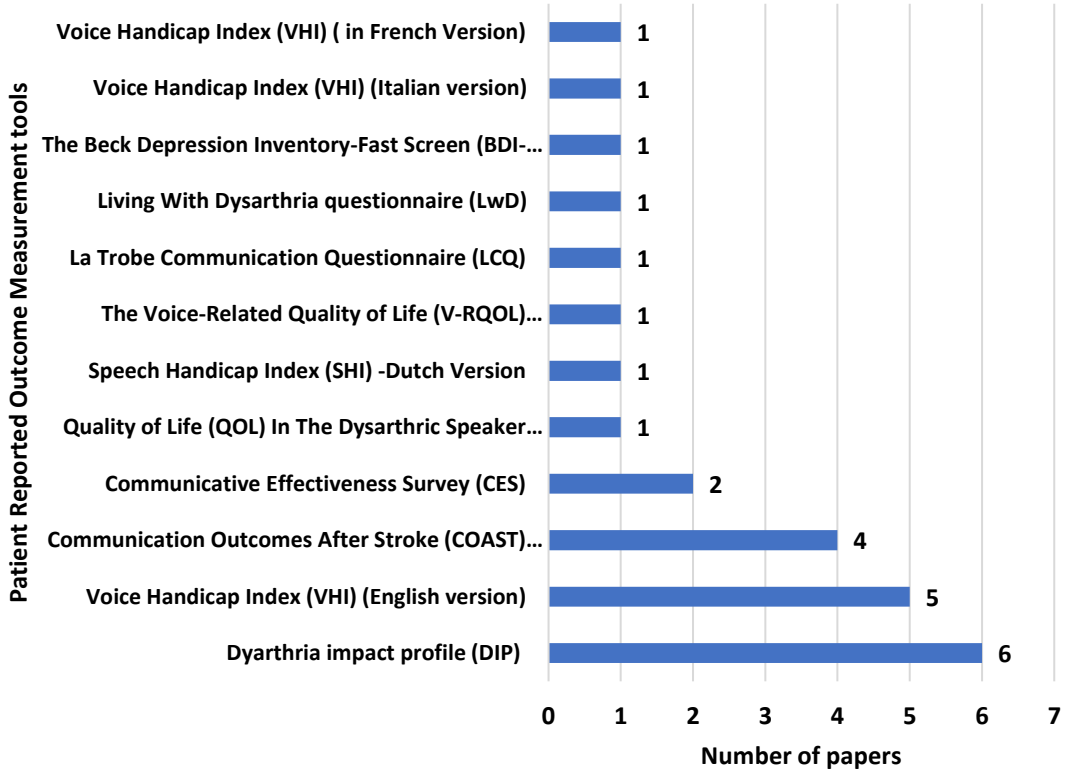

Figure 3 Patient-Reported Outcome Measurement tools recurrence in previous studies with dysarthria participants.

PROM tools validated for dysarthria

Although the PROM tools have been used in previous studies with dysarthria, only four (4) PROM tools were validated for dysarthria participants. The Table 1 shows the PROMs that have undergone adaptation and validation from English to other languages. The tools that were validated in English for dysarthria

participants were the DIP, the COAST Scale, the CES, the QOL-DYS, and the LWD. While the BDI-FS and VHI were not validated for dysarthria.

Table 1 The validated PROMs and adapted to other languages.

PROM tools& Authors	**Types of participants Validated for**	**Adapted and validated to another language**
Dysarthria Impact Profile (DIP)	Dysarthria	French & European Portugese
Voice Handicap Index (VHI)	General Voice	Italian & French
Voice Handicap Index (VHI) (Italian version)	General Voice	No
Voice Handicap Index (VHI) (in French Version)	General Voice	No
Communication Outcomes After Stroke Scale (COAST)	Aphasia and Dysarthria	No
Communicative Effectiveness Survey (CES)	Dysarthria	No
The Beck Depression Inventory-Fast Screen (BDI-FS; Beck, Steer, & Brown, 2000)	Stroke	No
Quality of Life in the Dysarthric Speaker (QOL-DyS; Piacentini et al., 2011).	Dysarthria	No
Living With Dysarthria (LWD; Hartelius et al., 2008),	Dysarthria	No

The PROM tools adapted to other languages

There were only two PROMs that were adapted to other languages i.e., the DIP and VHI. However, there were no articles on the validation of VHI for dysarthria participants. Besides, the DIP was adapted to French and European Portuguese and was validated for participants with dysarthria. Table 3 showed the validation details of the DIP into French and European Portuguese (EP). Both versions of the DIP showed a high correlation with VHI i.e., good convergent validity. While the DIP in French has been proved to be able to discriminate patients with Parkinson's Disease with and without dysarthria ($\chi 2$ = 176.6, df =4, P< 0.05). Anyhow, there were no details in discriminant validity for the DIP in EP language.

Table 2 The PROM has undergone adaptation and validation to other languages.

Authors	PROM	Translated and adapted to	Convergent Validity	Discriminant validity
Letanneux, Walshe, Viallet, & Pinto (2013)	DIP	French version of DIP	High correlation with VHI (Spearman's *r* = -*0.70, P*< 0.01).	Discriminant with participants with Parkinson's Disease (χ^2 = 176.6, df =4, *P*< 0.05)
Cardoso et al. (2018)	DIP	European Portuguese version of DIP	Convergent validity with Voice Handicap Index; Spearman's *P*= -0.8	No information

Discussion:

This scoping review findings showed the assessment and outcome measurement tools used in the previously published studies related to dysarthria patients. The findings showed that most of the studies used informal assessments rather than formal assessments for dysarthria in their research.

Assessment of Dysarthria

Standard assessments for dysarthria have been used in different studies for dysarthria worldwide, and most are available in the English version. These scoping review findings are similar to a study by Altaher et al. (2019) which has identified the FDA, ASSIDS, VHI, and DIP as the most commonly used assessments for dysarthria (Altaher et al., 2019). In this scoping review, the FDA-2 and ASSIDS are found to be the most popular assessment tools for dysarthria. This is probably due to both tools are meant to be clinically diagnostic, and clinicians will be able to determine the severity and type of dysarthria (Enderby, 2008). The FDA-2 and ASSIDS either have been used individually in a study or together with other formal assessment tools.

Patient-reported outcome measure (PROM) of Dysarthria

The PROMs are used in studies without validation. The studies indicate that PROMs for dysarthria is still not commonly used, although it has been proven to be valid for patients with dysarthria (Pascoal et al., 2018 and Pascoal et al., 2018). It was found that studies from the year 2008 until 2019 that related to PROM were available online, but were limited in number. The DIP was produced specifically for dysarthria participants and was adapted into French and European Portuguese. The translated DIP showed good validity and have good use. While for the VHI, although it was not validated for dysarthria, it was commonly used in previous studies on dysarthria possibly due to it being a 'gold standard' self-perception tool, albeit for voice (Kasper et al., 2011).

Conclusion:

The two most widely used FDA-2 and ASSIDS tools have good validity and were created for patients with dysarthria. Both assessment tools also have been used in research worldwide and adapted to other languages. However, there are limited outcome measurement tools in research so far, and limited choices of validated PROM are available online. The DIP and VHI are the common outcome measuring tools in use. Furthermore, the tools are available in English and might be adapted into other languages.

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The Effectiveness and Application of *Urtica dioica* (Stinging Nettle) for Musculoskeletal Disorders: A Systematic Review and Meta-Analysis

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Abstract:

Musculoskeletal disorders (MSDs) are injuries of muscles, bones, tendons, joints, and ligaments commonly treated with medications like non-steroidal anti-inflammatory drugs and analgesic. However, undesired adverse effects with prolonged use have been reported. *Urtica dioica* (stinging nettle) has become one of the popular alternatives for MSDs as evident from literatures. This systematic review and meta-analysis were conducted to review the stinging nettle's effectiveness as well as formulations and methods of administration in the MSDs treatment. PubMed, Google Scholar, IIUM Online Library, CINAHL, and OVID were searched for studies from the earliest publication. Mean pain reduction scores included standard mean difference values as a principal outcome measure. The risk of bias and certainty of evidence were assessed based on the Cochrane Handbook Review and GRADEpro tool, respectively. Of seven studies included, the stinging nettle treatment was shown to effectively reduce the musculoskeletal pain with only minor adverse effects were reported (29%). Oral ingestion (57%) and polyherbal formulation (57%) were frequently used in stinging nettle applications. Probable synergistic effect from polyherbal formulation and no definitive effects determined from the single formulations. Hence, there is a need for carefully designed RCTs for stinging nettle preparations in the MSDs treatment to strengthen clinical relevance.

Keywords: musculoskeletal disorders (MSDs), musculoskeletal pain, effectiveness, safety, *Urtica dioica*, stinging nettle

Introduction:

Musculoskeletal disorders (MSDs), injuries of the human locomotor system covering bone, muscle, tendon, joint, and ligaments, is known for its debilitating effect globally (Middlesworth, 2019). In 2016, about 4.5% adults in Malaysia were living with MSDs (Jamaludin et al., 2018), many of whom were prescribed non-steroidal anti-inflammatory drugs (NSAIDs) and analgesics. However, prolonged use of the drugs is found to be associated with undesired

adverse effects such as dizziness, constipation, and gastrointestinal (GI) effects (Babatunde et al., 2017).

Stinging nettle or *Urtica dioica* (family *Urticaceae*) is commonly known for its stinging hairs i.e. trichomes on its rough-textured leaves and stem. This perennial weedy plant is abundant in regions of the United States, North Africa, and parts of Asia (Baumgardner, 2016). It is shown to have anti-inflammatory and anti-rheumatic properties through the inhibition on nuclear factor kappa B, NF-kB activation, a transcription factor in the pro-inflammatory cytokines regulation, (Shakibaei et al., 2012; Farahpour & Khosgozaran, 2015) and analgesic characteristics (Safari et al., 2016). Due to these phytochemical properties, stinging nettle has become a popular alternative for MSDs (Hajhashemi & Klooshani, 2013). This was evidenced in The Lens database, where the patent and grant applications had risen dramatically from 2008 to 2015. This increasing trend, however, is slightly decreasing over the past few years and raising the question on the effectiveness of stinging nettle in treating MSDs. Therefore, this review aims to address the effectiveness of stinging nettle in the treatment of MSDs and its types of formulation and administration.

Methodology:

Search Strategies

This study was done based on the Preferred Reporting Items for Systematic Review and Meta-Analyses guidelines checklist (Moher et al., 2009). Google Scholar, PubMed, IIUM Online Library, CINAHL, and OVID were searched for articles from the earliest publication from 1987 to 2020 by using "stinging nettle" OR "*Urtica dioica*" OR "common nettle" AND osteoarthritis OR "musculoskeletal pain" OR "musculoskeletal disorders".

Original studies reporting on the effectiveness of stinging nettle tested on patients with MSDs related symptoms were included. Articles that defined the method of administration and formulation of stinging nettle were selected to fulfil the second objective of this study. The exclusion criteria included in-vitro and in-vivo studies related to stinging nettle, and duplicates, incomplete, or published articles in languages other than English.

Data Extraction and Collection

Data extracted were the first author's name, year of publication, number of patients, patients' characteristics, type of intervention, type of administration, formulation, and size of outcome variables as well as the funding sources when available (Ahn & Kang, 2018). The data extracted were recorded independently by two reviewers (SS and ZZ) using MS Excel 2019.

Data Analysis

The study was double-extracted and assessed for methodological appraisal by two reviewers (ZZ and NS) independently. Dichotomous data; ages and number of participants and the mean pain reduction scores including the outcome measures and outcome scale were collected from the searched articles. The quality assessment was done via a GRADEPro GDT evaluation tool (Schünemann et al., 2019).

Meta-Analysis

Random effect meta-analysis was used as the authors expected a heterogeneity but normally distributed data due to its broad scope of population and intervention (Deeks et al., 2019). The mean pain reduction scores were recorded with the standard mean difference (SMD) values i.e. effect size as a principal outcome measure. This effect size reflects the magnitude of the difference in outcomes between groups (Higgins & Green, 2011). By using Revman 5.3 software, the estimated effects of each study were pooled and presented in a forest plot at a 95% confidence level which the studies were evaluated for their overall effect size. The negative estimated values suggested the experimental effectiveness over the placebo tested.

Risk of Bias

Random sequence generation, allocation concealment, blinding of participants and personnel, and other domains were evaluated. Every study was graded to low, moderate or high risk or unclear (Higgins & Green, Chapter 7-8, 2011).

Results:

From 3,112 articles collected, seven articles met the eligibility criteria (Figure 1). The articles are two randomized controlled trials (RCTs) double-blind placebo-controlled (RCTs-PC), one RCT and one open-RCT, one RCT double-blind crossover (RCT-C), one open clinical trial, and one prospective case study. Two articles which had no placebo control group were excluded from the meta-analysis.

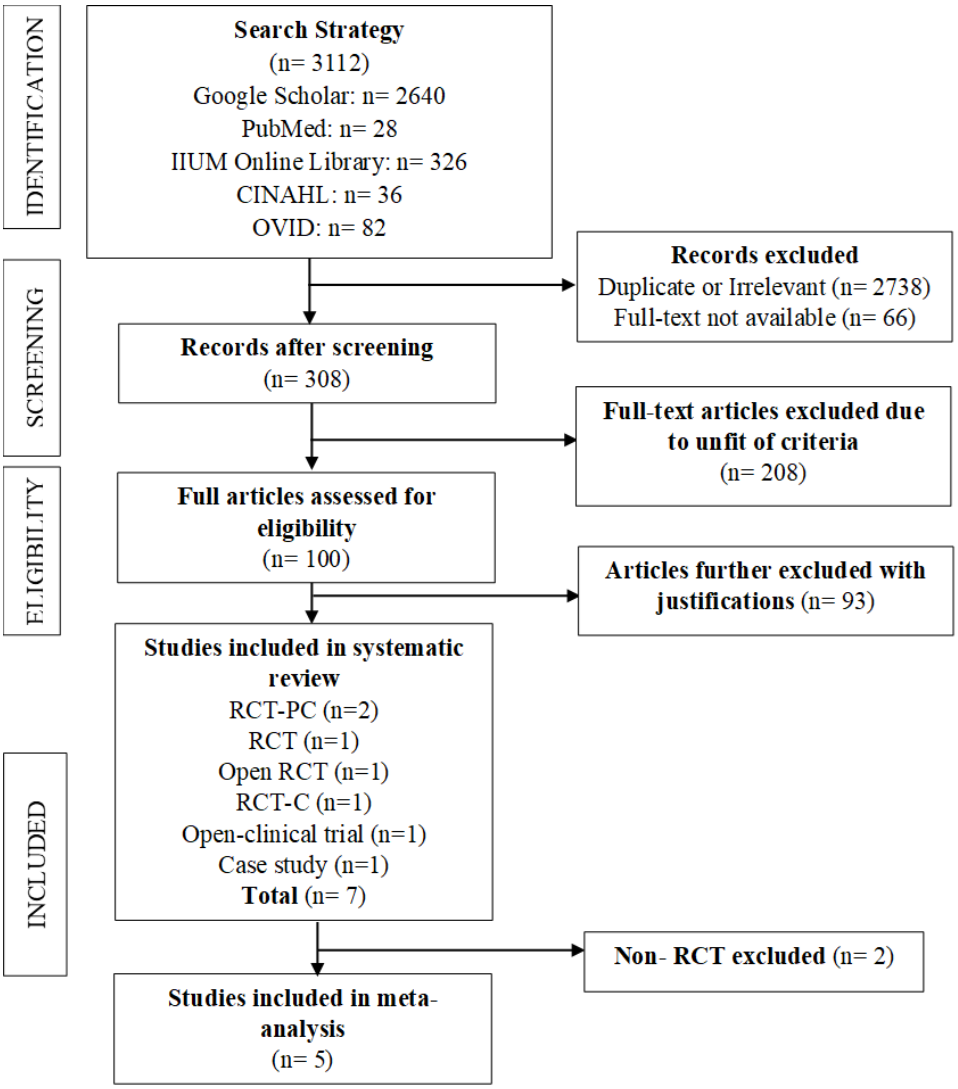

Figure 1 PRISMA flow diagram and search review process

Study Characteristics

Of the seven included studies, a total of four studies (57%) described polyherbal formulation in which two studies used mix herbs as the active ingredients and the other two used a combination of vitamins and herbs. Two studies used a higher amount of other herbs than that of stinging nettle. The oral use was demonstrated in four studies (57%), in capsules (43%) and blended (14%). The Visual Analogue Scale (VAS) score was mostly used for the authors main diagnosis (Hedaya, 2017; Randall et al., 2000). In addition to that, Moré et al. (2017), Jacquet et al. (2009), and Randall et al. (2008) employed the Western Ontario and McMaster Universities Arthritis Index (WOMAC) pain score as their primary pain outcome measure. The secondary outcome measures in several studies applied were aligned to their respective objectives, though it is noted to be inconclusive for pain reduction outcome. All five out of seven studies implemented the placebo which almost akin to its experimental (treatment) study which is physical feature, color, odor, shape, taste, and texture. Other characteristics of the studies (herbal composition, dosage form, etc.) are summarized in Table 1.

Adverse Effects

Two studies (29%) reported mostly transient adverse effects which were easily resolved with or without treatment (Chrubasik et al., 1997) (Table 2). Out of 14 patients reported, one patient had withdrawn due to diarrhoea with positive rechallenge (Jacquet et al., 2015).

Table 1 Characteristics of included studies

Study and Setting	Subjects (♀/ ♂)	Design and Duration (mo)	Mean Age (SD), years old	Intervention type (name and composition)		Application of stinging nettle		Primary Outcome Measure	Secondary Outcome Measure	Diagnosis	NSAIDs/ Analgesic Usage	Funding Source
				Experimental (unit)	Control	Type of formulation	Type of administration					
Moré et al. (2017) Germany	90 (67/23)	RCT-PC (3)	MA212: 57.9 (8.3) CON: 55.7 (9.3)	MA212 (40ml/juice) [supplement] (formulation of *R. canina* [24g], *U. dioica* [0.160g dry leave extract], *H. zeyheri* [0.108g])	Vegetable juice mixture + olive oil + basil extract*	Polyherbal	Oral	WOMAC Pain Score	WOMAC scores (function/stiffness), pain diary (ASA, diclofenac)	Knee OA; 4-8 (Average WOMAC Pain Score)	No	MedAgil (mbH)
Hedaya (2017) USA	13 (8/5)	Case Study (0.5)	59.75 (88.26)	DrH RejointTM (0.35g/ capsule)[2 capsules twice per day] (blend of *U.dioica, B. serrata, E. arvense, A. satsativum, A. graveolans* [0.25g powder], vitamin B [0.02g])	Nil	Polyherbal	Oral	VAS Score	Nil	Over 18 y/o with persistent musculoskeletal pain; at least 4 months	No	Agency
Samal et al. (2015) India	50 (14/36)	Open Clinical Trial (1.5)	43.36 (11.07)	Ayush Harijawan Oil (2-3ml/oil) [twice per day] (formulation of *B. campestris*	Nil	Polyherbal	Topical	Modified Universal Pain Assessment Tool	Tenderness and swelling assessment tools	30-65 y/o; primary backache, knee and any	No	Agency

Study and Setting	Subjects (♀/ ♂)	Design and Duration (mo)	Mean Age (SD), years old	Intervention type (name and composition)		Application of stinging nettle		Primary Outcome Measure	Secondary Outcome Measure	Diagnosis	NSAIDs/ Analgesic Usage	Funding Source
				Experimental (unit)	Control	Type of formulation	Type of administration					
				[0.53g], *E. globulus* [0.05g], *C. camphora* [0.11g], *U. dioica* [0.11g], *A. sativum* [0.11g], *M. fragrans* [0.05g], *P. nigrum* [0.05g])						muscular pain		
Jacquet et al. (2009) France	81 (55/26)	RCT-PC (3)	Phytalgic®: 56.8 (3.04) CON: 57.5 (13.07)	Phytalgic® (0.1g/capsule) [3 capsules per day] (formulation of *U. dioica* [0.06g], zinc [0.01g], vitamin C&E [0.012g], and omega-3 fatty acids)	Capsules (non-fish oils without omega-3 /omega-6 fatty acids)	Polyherbal	Oral	WOMAC Score	Patient diary (0.5g paracetamol or 0.2g ibuprofen per week and NSAIDs [DDD], slow-acting drugs [DDD/day]	40-80 y/o; chronic knee or hip OA; NSAIDs-dependents for pain relief	Yes**	Phythea Laboratories
Randall et al. (2008) United Kingdom	42 (18/24)	RCT (2)	Nettle sting: 65 (7.2), CON: 67 (6.5)	Nettle sting [once daily for 7 days] (*U. dioica* fresh leaves)	Non-stinging' nettle (*U. Galeopsifolia* ***)	Single	Topical (leaves of both groups were pressed on the painful knee for 10 seconds and repeated twice on the other sides)	WOMAC Pain Subscale Score	VAS Score, WOMAC B/C, Pain diary, Nurse Attendance	55-80 y/o; Knee OA (ACR clinical criteria)	No	South West General Practice Trust

Study and Setting	Subjects (♀/ ♂)	Design and Duration (mo)	Mean Age (SD), years old	Intervention type (name and composition)		Application of stinging nettle		Primary Outcome Measure	Secondary Outcome Measure	Diagnosis	NSAIDs/ Analgesic Usage	Funding Source
				Experimental (unit)	Control	Type of formulation	Type of administration					
Randall et al. (2000) United Kingdom	27(23/4)	RCT-C (3) 5 weeks of washout period between 2 experimental weeks	61.75(57.5)	*U. dioica* plant	Non-stinging placebo (*L. album* plant***)	Single	Topical (base of thumb pain of OA)	VAS Score	VRS Score, use of analgesics, sleep analogue VAS score, Side effects and patient comments	Over 18 y/o; persistent base thumb or index finger OA of at least 10 weeks	No	Self-sponsor
Chrubasik et al. (1997) Germany	36 (18/18)	Open-RCT (0.5)	Stewed *U. dioica*: 52 (20.0) CON: 63 (15.5)	Young leaves *U. dioica* [25g per week] (with 0.05g diclofenac)	Diclofenac [0.1g per week] (with misoprostol)	Single	Oral	The relative improvement of elevated C-reactive protein serum	VRS Score (total joint scores, subjective pain and pain on pressure, and stiffness)	Acute arthritis (no suffering from severe hepatic or renal disease); 3 weeks	Yes (diclofenac)	Self-sponsor

SD= standard deviation, CON= control, WOMAC= Western Ontario and McMaster Universities Osteoarthritis Index scale, VAS= Visual Analogue scale, VRS= Verbal Rating scale, OA= osteoarthritis

*Not specified, ** to assess both treatment and control effect on the medication with prior hypothesis that the treatment would decrease the symptoms and reduce the usage of analgesics by at least 20% from initial stage (Jacquet et al., 2015), ***phenotypically similar to *U. dioica*

Table 1 Reported adverse effects from two studies

Study	No. of patients	Events***
Jacquet et al. (2015)	EXP: 14	1,2,3,4
	CON: 13	1,5,6,7,8,9
Chrubasik et al. (1997)	EXP: 3	1,10
	CON: 3	11

EXP= Experimental, CON= Control

***1, diarrhoea; 2, eructation smelling of fish-oil; 3, pain at sciatic, lumbar, scapula and dental; 4, common cold, lymphangitis; 5, gastroenteritis; 6, hypercholesterolaemia; 7,dental problems; 8, cystitis; 9, vomiting and GI pain; 10, abdominal pain; 11, meteorism.

Risk of Bias

Four RCTs adequately fulfilled all domains (Moré et al., 2017; Jacquet et al., 2009; Randall et al., 2008; Randall et al., 2000). This includes low risk in allocation concealment by means of of computerized random generator, identical capsules (both treatment and placebo), serially numbered, and opaque bags. However, two studies had a high risk of bias (Samal et al., 2015; Hedaya, 2017) and one for high risk of confounding bias and sequence generation (Chrubasik et al., 1997) (Table 3)

Table 2 Risk of bias assessment on the included studies

Study	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias
Moré et al. (2017)	L	L	L	L	L	L	L
Hedaya (2017)	H	H	U	U	L	L	L
Samal et al. (2015)	H	H	H	H	L	L	L
Jacquet et al. (2009)	L	L	L	L	L	L	L
Randall et al. (2008)	L	L	L	L	L	L	L
Randall et al. (2000)	L	L	L	L	L	L	L
Chrubasik et al. (1997)	H	L	H	M	U	U	H

L= Low risk, U= Unclear, H= High risk, M= Moderate risk

Effectiveness of Stinging Nettle (and Quality Evidences)

The meta-analysis indicated no significant difference with negative pooled estimate effect of -0.53 (95% CI -2.35 to 1.29, p = 0.57) between the experimental and control groups (Figure 2). Despite the considerable heterogeneity i^2 = 98% with a wide confidence interval (CI), the experimental effect was shown consistent among the studies given small prediction interval effect (95% prediction interval -0.85 to -0.21). The high credible evidences (Table 4): Randall et al. (2000) and Jacquet et al. (2009) exerted statistically significant large effects -4.23 (95% CI -5.22 to -3.24, p < 0.001) and -1.26 (95% CI -1.73 to -0.78, p < 0.001), respectively. Randall et al. (2008) with their placebo, *U. Galeopsifolia* was found to demonstrate small treatment effect from imprecision 0.04 (95% CI -0.57 to 0.64) (as indicated by a wide CI). Chrubasik et al. (1997) also revealed small true effect from imprecision 0.20 (95% CI -0.46 to 0.85). While, Moré et al. (2017) was found to favor the placebo instead with 2.47 (95% CI 1.92 to 3.02, p < 0.001). Other two studies indicated small effect sizes as referred in Table 5.

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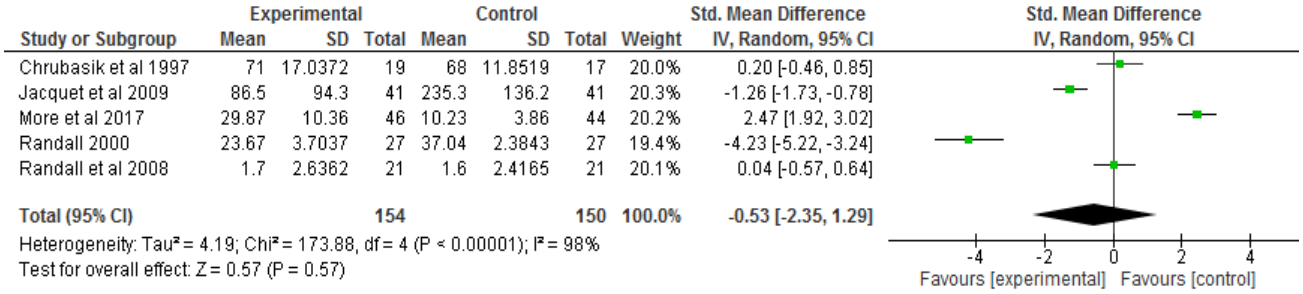

Figure 2 Random effect meta-analysis of five studies that determine the effectiveness of stinging nettle (experimental) on MSDs patients

Discussion:

The true effects were observed substantial with imprecision in several studies (Randall et al., 2008; Chrubasik et al., 1997) emphasizing the need for large studies with large effects as seen in Randall et al. (2000) and Jacquet et al. (2009). This explains the impact of a small study through its result of a wide CI and small effect size. Samal et al. (2015) and Hedaya (2017), two of which exempted from meta-analysis were analyzed based on the estimated effect sizes cohen's *d*. The small studies presented too small an effect to be considered as clinically meaningful despite the significant effects reported (Table 5). The overall results are pooled for SMD via the random effect meta-analysis as the different scales of outcome measure. SMD converted data from different scales to common scale. When the 95% prediction interval was calculated, the negative pooled estimate effect -0.53 (95% CI -2.35 to 1.29, $p = 0.57$) showed significance given the small interval (95% prediction interval -0.85 to -0.21). The consistency was demonstrated, $p = 0.57$ (p-value > 0.05) which exhibits a higher probability for clinical effectiveness of stinging nettle in MSDs.

The possible mechanisms of stinging nettle actions are via its derivative of phytochemicals i.e. flavonoids, tannins, and phenolic acids (Said et al., 2015; Yousef et al., 2015). These phytochemicals have an anti-inflammation effect, demonstrating the stabilization of NF-kB complex activation on the IL-1β-induced human canine articular chondrocytes (Shakibaei et al., 2012). The pain reduction from the anti-inflammation of stinging nettle is further documented by Hajhashemi and Klooshani (2013). Safari et al. (2016) also found peripheral analgesic activity from the nettle leaf administration on pain-induced mice. However, the exact mechanism of the said effectiveness of the plant remains elusive.

The indirect effect of stinging nettle from polyherbal formulation lies in the herb-herb combinations concept that have been shown to produce potential interaction effects including mutual enhancement and assistance producing synergistic effect (Sun et al., 2019). However, we do acknowledge that only little effect could be attributed to the lower content of stinging nettle as as compared to the other mixed herbs in the two studies This differs from the single formulation studies, where the effectiveness of stinging nettle may have illustrated by the positive interactions between the active phytochemicals responsible like flavonoids, tannins, and other constituents of hydroethanolic extract for anti-inflammation and analgesic properties (Sun et al., 2019).

Table 3 GRADE of quality evidences

	Certainty assessment						Certainty
№	Risk of bias	Inconsistency	Indirectness	Imprecision	Other	Absolute (95% CI)	
1 Moré et al. (2017)	not serious	not serious	not serious	not serious	none	SMD 2.47 SD higher (1.92 higher to 3.02 higher)	⨁⨁⨁⨁ HIGH
1 Hedaya (2017)	serious [a]	not serious	not serious	not serious	strong association	MD 34.71 SD lower 18.13	⨁⨁⨁◯ MODERATE
1 Samal et al. (2015)	serious [a]	not serious	not serious	not serious	none	MD 1.4 SD lower 0.75	⨁◯◯◯ VERY LOW
1 Jacquet et al. (2009)	not serious	not serious	not serious	not serious	very strong association	SMD 1.26 SD lower (1.73 lower to 0.78 lower)	⨁⨁⨁⨁ HIGH
1 Randall et al. (2008)	not serious	not serious	not serious	serious [c]	none	SMD 0.04 SD higher (0.57 lower to 0.64 higher)	⨁⨁⨁◯ MODERATE
1 Randall et al. (2000)	not serious	not serious	not serious	not serious	strong association	SMD 4.23 SD lower (5.22 lower to 3.24 lower)	⨁⨁⨁⨁ HIGH
1 Chrubasik et al. (1997)	very serious [b]	not serious	not serious	serious [c]	residual confounding[d]	SMD 0.2 SD higher (0.46 lower to 0.85 higher)	⨁⨁◯◯ LOW

EXP: experimental, CON: control, CI: confidence interval, SD: standard deviation, MD: mean difference, SMD: standardized mean difference

[a] Non-blinding and lack of randomized and control group.

[b] **S**ignificant confounders; age and origin of pain in both groups and performance bias

[c] Wide CI

[d] Plausible residual confounding would suggest spurious effect, while no effect was observed

Table 4 Mean difference of pain scores and effect sizes of two studies excluded from the meta-analysis

Study	Mean difference of pain scores (SD)	Effect Size Cohen's *d* (95% CI)
Hedaya (2017)	0.34 (0.19)	1.79 (0.26, 0.47)
Samal et al. (2015)	2.00 (2.52)	0.79 (1.04, 2.95)

The high prevalence of oral use may reflect the most convenient method of drug delivery with high patient compliance (Savjani et al., 2012). Nevertheless, it requires an "upgrade" of the oral drug for significant manifestation of its pharmacological effects (Savjani et al., 2012) based on its low bioavailability

from pre-systemic metabolism and the drug biotransformation that occurs along the GI tract (Latifa et al., 2007). This can be seen in a study by Chrubasik et al. (1997) that uses capsules prepared with isolated compounds using a high-performance liquid chromatography, HPLC for standard calibration. The particle size reduction in MA212 by Moré et al. (2017) improve its solubility and gastric emptying rate (Savjani et al., 2012). The topical applications of stinging nettle, either in the form of oil (Samal et al., 20015) or leaves (Randall et al., 2008; Randall et al., 2000), provide localized effect and confer prolonged drug release due to longer plasma half-life than oral ingestion (Jalloh, 2016) .Besides the above-mentioned factors, other aspects like age, gender, and disease severity can also affect the oral bioavailability and maximum plasma drug concentration which may lead to discrepancies in the therapeutic effects (Jalloh, 2016).

A considerable heterogeneity between the selected studies were probably due to different interventions and outcome measures which might explain the non-significant difference in the pooled estimate effect. The existence of heterogeneity were managed by using a random-effect model and 95% prediction interval to determine the overall interval effect. The small placebo effects in Moré et al. (2017) may complicate the result interpretation. While, few studies demonstrated significant imprecision (Randall et al., 2008; Chrubasik et al., 1997) and confounding bias of Chrubasik et al. (1997) which degrade the certainties of evidence. This warrants future RCTs of standardized stinging nettle preparation to assess its effectiveness and safety.

Conclusion:

The findings of this original article provide a concise overview and support of the stinging nettle effectiveness in MSDs due to consistent treatment effectiveness demonstrated with minor adverse effects. Of note, the stinging nettle is commonly taken orally in the form of capsules and blends, and polyherbal formulated. However, larger RCTs are warranted for higher reliability. Therefore, until further evidence is available, the use of stinging nettle should be considered as an alternative therapy to NSAIDs and analgesics in the treatment of MSDs.

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Author Contributions

SSAZ wrote the main body of the paper. ZZ and NS provided feedback on the draft paper and approved the drafted manuscript. All authors read and approved the final manuscript.

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A Review of Sex Education Impact in Health Promotion and Teenage Behavior

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Abstract:

Introduction: Enhancing young people's knowledge, attitudes, and behaviours regarding sexual and reproductive health and behaviours is one of the positive consequences of sexuality education. However, there are a lot of barriers to implement the program due to lack of understanding within the community and misperception of its objectives. To summarise the impact of sex education on health promotion and adolescent behaviour, a systematic review was done. **Methods:** A database search utilising PubMed, Scopus, and CINAHL was used to identify potential articles for reviewing. 36 articles were eligible for assessment based on the criteria of original papers in English language published between January 2011 and November 2021. **Results:** The systematic review revealed that sexuality education benefits the teenagers and students with regards to the prevention of unintended sexual intercourse, sexual harassment and other high-risk behaviours. **Conclusion:** There are multiple effective platforms and ways to incorporate sexual education into the school curriculum that can give benefits to teenagers, especially in preventing sexually transmitted diseases and unintended pregnancy.

Keywords: Review, sex education, teenage

Introduction:

The exposure of teenagers with sexual initiation at an early age is associated with many health outcomes, including sexually transmitted diseases (such as human immunodeficiency virus and syphilis), maternal illicit drug use, pregnancy-related complications, maternal mortality and other psychosocial consequences like school dropout and rejection from the community (World Health Organization, 2020). In Malaysia, although the prevalence of teenage pregnancy is low relative to other countries, the figure might not suggest the real numbers. This is because many cases go unreported, and teenage mothers are more likely to engage in illegal miscarriages (Noordin et al., 2012). The Malaysia Welfare Department reports that about 111 of unmarried teenagers were pregnant with a recorded rate of 6 births per 1000 women aged 15-19 years. Furthermore, 18,847 pregnant girls aged 10 to 19 were recorded in Malaysian public health institutions in 2012, making up 3.2% of the projected 580,536 expecting moms that year (32 out of 1,000 pregnancies) (Nagandla & Kumar, 2020).

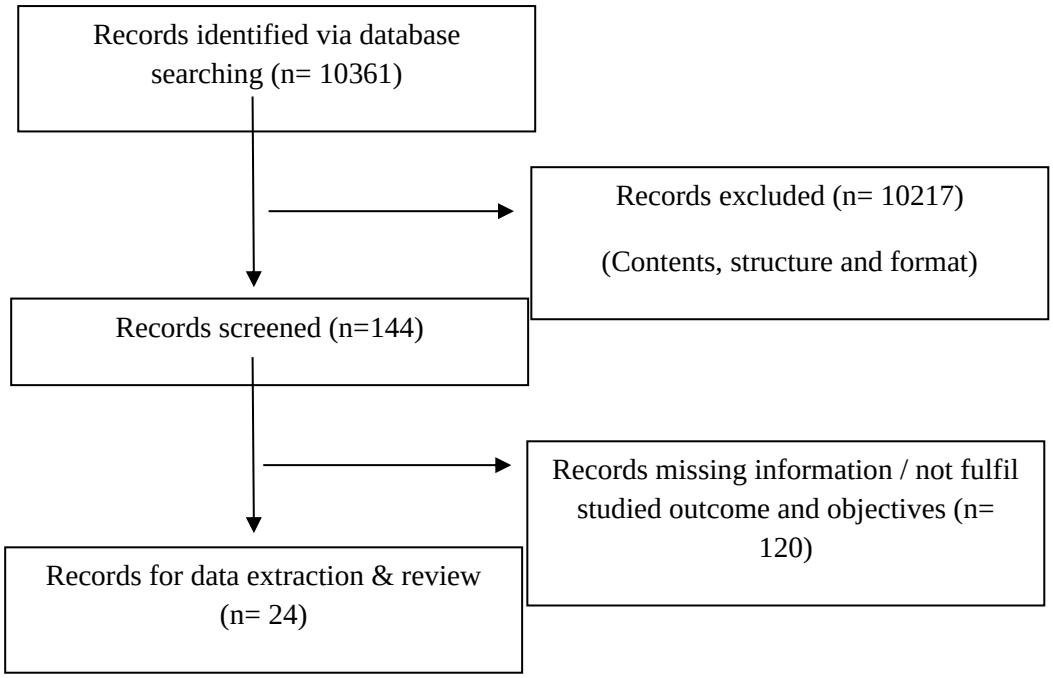
As they transition from infancy to maturity in the contemporary era of mass and digital media, too many teens are inundated with false information about romance and sex (UNESCO, 2018). Due to that, teenagers are becoming more interested in factual knowledge that will enable them to have secure, fruitful, and fulfilling lives. Sex education has long been seen as critical to the sexual health and wellbeing of teenagers by public health specialists and legislators (UNESCO, 2018). Sexual education equips the young with knowledge and life skills regarding respectful relationships and sexuality for health and wellbeing. Sex education is important to avoid sexual abuse, violent sexual actions, and dangerous practices (UNESCO, 2018). Furthermore, it can empower and navigate them in a world where unintended pregnancy, the transmission of (human immunodeficiency virus) HIV and other sexually transmitted diseases and gender-based violence are becoming a serious problem to their health and wellbeing (UNESCO, 2018).

Sexual education is a way to help lower the spread of infectious diseases like HIV because it raises HIV prevention awareness. In addition, the students should also be aware that they have the right to reject intercourse or request the use of a condom if they suspect that their partner had a sexually transmitted disease (Rose, 2014). The communities are gradually recognizing the necessity of providing teenagers with the information and skills to make accountable decisions in their lives. Moreover, public opinion polls have continuously expressed substantial support for comprehensive sex education in developed countries like the United States of America. (Kantor & Holstrom, 2019; Planned Parenthood Federation of America, 2018). Looking at the situation, Malaysia also needs to develop a reliable syllabus for the sexual education curriculum. Nonetheless, the issue is still widely debated in our community and challenging to be discussed due to socio religious stigma (Razali & Preference, 2021; Hazariah et al., 2020; Aalsma M.C. et al., 2013). Because of the potential positive outcome of sexual education on our teenagers, this article review will give us more information regarding the impact of sexual education on health promotion among teenagers and its associated factors.

Materials and Methods:

The objective goal of this review paper is to determine how sex education affects the promotion of health among teenagers. From the database's debut in January 2011 through November 2021, three electronic databases (PubMed, CINAHL, and Scopus) were searched. The titles and abstracts found from the search approach for all databases were analyzed by four reviewers who then stratified the articles. The finalised papers were vetted by another independent reviewer with subject-matter knowledge. Any disagreements between the reviewers were resolved. The search strategy used the following MeSH (Medical Subject Headings) keywords: effects, outcome, sex, abortion, pregnancy, education, syllabus, curriculum, program, health, promotion, empowerment, teenage, youth, young people, secondary school students, behaviour, action, and attitude. The following research questions needed to be answered in this reviewing process: the impacts of sexual education on health promotion and teenagers' behaviours, as well as on the associated risk factors of sexual behaviour in teenagers. The inclusion criteria for this review include the paper format for the study required to be cross-sectional, case-control, or cohort and the articles were to be published in English within the stipulated time as mentioned previously. Exclusion criteria includes other paper formats such as case reports, case series, commentary, and randomised control trials. The first three reviewers performed data extractions using a common data extraction table to gather pertinent data from each qualifying study. The dataset included information on the study's features, site, design, sample size, eligibility requirements and outcome measures. The fourth reviewer conducted discussions to resolve any

differences in data extraction between the initial three reviewers. Any articles with insufficient or omitted information were eliminated. Articles that just addressed sexual assault or harassment without covering sexual education elements were also excluded. 144 articles that met the inclusion requirements were included out of the initial 10361 articles found by the search process. After reviewing the data extraction results and finalisation, only 24 articles fulfil the eligibility criteria as summarised in Table 1.



Flow chart 1: Schematic flow for articles identification and extraction

Results:

Based on 24 articles that fulfilled the eligibility criteria (Table I), all articles targeting the implementation of sexual educational programs at secondary school and adolescents. One article targeting lesbian, gay, bisexual, and transgender (LGBT) group and another three articles emphasis on the HIV and sexually transmitted disease to be incorporated in the program. One article suggests implementation of national law of mandating sex education in schools. The most common method to deliver the knowledge includes through curriculum syllabus, school-based programs, religious input, web-based education, media platforms, mobile health education and peer-to-peer education. All 24 articles list similar impact of better adolescent sexual health outcomes.

Role of religious belief

Religious input is one of the components that can be incorporated in sexual education programs among adolescents. Research has shown that adolescent religiosity is negatively related to risky sexual behavior (Razali & Preference, 2021; Hazariah et al., 2020; Aalsma M.C. et al., 2013). Religiosity is proven for lower sexual conservatism and sexual behavior (Aalsma M.C. et al., 2013). Spiritual and religious input not only been practised by school educators, in fact had been practiced among health care providers in dealing with teenagers with high-risk sexual behaviours (Hazariah et al., 2020). In fact, it has been a trend among healthcare professionals to positively incorporated Islamic beliefs into sexual health education session (Hazariah et al., 2020). According to research, an effective relationship between socio-sexual attitudes and religion should be understood for effective tactics of sexual health promotion (Aalsma M.C. et al., 2013).

Impact of sexual education

Sexual education if properly delivered would provide impactful preventive measures in rescuing the teenagers from high-risk behaviours (Table I). This is reflected in higher sexual health awareness and literacy among the youths and therefore allow them to experience safe sexual practice (Akuiyibo et al., 2021; Lameiras-Fernández et al., 2021; Narkarat et al.,2021). This will prevent sexually transmitted infections and human immunodeficiency virus transmission, lower

the risk of adolescent pregnancy, reduce the frequency of sexual intercourse and even delay the onset of sexual debut (Ramírez-Villalobos D et al., 2021; Evans R et al., 2020; Martin et al., 2020). Even if they practice sexual intercourse, they are more aware to use contraceptive methods such as barrier method, oral contraceptive pills and practice monogamous relationship (Yau et al., 2020; Wado et al., 2019; Yakubu et al., 2019). If they develop symptoms suggestive of genital infections, they are also more ready to seek for medical attention and undergone screening (Scull TM et al., 2018; Layzer C et al., 2017; Li C et al., 2017; Breuner et al., 2016). Overall, they become more confidence in themselves, feel more positive about themselves and therefore avoiding themselves from drug abuse, alcoholism, nicotine addiction and sexual risky behaviours (Jonas et al., 2016; Oman et al., 2016; Jørgensen et al., 2015; Taylor M et al., 2014; Aalsma M.C. et al., 2013; Morrison-Beedy et al., 2013).

Table 1: List of Articles Fulfilled Searched Objectives for Sexual Education

No	Author and Year	Study place	Population	Description	Impact
1.	Akuiyibo *et al.*, 2021	Northwestern states of Nigeria	Young people aged 15–24 years	HIV/AIDS education been incorporated in sexual education	Prevention of risky behavior, better health awareness among youths
2.	Lameiras-Fernández *et al.*, 2021.	Multiple sites	Adolescent (10 schools)	Combination of learning experiences aimed at facilitating voluntary behaviour Online supports interventions Less threatening, awkward, or embarrassing	Including social, emotional, mental, physical, and other elements Decrease in dangerous behaviours Enjoyable and safe sexual experiences Knowledge about preventing STIs and other diseases, which has increased
3.	Narkarat *et al.*,2021.	Rural Thailand	Female school-going adolescents	Mobile health education on sexual and reproductive health information among female school-going adolescents	Increase sexual and reproductive health literacy
4.	Ramírez-Villalobos D *et al.*, 2021.	Morelos, Mexico	Seventy-five public schools	Comprehensive education in sexuality (CES) in public secondary school	Reduction in STI Delay sexual debut, lower the risk of adolescent pregnancy, reduce the frequency of sexual intercourse
5.	Evans R *et al.*, 2020.	Multiple sites	Black adolescents	Primary prevention programs which are directly aimed at encouraging abstinence or safer sexual behaviour	Promote the utilization of medical testing and treatment services. Increasing sexual health self-efficacy and knowledge Improvements in abstinence & condom use

				Reduce the risk of (HIV) infection	
6.	Martin *et al.*, 2020.	Multiple sites	Web-based participatory interventions among young people	Online support interventions	Reduction in STI
7.	Paton *et al.*, 2020.	Multiple sites	Sex & relationship educations among teenagers	Laws mandating sex education in schools	Reduction of teen pregnancy and sexually transmitted illnesses like HIV. Reduction in drug and alcohol usage, as well as use of other substances
8.	Rabbitte M., 2020.	United states	Youth in school	Targeting lesbians, gays, and bisexuals	Reduction is sexual risk behavior
9.	Scull TM *et al.*, 2020.	United states	High school students	Media literacy education (MLE) to teenagers	Increased self-efficacy about their own sexual act Lowered hazardous sexual acts and increased intentions to use a condom if they choose to have sex
10.	Yau *et al.*, 2020**.**	Thailand	423 students aged 15 through 19 years	Educational programs towards targeted selected groups.	Reduce dangerous sexual acts including promiscuity and sporadic condom use. Increase test for HIV
11.	Crocker *et al.*, 2019.	Australia	Stakeholder perceptions of the Australian Positive Adolescent Sexual Health (PASH) Conference	Internet has become one of the major health- related information Strengthening the school and family context, empowering youth building skills	Better adolescent sexual health outcomes
12.	Wado *et al.*, 2019.	Five east African countries	Adolescents	Multi-sectoral approaches to addressing adolescent pregnancy	Delay in onset of sexual activity Reduction in unwanted and unintended birth. Postponing intercourse, having fewer sexual partners.

13.	Yakubu *et al*., 2019.	Adolescent girls	Northern Ghana	Educational intervention program on sexual abstinence based on the health belief model amongst adolescent girls	Some knowledge and commitment to prevent conception
14.	Scull *et al*., 2018.	United states	Adolescent Sexual Health Promotion in Middle School	Increased their interest and curiosity in sex and relationships	Increased use of contraception, a delay in the commencement of sexual activity Increased adolescent's intention to use contraception More confidence in one's ability to communicate with their spouse
15.	Scull TM *et al*., 2018.	United states	Older adolescents attending community college	Media Literacy Education for Adolescent Sexual Health Promotion in Middle School	More conscious of the impact of a lack of conscience on sexual behaviour decisions significant increase in sexual health awareness
16.	Layzer C *et al*., 2017.	United states	11th- and 12th-grade students are trained by school health educators	Peer-to-Peer Sexual Health Education	Awareness to use condoms or other birth control methods themselves or with a partner.
17.	Li C *et al*., 2017.	Eastern, central, and western parts China	130 colleges, undergraduates aged 18 ~ 25	School-based sexuality education, sexual knowledge and sexual behaviors	More positive sexual practices and reproductive health outcomes
18.	Breuner *et al*., 2016.	Unites states	Clinical guidance for paediatrician	Sexual anatomy, STI, sexual activity, orientation, abstinence, contraception	Allow adolescents to make safe choices about healthy relationships, responsible sexual activity, and their reproductive health
19.	Jonas *et al*., 2016.	South African	School-going adolescents	Sexual risk behaviors and substance use education	Reduction of teen pregnancies and sexually transmitted illnesses like HIV Decrease in the use of alcohol, cigarettes, and other narcotics as drugs of abuse

20.	Oman *et al*., 2016.	California, Maryland, and Oklahoma	Youth from 44 residential group homes	Numerous venues, including community centers, schools, and health clinics, are available for the delivery of sexual health programs.	Improve knowledge, attitudes, self-efficacy, and sexual behaviours intentions
21.	Jørgensen *et al*., 2015.	General Danish population	Youth aged 15–29 years	A web-based sexual behaviour questionnaire	Reduction of teen pregnancies and sexually transmitted illnesses like HIV
22.	Taylor M *et al*., 2014.	KwaZulu-Natal, South African	816 high school students	Teenage Pregnancy Prevention Program for high school students	Increase condom usage among sexually active students More students expressed a desire to discuss teenage pregnancy with their partner and to use condoms
23.	Aalsma M.C. *et al*., 2013.	United states	328 young women to assess the role of religion and socio-sexual	Emphasis on socio-sexual cognitions and religiosity on adolescent sexual behavior	Positive effect requires strong religious belief
24.	Morrison-Beedy et al., 2013.	Northeastern United states	738 sexually active urban adolescent girls	Sexual risk-reduction (SRR) intervention, supplemented with postintervention booster sessions, targeting low-income, urban, sexually active teenage girls	Sexual risk and unwanted pregnancies in adolescent girls can be minimized Self-efficacy Towards Contraception

Discussion:

Any set of educational activities aimed at encouraging voluntary behaviour that promotes sexual health is considered a sexual education (Lameiras-Fernández et al., 2021). This may be done by implementing sexual health interventions, which includes primary prevention programmes targeted at promoting abstinence or safer sexual act in order to lower the chance of contracting HIV infection and other sexually transmitted infections (STIs) as well as unintended pregnancy (Evans et al., 2020). Any information that covers knowledge on sexual health and concept including sexual anatomy, sexually transmitted infection, sexual activity, orientation, abstinence, and contraception should be covered (Breuner et al., 2016).

According to Lameiras-Fernandez et al. (2002), the effectiveness of sex education programmes primarily focused on the reduction of risky behaviours and outcomes, such as sexual transmitted diseases (STDs), unintended pregnancies, and unexpected paternity/maternity as public health outcomes. In fact, the major goal of abstinence-only programmes is to assist young adults in preventing unexpected pregnancies and sexually transmitted diseases. This is based on the idea that although using contraceptives simply lowers the risk, abstinence eliminates it. Additionally, Scull et al. (2018) asserted that, in addition to increasing the use of contraceptives, sexual health treatments may cause a delay in the initiation of sexual activity. Furthermore, research revealed that early sexual initiation is a strong indicator of teenage

pregnancy, contraceptive non-use, and HIV infection (Wado et al, 2019).

By promoting sexual health in a way that includes not only the biological but also the psychological and emotional aspects of sexuality, comprehensive sexual education initiatives help young people have enjoyable and safe sexual experiences in the future (Lameiras-Fernández et al., 2021). Sexual health goals, sexual health knowledge, and sexual health self-efficacy were all found to be strongly correlated with health intervention in psychological outcomes research (Evans et al. 2020). Additionally, compared to the control group, students received education on sexual health reported higher levels of self-efficacy for using contraception and speaking with their partner at the post-test (Scull et al, 2018). Sexual communication is essentially a protective factor against dangerous sexual behaviour, even though it is frequently seen as taboo in our culture. This is due to the increased likelihood of safer sex among teenagers who can discuss sexual issues with their partners or a doctor. In fact, talking to a doctor will help them get more precise information on sexual health.

There are numerous things that can influence a person's sexual behaviour. The most common factors are education and socioeconomic status. As cited by Wado et al. (2019) poor knowledge of sexual and reproductive health services and lack of education has contributed to unintended pregnancy among youth in the sub-Saharan African. Jonas et al. (2016) also mentioned that a few research have investigated the factors that contribute to the teen pregnancy and other sexual risk behaviours, such as low contraceptive use and poor knowledge of contraceptives. In South Africa, even contraceptives are readily available at the public healthcare setting for free, but the number of girls who use it is very minimal and this can be explained by the poor knowledge of contraceptives. Furthermore, among sexually experienced Thai adolescents, a lack of awareness of premarital sexual practise may lead to the dissemination of risky sexual behaviour such as promiscuity, inconsistent condom usage, and reluctance to test for HIV (Yau et al., 2020).

Other than that, socioeconomic status also can affect the sexual behaviour among youth. Adolescent girls are vulnerable to early sexual debut and intergenerational intercourse because of poverty and low prospects for future economic success, according to Wado et al. (2019). According to research, those who live in poor neighbourhoods, adolescent girls from low-income families (Wado et al., 2019) and low-income urban settings are more likely to have unwanted pregnancies, STIs and HIV (Morrison et al., 2013). Substance abuse including alcohol, cigarettes, and other drugs, is quite common among teenagers, according to David et al. (2020). Teenage sexual risk-taking behaviour has been linked to substance misuse. A further point made by Jonas et al. (2016) was that substance use (particularly marijuana and cocaine) continue to reflect individual-level risk factors related with teenagers' sexual behaviours, including use of contraception, safe sex practises and teenage pregnancy.

Strong religious belief also plays a significant role in affecting sexual behaviour in adolescent. Reduced religiosity, according to Aalsma et al. (2013), influences the accumulation of sexual experience by lowering sexual conservatism and results in higher sexual risk behaviour. According to a study, higher levels of religiosity in adolescents are associated with fewer sexual partners, a later age for first coitus, and a lower percentage of sexual intercourse with an unknown partner. They are also associated with a longer wait for the first sexual encounter and fewer sexual encounters (Aalsma et al., 2013). Other than that, genders and sexual minority youth such as lesbians, gays, and bisexuals, have been linked to sexual risk behaviour. These youth are noted to have more sexual partners, a younger sexual debut age, drinking before sex, and a lower use of condoms and contraceptives (Rabbitte, 2020).

Conclusion:

Sexuality education should be implemented starting at primary school in view of its benefits to students specifically and society generally. Nevertheless, the format of education should always be revised to incorporate a spiritual approach and be suitable according to the developmental age of the children and students. It should fulfil the main objectives of preventing any high-risk behaviour, sexually transmitted diseases, unintended pregnancy and psychological distress among students and teenagers. Indeed, there are multifactorial factors contributing to sexual behaviour among teenagers. Therefore, in order to contribute to the establishment of a useful and successful sexuality education programme worldwide, awareness and active involvement particularly among families, teachers, community leaders, religious authorities, and community leaders should be strengthened further.

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Survey on Awareness and Knowledge Towards Pelvic Floor Muscles Exercises Among Female University Students

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Abstract:

Pelvic floor muscle exercises (PFME) has been highlighted as one of the core components in managing pelvic floor dysfunction (PFD). As the incidence of PFD is reported to be high in the female population, it is still crucial to ensure that this population has adequate awareness and knowledge about PFME. To date, published studies on awareness and knowledge about PFME have focused on women who have a history of giving birth. Hence, this study aimed to determine the awareness and knowledge about PFME among nulliparous women, specifically students in IIUM Kuantan and to examine the association between awareness and knowledge of PFME among this population. A cross-sectional online survey was conducted. The questionnaires on awareness and knowledge of PFME used in this study were adopted from previous studies. 133 respondents with a mean age of 22.19 (±1.21) years participated in this study. Descriptive statistics was used to analyze the awareness and knowledge of PFME, while the Chi-square test was used to examine the association between variables. The findings indicated that less than 50% of the respondents were aware and had knowledge of PFME, 48.1% and 42.9%, respectively. The awareness and knowledge of PFME were found to be statistically associated ($p < 0.001$), in which respondents who were aware of PFME also had knowledge of PFME. These results suggest a need to strategize a health education programme for PFME that is accessible to a diverse female population.

Keywords: Knowledge, awareness, pelvic floor muscles exercises, nulliparous women

Introduction:

Pelvic floor dysfunction (PFD) is considered one of the most common burdensome gynaecological disorders that impair body functions and disturb daily living. It occurs when the pelvic floor muscles are neglected or injured, resulting in obstructive micturition, incontinence, pelvic pain, pelvic organ prolapse, and sexual dysfunction (Berzuk & Shay, 2015; Fante et al., 2019). These conditions have significant impacts on individuals' health and well-being.

The incidence of PFD is common in women (Dieter et al., 2015). A recent study revealed that around 10% to 30% of women suffered from PFD (Islam et al., 2019). It may affect this population at any age, as early as 13 to 19 (Rebullido et al., 2021; Arbuckle et al., 2018; Parden et al., 2016). Among young women below 30 years old, urinary incontinence was the most prevalent type of PFD, followed by pelvic organ prolapse, 31.5% and 1%, respectively (Arbuckle et al., 2018). This figure was found to be high among young women who play

professional sports (Rebullido et al., 2021; Teixiera et al., 2018).

Materials and Methods:

Study design

A cross-sectional study was conducted among female students enrolled in IIUM Kuantan Pahang. This study was conducted from March 2021 to May 2022.

Sampling

A convenience sampling method was employed to recruit the participants. The female students of the IIUM Kuantan campus were invited to participate in the survey. The inclusion criteria of this study were ages between 18 to 30 years old, have never been diagnosed with PFD, and have never given birth.

The sample size was calculated using a single proportion formula, with a confidence level of 95% and an expected proportion of 27.9% (Temtanakitpaisan et al., 2020). 10% of the non-response rate was included, which indicated that 133 participants were required for the survey.

Data collection

Data was collected through an online survey using a Google Form. All information about the study and instructions to complete the questionnaire were provided with the questionnaire. Participants were required to fill up an informed consent form attached to the questionnaire before completing the questionnaire. All participants were asked to answer all the questions without referring to any source of information related to PFME to obtain honest responses. Those who submitted a complete response were provided with an infographic pamphlet regarding PFME. It was to appreciate them for participating in the study and as a strategy to obtain the required ample size.

The data was collected using a self-reported questionnaire. The questionnaire consisted of three sections. The first section was demographic data, followed by an awareness of PFME with four questions and knowledge of PFME comprising eight questions. Questions related to awareness of PFME were extracted from a study done by Hill et al. (2017), while questions related to knowledge of PFME were drawn from a previous study by Temtanakitpaisan et al. (2020). The properties of the questionnaires were evaluated sufficiently in previous studies (Temtanakitpaisan et al., 2020; Hill et al., 2017).

In the awareness questionnaire, those who answered "Yes" to the first question proceeded to complete all questions regarding the awareness of PFME. The remaining questions were YES / NO questions and one best-answer question. The researcher then calculated the frequency of each response. While in the knowledge questionnaire, participants who answered "Yes" to the first question proceeded to answer the remaining questions related to knowledge of PFME. The remaining questions were multiple choices questions where the participants had to identify the correct answer for each question. The researcher calculated the frequency of questions with a correct answer in each section.

Data Analysis

Descriptive statistics were used to analyse the demographic data, awareness, and knowledge of PFME. The Chi-square test was used to examine the association between awareness and knowledge. A *p*-value of less than 0.05 was considered statistically significant.

Ethical Consideration

Ethical approval of this study was granted by Kulliyyah Postgraduate and Research Committee (KPGRC; No. 4/2021). Participants' information and responses were kept confidential and only used for research purposes.

Results:

A total of 133 respondents participated in the survey. The mean age of participants was 22.19 (±1.21) years, with 90% of them aged 20 to 26 years old (Figure 1). Of these, 99.2% were Malay, while 1% were Chinese. Respondents' level of study was varied. 99% of respondents were undergraduate students, and the remaining 1% were postgraduate students (Figure 3).

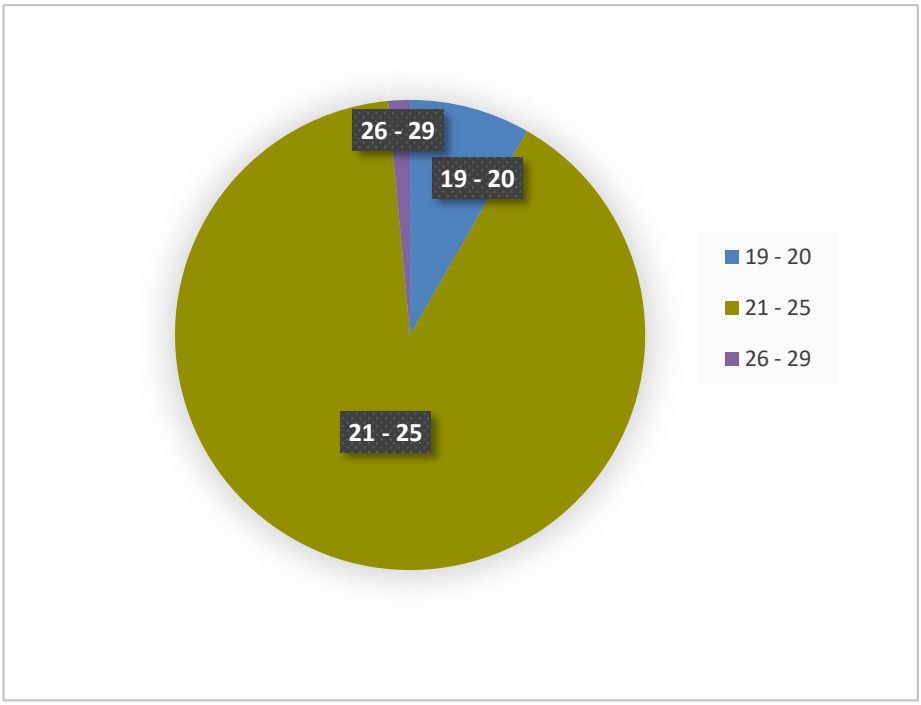

Figure 1: Age of respondents

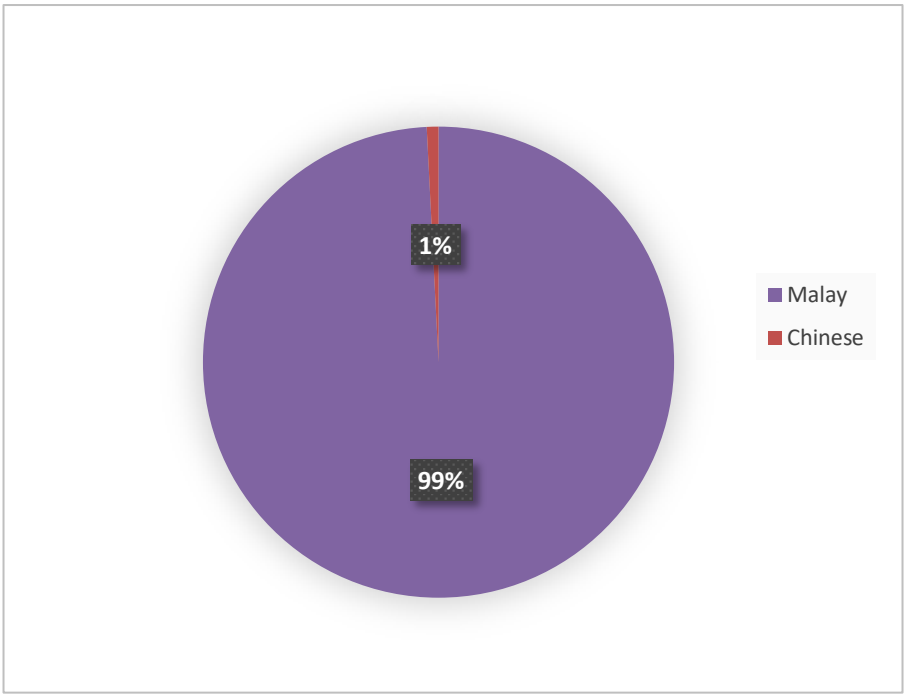

Figure 2: Race

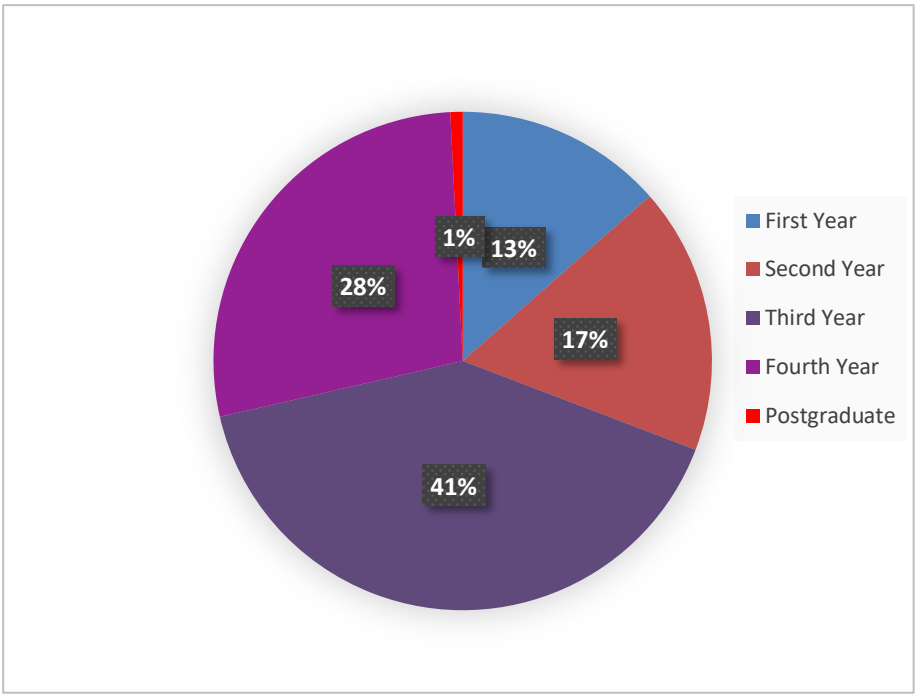

Figure 3: Year of study

Awareness and knowledge of pelvic floor muscles exercises

The results revealed that less than half of the respondents had answered "Yes" to the first question in the awareness section. Among those who were aware of PFME, 76.6% acknowledged that PFME is related to pelvic health, 14.1% were familiar with PFME, and 7.8% were aware of treatments provided in pelvic floor rehabilitation. 39.1% of the respondents had answered 'Yes' for all questions in this section, indicating that most respondents were not completely aware of PFME. Regarding the factors of low level of awareness, lack of exposure to PFME was found to be the leading cause (71.9%), followed by the negligence of the participants to know about PFME (15.6%). Surprisingly, PFME was also considered taboo to some respondents (12.5%). The responses are displayed in Table 1.

As for knowledge of PFME, less than 50% of the respondents answered 'Yes' for the first question in the knowledge section (Table 2). Out of 57 respondents who answered 'Yes', 15.8% of them managed to recognize the pelvic floor muscles, 21.1% acknowledged the breathing technique when performing PFME, 17.5% had knowledge of the PFME techniques, 38.6% were able to determine the appropriate posture for PFME, 45.6% and 31.6% understood the advantages and disadvantages of PFME. In addition, 64.9% understood that PFME is safe during pregnancy. The frequency of respondents who could answer all the questions correctly was low, only 33.6%. In this study, the respondents claimed that the health providers was the primary source of knowledge for PFME, followed by media, 50.9% and 35.1%, respectively.

Association between knowledge and awareness of pelvic floor muscles exercises

A Chi-square test of independence was used to determine the association between awareness of PFME and knowledge of PFME. All relevant assumptions for the Chi-square test were met. As portrayed in Table 3, this study found a statistically significant association between awareness and knowledge of PFME ($p \leq 0.001$). This finding implied that most of the respondents who were aware of PFME had knowledge of PFME.

Table 1 Awareness of PFME among respondents who possessed an awareness of PFME (N= 64)

Awareness on PFME	n (%) Yes	n (%) No
Are you aware that PFME is included in the scope of practice in pelvic health?	49 (76.6)	15 (23.4)
Are you familiar with PFME?	9 (14.1)	55 (85.9)
Are you aware of these treatments in pelvic floor rehabilitation?	5 (7.8)	59 (92.2)
Factors of low awareness of PFME		
Lack of exposure to PFME	46 (71.9)	-
Negligence by the participants	10 (15.6)	-
Perception of taboo	8 (12.5)	-

Note: PFME = Pelvic floor muscles exercise.

Table 2 Knowledge of PFME among respondents who possessed had knowledge of PFME (n= 57)

Questions on Knowledge of PFME	n (%) Correct answer	n (%) Incorrect answer
Which area of muscles do you think involves in exercising the pelvic floor muscles?	9 (15.8)	48 (84.2)
When exercising the pelvic floor muscles, how should you breathe?	12 (21.1)	45 (78.9)
While exercising the pelvic floor muscles, do you think you should contract your abdominal muscles together?	10 (17.5)	47 (82.5)
What is the proper posture while exercising the pelvic floor muscles?	22 (38.6)	35 (61.4)
The benefit of exercising the pelvic floor muscles is	26 (45.6)	31 (54.4)
The disadvantage of exercising the pelvic floor muscles is	18 (31.6)	39 (68.4)
Can pregnant women exercise the pelvic floor muscles?	37 (64.9)	20 (35.1)
Source of information on PFE		
Family members	3 (5.2)	-
Friends	5 (8.8)	-
Healthcare providers	29 (50.9)	-
Media outside hospital	20 (35.1)	-

PFME = Pelvic floor muscles exercise

Table 3 Association between knowledge and awareness of PFME

	Knowledge of PFME				
	Yes (%)	No (%)	X^2	df	*p*-value
Awareness on PFME					
Yes	50 (78.1)	14 (21.9)	0.0778	1	0.001
No	7 (10.1)	62 (89.9)			

df; degree of freedom

Discussion:

This study found that less than half of the respondents had perceived awareness of PFME. Previous studies done by Berzuk and Shay (2015), Hill et al. (2017) and Temtanakitpaisan et al. (2020) also reported similar findings, in which the awareness of PFME was low among women especially including young and nulliparous women. Most of our respondents who claimed to be aware of PFME were unfamiliar with the exercises and overlooked the role of PFME in pelvic floor management. The probable reason for this finding is due to lack of exposure to PFD as the incidence of PFD is not common in this population compared to those who are multiparous and the ageing population, which causes the PFME not to be widely acknowledged by this population. In an earlier study, the researchers reported that young women were disinterested in PFME as they were unaware of the reason o importance of performing PFME and believed such exercises were unnecessary for the young population (Dickinson & Briscoe, 2017).

Regarding the knowledge of PFME, this study found that most respondents had no knowledge of PFME. Those who perceived to have knowledge of PFME had little understanding of PFME, as the percentages of the respondents who provided a correct answer for all the questions were only 33.6%. The finding of this study is supported by previous studies by Liu et al. (2019) and Berzuk and Shay (2015). The probable explanation for this finding is that young women, particularly the nulliparous population, may feel uncomfortable seeking information and advice related to gynaecological matters due to the sense of shame of others' perception (Fante et al., 2019). In addition, some individuals claim that the pelvic region is an embarrassing or a sensitive topic (Pintoz-Diaz et al., 2019). Besides, as mentioned previously, this population may be less susceptible to PFD, resulting in indifference to acknowledge the importance of PFME.

In this study, most respondents believed that healthcare professionals should be the primary source of information for PFME. At the same time, family members and friends were considered less likely to be a source of information. A recent study also reported that women in Malaysia chose medical practitioners as their primary source of PFME information (Muhammad et al., 2019). The findings demonstrated that this population preferred to seek information from the reputable sources and trained personnel. Qualified health professionals for PFME include gynaecologists, physicians, nurses, and physiotherapists (Abhyankar et al., 2020). Their experience managing PFD could be the best for reliable health care information. Practically, individuals with PFD are often referred to physiotherapists for PFD rehabilitation. These individuals will be educated, guided, and trained with the appropriate techniques of PFME (Rodas & Garcia-Perdomo, 2018). Moreover, many PFME programmes are conducted by physiotherapists (Fernandez et al., 2021; Hagen et al., 2020; Wilson, 2015).

This study found that awareness of PFME and knowledge of PFME were significantly associated. The finding implied that respondents who declared awareness of PFME had knowledge of PFME, while those unaware of PFME had no knowledge of PFME. A population-based study also found that those women who lacked awareness of PFME had insufficient knowledge of PFME (Hill et al., 2017). According to Berzuk and Shay (2015), awareness and knowledge of PFME could be improved through a 'Pelvic Floor Health and PFME Education' programme. Those who were aware and had knowledge of PFME positively affected individuals' care-seeking behaviour.

This study has a few limitations. Firstly, the scope of this study was limited to female students of IIUM Kuantan who were unmarried and had never given birth. Hence, the findings may not reflect the entire young women population. Secondly, this study used closed-ended questionnaires, which limited the ability to explore the depth of PFME knowledge and awareness among this study population. Third, the study duration is relatively short due to the logistical issue, which limits researchers' ability to employ a multi-centre study design.

Implication to Practice

Knowledge of PFME is crucial in PFD prevention and management (Hill et al., 2017; Liu et

al., 2019; Temtanakitpaisan et al., 2020). The findings of this study highlight the necessity to plan and implement an appropriate approach to disseminate information related to PFME, as most of the nulliparous respondents in this study were unaware of PFME and had no knowledge of PFME. Thus, it relevant that a population like this be well informed of PFME to promote the incidence of PFD in young women and as a medical issue that warrants public health attention. The health policy marker needs to determine the appropriate approach to do this.

Conclusion:

The number of respondents who had knowledge and awareness of PFME was relatively low, less than 50%. Most of those who possessed an awareness of PFME had less ability to embrace the importance of PFME, and those who possessed knowledge of PFME had a low understanding level of PFME. The association between knowledge and awareness of PFME was statistically significant, indicating that those who were aware of PFME most likely had PFME knowledge. These results suggest a need to initiate a health education programme related to PFME that is reachable and accessible to a diverse women population.

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The Knowledge and Awareness of Obesity and Its Risk of Cancer Among IIUM Undergraduate Students

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Abstract:

Introduction: Obesity, a condition of excessive adipose tissue accumulation, has been elucidated as a common risk factor in many types of cancer by previous studies. Thus, the purpose of this study was to investigate IIUM Kuantan undergraduates' knowledge and awareness of obesity and its risk of cancer. **Methods:** A cross-sectional study using convenience sampling was conducted using a validated, self-administered online questionnaire that comprised (1) sociodemographic characteristics and questions on (2) knowledge and (3) awareness of the topic. 133 respondents participated in the survey. **Results:** The data were analysed using SPSS IBM Statistics 26. The study revealed that most respondents have moderate knowledge (n=67, 50.4%) and awareness (n=79, 59.4%) regarding obesity and the risk of cancer. Significant differences in knowledge level were identified using the Kruskal-Wallis test between respondents' gender ($p=0.017$) and Kulliyyah ($p<0.001$). A fair positive correlation between knowledge and awareness of obesity and its risk of cancer among respondents was found by the Spearman coefficient ($r=0.463$, $p<0.001$). This implied that moderate knowledge on the topic also contributes to a moderate level of awareness. **Conclusion:** Most respondents were moderately aware of and acknowledged the potential cancer risk in obesity. The respondent's level of knowledge of the topic may have been influenced by their associated gender and kulliyyah. Nonetheless, more awareness needs to be spread among the students regarding the potential for cancer incidence in people with obesity and excessive adiposity.

Keywords: Obesity, Risk of cancer, Knowledge, Awareness, Correlation

Introduction:

Obesity, a disease of excessive adiposity, has been one of the most concerning comorbidities in current times (Panuganti et al., 2021; Purnell, 2000). In Malaysia, the 2019 National Health and Morbidity Survey (NHMS) found that out of more than 14, 000 individuals, more than half were overweight or obese, with 30.4% being overweight and the remaining 19.7% being obese (Perialathan et al, 2020). Overweight and obesity rates have increased significantly since the NHMS 2015, with 30.0% and 17.7%, respectively (Institute of Public Health, 2015). With current dietary trends like boba milks and junk foods (Goh et al., 2020) that are high in sugar and unsaturated fats and sedentary lifestyle trends among Malaysian youths and adults, the percentage may potentially remain inclined, simultaneously exposing obese populations to obesity-associated complications such as cancer. This dietary trend is also observable among IIUM Kuantan students, along with an alarming 42.5% reported prevalence of obesity and overweight among IIUM Kuantan students (Fauzy et al., 2020) which has sparked concern about the need to provide the students with adequate insights that they may be exposed to the underlying risk for cancer with increasing body fat storage.

Multiple studies have found that obesity has become a common risk factor in many cancers such as colorectal, endometrial, and pancreatic cancer as more correlations between obesity and cancer have been

elucidated (Avgerinos et al., 2019). These risk factors include circadian rhythm dysregulation (Gan et al., 2018) and an imbalanced diet (Sung et al., 2011). A recent review by Avgerinos et al. (2019) also compiled several mechanisms of cancer induction in obesity, such as chronic inflammation, anomalies in the secretion of insulin and insulin-like growth factor (IGF) and sex hormone biosynthesis, as well as possible therapeutic approaches such as lifestyle change, insulin-regulating drugs, and bariatric surgery. However, this fact is commonly overlooked. This was seen based on past health surveys, which concluded a relatively low level of awareness of the potential of obesity-associated cancer among Malaysian adults (Seng et al., 2018; Yusof et al., 2014; Schliemann et al., 2020; Su et al., 2013). Thus, this research aspired to identify the level of knowledge and awareness of obesity and its link to cancer risk among IIUM Kuantan undergraduates, sociodemographic factors that may influence the level of knowledge and awareness, and the correlation between knowledge and awareness on the topic.

Methodology:

Study Design and Study Population

The study has been conducted as a cross-sectional study in the Kuantan campus of the International Islamic University Malaysia (IIUM). This type of study was chosen as it can be conducted on a specific population at a single point in time (a short period). The research was carried out between April 18 and April 30, 2022. The selected population were IIUM Kuantan undergraduates.

Sampling Method

The convenience sampling method was used in this study, in which the study population was randomly selected among IIUM Kuantan students who were available to participate. The self-administered questionnaires were disseminated via a Google Form link.

Questionnaire Design and Data Collection

The items of the questionnaire were constructed based on the literature review of this study. The questionnaire was divided into three sections. The first section was on participants' sociodemographic characteristics, such as gender, discipline of study, year of study, participant's height and weight, self-history, and familial history of obesity or cancer. Self-reported histories of obesity and cancer indicated whether the respondents had previously suffered from either of these conditions prior to this study.

The second section of the questionnaire consisted of nine items that evaluated participants' knowledge of obesity and its risk of cancer based on three domains: (1) mechanism and metabolic pathway of cancer induction in obesity, (2) common risk factors of obesity and cancer, and (3) possible therapeutic approaches. This section provided the answers "true," "false," and "not sure." The correct answer was awarded two marks, while the incorrect and "not sure" options were given zero mark.

The third section also contained nine items that assessed the participants' awareness of obesity as a risk factor for cancer based on the same domains as the second section. In the second and third sections, a mixture of positive and negative items were constructed to reduce the response bias's occurrence. A Likert scale was utilized, which consisted of as follows: '5 = Strongly Agree', '4 = Agree', '3 = Neutral', '2 = Disagree' and '1 = Strongly Disagree. 'Strongly Agree' and 'Agree' options carried 2 marks, while 'Neutral', 'Disagree' and 'Strongly Disagree' carried a zero mark. Reverse coding is done for the negative items.

Inclusion and Exclusion Criteria

The study included all IIUM Kuantan undergraduate students from six Kulliyyah who voluntarily participated in this study. Kulliyyah of Medicine (KOM), Kulliyyah of Dentistry (KOD), Kulliyyah of Pharmacy (KOP), Kulliyyah of Allied Health Sciences (KAHS), Kulliyyah of Nursing (KON), and Kulliyyah of Science (KOS) were among those included. Respondents were both males and females and of all nationalities. Years 1-4 and Year 5 (from KOM and KOD students) were included in the study. The study excluded postgraduate students and IIUM Kuantan undergraduate students who were on study leave. The participants were also reminded of the eligibility criteria for the survey's participation before the first section of the questionnaire.

Content Validation and Pilot Study

Six experts (N=6) among medical doctors from Lukut District Health Clinic, Port Dickson District Health Office, Raja Perempuan Zainab II Hospital, and Slim River Hospital were involved in

the content validation of the questionnaire. Items that received a content validity index (CVI) value of 0.7 and above were retained for the pilot study. Then, eighteen respondents were recruited for the pilot study. This study was carried out to evaluate the questionnaire's internal consistency and reliability.

Data Analysis

Data analysis was done using IBM SPSS Statistics version 26. The normality of the raw data was checked before proceeding to any statistical analysis by checking the histogram, comparing means, and calculating skewness. The evaluation of the level of knowledge and awareness of IIUM Kuantan undergraduate students regarding obesity and its risk of cancer was done using a descriptive frequency table.

For the determination of a possible relationship between sociodemographic factors and knowledge and awareness of obesity and its risk of cancer among IIUM Kuantan undergraduates, Kruskall-Wallis and Mann-Whitney U tests were used. The determination of the association between knowledge and awareness of obesity and its risk of cancer among IIUM Kuantan undergraduate students was done using correlation analysis and the Spearman correlation coefficient. Table 1 displayed the scoring method used to evaluate the level of knowledge and awareness based on an adjusted Bloom's cut-off point to divide the proportion of marks earned into three categories: good, moderate, and poor (Ramli et al., 2018).

Table 1 Categorization for Level of Knowledge and Awareness of Obesity and its Risk of Cancer among IIUM Kuantan Undergraduate Students (adapted from Ramli et al. (2018).

Percentage (%)	Knowledges	Awareness	Level of knowledge and awareness
80-100	12-18	25-36	High
60-79	6-11	12-24	Moderate
≤ 59	0-5	0-11	Poor

Results:

From 3,112 articles collected, seven articles met the eligibility criteria. The articles are two randomized controlled trials (RCTs) double-blind placebo-controlled (RCTs-PC), one RCT and one open-RCT, one RCT double-blind crossover (RCT-C), one open clinical trial, and one prospective case study. Two articles which had no placebo control group were excluded from the meta-analysis.

Content Validation and Reliability

One item in the knowledge and awareness section with I-CVI values of 0.75 and 0.50, respectively, was revised and removed from the questionnaire. The remaining nine items in both the knowledge and awareness sections were kept as the CVI values obtained were 0.70 and above. The Cronbach's alpha values for the knowledge and awareness sections were acceptable with 0.756 and 0.791, respectively.

Scores of Knowledges and Awareness on Obesity and its Risk of Cancer

The evaluation of the level of knowledge and awareness of IIUM Kuantan undergraduate students regarding obesity and its risk of cancer has been identified as the first objective of this study (Table 3). For knowledge scores, the frequency of respondents obtaining the score "moderate" was the highest (n=67, 50.4%) compared to the respondents obtaining the score "high" (n=57, 42.9%) and "poor" (n=9, 6.8%). This indicated that the level of knowledge and awareness of obesity as a risk factor for cancer among the respondents was largely moderate. The same trend can be seen in the awareness category, where respondents attaining a moderate score had the highest frequency (n=79, 59.4%) followed by those scoring "poor" (n=54, 40.6%). No respondents obtained a high score for the awareness section in this study.

Comparison of Sociodemographic Characteristics on Knowledge of Obesity and Its Risk of Cancer

The Mann-Whitney test indicated that there is a statistically significant difference between the level of knowledge of obesity and its risk of cancer between male (M=10.00) and female (M=10.00) respondents ($p = 0.017$) (Table 4).

Kruskall-Wallis test showed that there was a statistically significant difference between respondents' associated Kulliyyah and their level of knowledge on obesity and its risk of cancer ($p<0.001$),

Sociodemographic Characteristics of Respondents

Table 2. Sociodemographic Data of Respondents (n=133)

Sociodemographic characteristics	Frequency	Percentage (%)
Gender		
Male	18	13.5
Female	115	86.5
Kulliyyah		
KOM	12	9.0
KOD	9	6.8
KOP	25	18.8
KAHS	65	48.9
KON	10	7.5
KOS	12	9.0
Level of Study		
Year 1	29	21.8
Year 2	30	22.6
Year 3	64	48.1
Year 4	9	6.8
Year 5	1	0.8
Body Mass Index (BMI)		
Below 18.5 (Underweight)	34	25.6
18.5 to 24.9 (Normal)	78	58.6
25.0 to 29.9 (Overweight)	11	8.3
30.0 to 34.9 (Obesity class I)	7	5.3
35.0 to 39.9 (Obesity class II)	3	2.3
Self History of Overweight, Obesity and Cancer		
None	99	74.4
Underweight (BMI below 18.5)	1	0.8
Overweight (BMI 25.0 to 29.9)	27	20.3
Obesity (BMI 30 to 40)	11	8.3
Cancer	0	0.0
Familial History of Health Conditions		
None	47	35.3
Overweight (BMI 25.0 to 29.9)	62	46.6
Obesity (BMI 30 to 40)	27	20.3
Cancer	24	18.0
Household Income		
B40 (RM 4850 and below)	54	40.6
M40 (RM 4851 to RM10,970)	57	42.9
T20 (RM 10,971 and above)	22	16.5

Table 3. Categories of Knowledge Scores and Awareness Scores on Obesity and Its Risk of Cancer.

Categories	Frequency	Percentage
Knowledge scores		
High	57	42.9
Moderate	**67**	**50.4**
Poor	9	6.8
Awareness scores		
High	0	0.0
Moderate	**79**	**59.4**
Poor	54	40.6

Note: The total of highest frequency from each category is highlighted in bold.

which was between respondents from Kulliyyah of Science (M=8.00) and Kulliyyah of Pharmacy (M=10.00), Kulliyyah of Allied Health Sciences (M=10.00) and Kulliyyah of Medicine (M=12.00). Respondents from Kulliyyah of Medicine scored higher in the knowledge section (M=12.00), in contrast to respondents from Kulliyyah of Dentistry (M=6.00) which had low scores in the same section. Nonetheless, there was no statistically significant difference between age, level of study, BMI, self, and familial history of overweight and obesity, familial history of cancer, and household income in terms of respondents' level of knowledge on obesity and its risk of cancer.

Comparison of Sociodemographic Characteristics on Awareness on Obesity and Risk of Cancer

According to the Kruskall-Wallis test, there was no statistically significant difference between respondents' associated Kulliyyah, level of study, body mass index (BMI), and household income in

Table 4. Comparison between Sociodemographic Characteristics and Knowledge Scores (n=133)

Sociodemographic characteristics	Median	*p*-value
Gender		
Male	10.00	0.017*
Female	10.00	
Kulliyyah		
KOM	12.00	p<0.001*
KOD	6.00	
KOP	10.00	
KAHS	10.00	
KON	12.00	
KOS	8.00	
Level of Study		
Year 1	10.00	0.543
Year 2	10.00	
Year 3	10.00	
Year 4	10.00	
Year 5	-	
Body Mass Index (BMI)		
Below 18.5 (Underweight)	10.00	0.316
18.5 to 24.9 (Normal)	10.00	
25.0 to 29.9 (Overweight)	10.00	
30.0 to 34.9 (Obesity class I)	8.00	
35.0 to 39.9 (Obesity class II)	12.00	
Self History of Overweight and Obesity		
Yes	10.00	0.494
No	10.00	
Familial History of Overweight and Obesity		
Yes	10.00	0.053
No	10.00	
Familial History of Cancer		
Yes	10.00	0.343
No	10.00	
Household Income		
B40 (RM 4850 and below)	10.00	0.759
M40 (RM 4851 to RM10,970)	10.00	
T20 (RM 10,971 and above)	9.00	

Note: (*) Statistically significance is shown.

terms of respondents' level of awareness on obesity and its risk of cancer.

Meanwhile, there was no statistically significant difference between the respondents' gender, self, and familial history of overweight and obesity, as well as familial history of cancer, and their level of awareness of obesity and its risk of cancer, according to the Mann-Whitney U test.

Correlation Between Knowledge and Awareness on Obesity and Risk of Cancer

The Spearman's correlation coefficient's value was 0.463 (p<0.001), indicating that a statistically significant, fair positive correlation was observed. Table 5 displays the correlation analysis result between knowledge and awareness.

Table 5. Correlation between Knowledge Scores and Awareness Scores on Obesity and Its Risk of Cancer (n=133)

Variables	Correlation coefficient, *r*	*p*-value
Knowledge scores-Awareness scores	+0.463	<0.001**

Note: *r*-value which is positive show a fair positive correlation; (**) p-value is statistically significant (<0.01)

Discussion:

Firstly, the study aimed to evaluate the level of knowledge and awareness of IIUM Kuantan undergraduate students regarding obesity and its risk of cancer. Most of the respondents displayed a moderate level of knowledge regarding the topic of obesity and its risk of cancer. None of the respondents also received high scores for the awareness section of the questionnaire. A previous study by Ramya et al. (2019) also reported that medical students possessed moderate knowledge on the relationship between obesity and breast cancer. This outcome was attributed to the fact that the students undertaking medical-related courses may have been exposed to information related to breast cancer, such as a risk factor, in their learning module. Thus, it can be concluded that exposure to information regarding obesity as a risk factor for certain types of cancer can contribute to the knowledge and awareness level of the mentioned topic.

It was discovered that there was a statistically significant difference in the level of knowledge of obesity as a risk factor for cancer between females and men ($p = 0.017$). This suggested that each gender may have responded differently to the prompted questions, which led to differences in the knowledge section's score obtained by them. This result was similar to the Lin Loo et al. (2013) research finding that gender contributed to a significant difference in terms of knowledge of cancer. The study highlighted the possibility of females being more actively engaged in the actions of cancer detection compared to males, especially in cancers that are highly associated with women, such as breast and cervical cancer, where awareness campaigns for these cancers are frequently conducted.

Significant differences in knowledge levels can also be found among the respondents' kulliyyah ($p< 0.001$). According to this result, most of the respondents receiving high scores were from the Kulliyyah of Medicine (KOM). This is due to the topic's relevance to their discipline, as opposed to non-health science and non-medical science students like Kulliyyah of Science. This finding was also supported by the studies by Ramya et al. (2019) and Lin Loo et al. (2013) on medical and science students' higher knowledge levels of breast cancer risk factors and cancer in general, respectively, compared to non-medical and non-science students. The study by Ramya et al. (2019) stated that the medical students' sources of information on breast cancer were largely attributed to the education provided by the university, as reflected in the frequency of 42% (n=106) of 116 respondents compared to that of non-medical students, which was only 4% (n = 10). Meanwhile, the study by Lin Loo et al. (2013), which examined the cancer knowledge, awareness, and attitude of Malaysian undergraduate students regarding cancer, testified that higher knowledge was identified among science students in comparison to non-science students with respect to knowledge, awareness, and attitude toward cancer. The syllabus provided by the respondents' university was crucial in influencing the level of knowledge of breast cancer due to the different amount of exposure to the issue received by both medical and non-medical students (Ramya et al., 2013; Lin Loo et al., 2013). Nevertheless, there was no statistically significant difference in regard to the respondents' level of knowledge on obesity and its risk of cancer between level of study, Body Mass Index (BMI), self and familial history on overweight and obesity, familial history on cancer as well as household income.

It has been observed that there was no significant differences in terms of awareness of obesity and its risk of cancer among all sociodemographic groups were identified. This result contradicted the outcome of the study by Schliemann et al. (2020), Lin Loo et al. (2013), Hooper et al. (2018) and Seng et al. (2018) in which a significant difference between genders was found in terms of awareness of cancer signs and symptoms, with females scoring higher in terms of awareness of cancer risk factors. Females were also more exposed to the awareness campaigns targeting female-dominated cancers like cervical cancer, which are among the most actively promoted in specified localities. The type of academic discipline (medical or non-medical) was also a factor in cancer awareness, as evidenced by the significant difference in cancer awareness between Malaysian undergraduate students of science and non-science faculties (Lin Loo et al., 2013).

Finally, a moderately positive correlation has been found between knowledge and awareness of obesity and its associated risk of cancer among IIUM Kuantan undergraduates. A probable factor may be that sufficient knowledge can result in positive, elevated awareness on the issue, whereas poor awareness of obesity as a cancer risk factor may be a result of a lack of knowledge on the topic. A positive correlation indicates that the two variables, knowledge, and awareness, moved in the same direction, with an increment in knowledge increasing awareness.

Conclusion:

In conclusion, the study targeted to examine the level of knowledge and awareness of obesity and its risk of cancer among undergraduate students at IIUM Kuantan Campus. Most respondents among IIUM Kuantan undergraduates were aware of the role of obesity as a cancer risk factor. The differences in respondents' affiliated gender and kulliyyah may have contributed to the level of knowledge of obesity as a risk factor for cancer, as significant differences have been identified between these sociodemographic groups and the level of knowledge. The findings also show a significant positive correlation between the level of knowledge and awareness about obesity and the risk of cancer. Nonetheless, more efforts must be made to raise awareness of the role of obesity in the incidence of cancer for the information to reach a larger number of people, such as public populations.

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The Trends in Paediatric Speech Audiometry: A Scoping Review

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Abstract:

Speech tests are essential assessment tools of auditory abilities for both adults and children. A scoping review was conducted with the aim to explore possible changes in materials and methods of paediatric speech tests between 1980 and 2019. Thirty-eight articles were selected, and the extractions of information were made related to the name of the paediatric speech test, country of origin, year of publication, language used in the speech test, the target age range for the speech test, and the procedural parameters. Exploration of the articles provided insights into current trends of paediatric speech test applications that should be taken into careful consideration when developing a new speech test for children.

Keywords: *paediatric, speech test, scoping review, speech test design, material, method*

Introduction:

Speech audiometry is used to assess and diagnose peripheral and central hearing impairments, verify, and monitor the rehabilitation outcomes of amplification and for research applications. Earlier speech tests focused on adults and later, tests for children were developed. Paediatric speech audiometry is important as it predicts the effect of hearing impairments on the child's speech, language, and cognitive abilities. According to Theunissen et al. (2009), the development of a speech test requires consideration on various aspects as it will influence the accuracy of the tests results by variables other than the hearing impairment. These variables include both internal and external factors such as the child's age and cognitive skills and the test's type of response format, material and method of testing (Kirk et al., 1997). Moreover, it is impossible to make a valid comparison between these tests because the differences are attributed by many factors such as the types of material, procedure, or the participants of the study. Thus, the aim of this scoping review was to explore the material and methods of paediatric speech tests between 1980 and 2019.

Materials and Methods:

To ensure a broad range of results were obtained, relevant studies on the paediatric speech tests were systematically searched through four online databases namely the Cumulated Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrieval System Online (Medline), PubMed, and Scopus. A research string of keywords with Boolean operator, truncation, and wildcards where applicable was used to yield desired results. The precise keywords were *speech test*, *speech recognition test*, *speech perception test*, *speech audiometry*, *speech intelligibility test*, *paediatric*, *paediatrics*, *child*, and *children*. The search was limited to relevant studies between 1980 and 2019. Additional potential articles were also searched through the reference lists of the screened articles.

In the screening phase, duplicate articles were excluded after reviewing the title of all articles retrieved in the identification phase. The articles were omitted if they were related to speech tests exclusively developed for adults, an unpublished article or published in languages other than English, a screening test, developed for a specific population (e.g., central auditory processing disorder (CAPD) or specific language impairment (SLI)) or a non-speech test. An independent review of the title, abstract and full texts were conducted by two reviewers that extracted the data from the final full-text manuscripts into a spreadsheet for further analysis. Any discrepancies on the data extracted were clarified through discussion. The extractions were made based on key information which included the name of the paediatric speech test, country of origin, year of publication, language used in these speech test, the target age range for the speech test and procedural parameters (e.g., test format, method of response, type of speech stimuli, type of masker). The data was analyses using pivot tables to identify any trends and were summarized descriptively.

Results:

A total of 6293 articles were retrieved from the online databases search. After reviewing the title, 3594 articles were excluded. Searches through reference lists within the selected articles added 33 more articles. They were then reviewed together with the remaining 2699 articles. 50 articles were left for full-text analysis after reading the abstract. Based on the exclusion criteria, in the end, 38 articles were finally selected for further review. Figure 1 below shows a flow chart of the articles' review process.

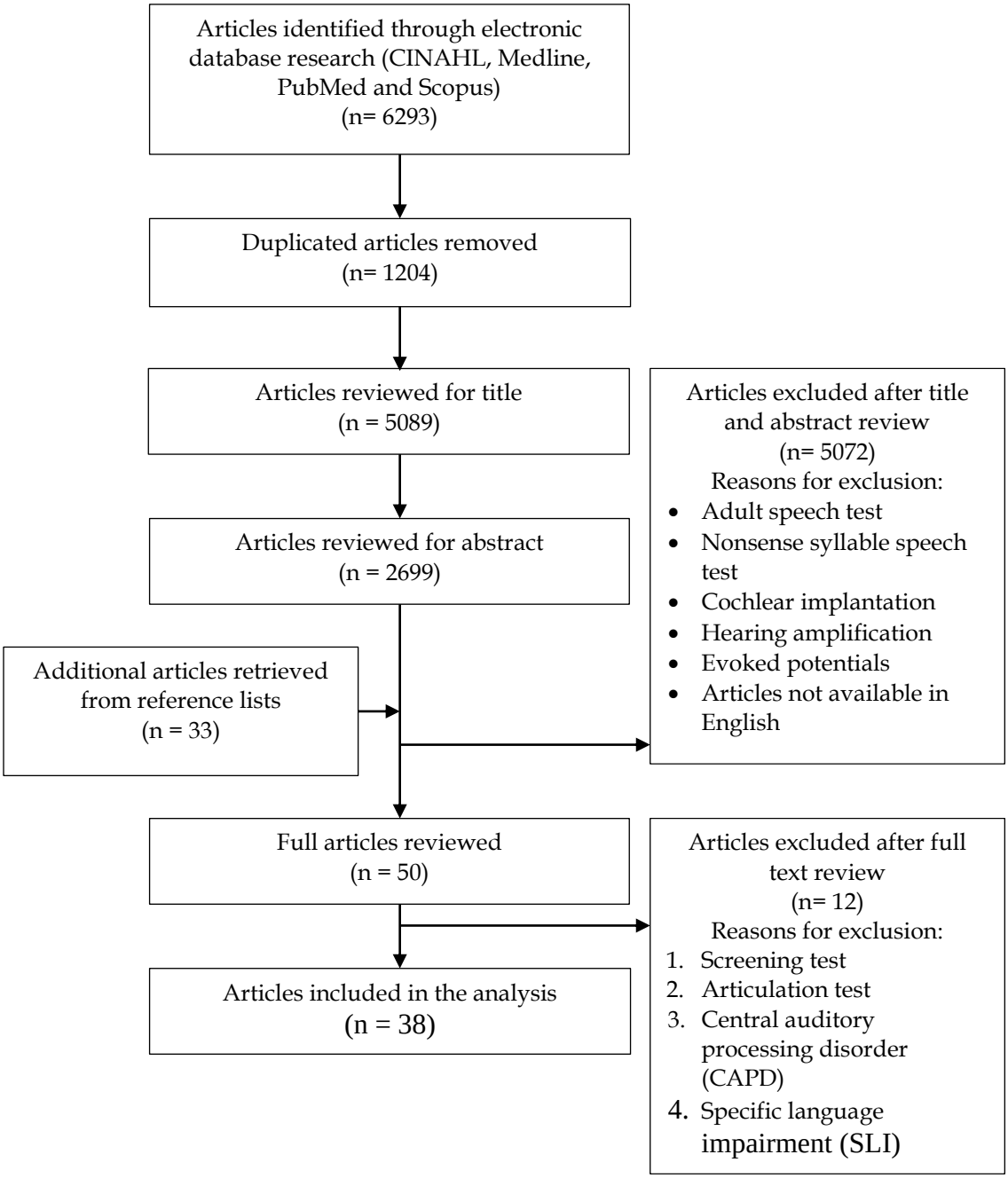

Figure 1 Flow chart of the review process

Paediatric speech tests articles identified within the four decades showed that 74% of the studies were published in the last decade (2010 to 2019) followed by 18% in the 1980s, 5% in the 1990s, and 3% in the 2000s. Even though there were 38 articles included in this scoping study, the total number of paediatric speech tests accounted for were 34. Four articles (the Mandarin Tone Identification Test (MTIT) (1), The Galker test (1) and the Pediatric Speech Intelligibility (PSI) test (2)) were studies on the same paediatric speech tests with different objectives. There were four speech tests that were not named. A list of all the included Paediatric Speech tests as well as its key characteristics is summarized in Appendix 1.

Countries of origin and the languages used in the speech tests

Altogether the paediatric speech tests originated from 18 countries. 38% were from Europe which included Sweden, the United Kingdom, Denmark, Greece (at 6% respectively), Germany, Romania, Belgium, Poland, and Norway (at 3% respectively). As for the language of the speech tests included in this review, the highest percentage was in English

at 32.4% followed by Mandarin and Cantonese at 8.8% respectively. Other languages recorded in the findings were Arabic, Greek, Swedish, Danish which accounted for 5.9% respectively, and German, Norwegian, Thai, Portuguese, Romanian, Spanish, Urdu, Polish, and Estonian languages that were 2.9% respectively.

The target age range for the speech tests

These speech tests were developed for children ranging from two to 17 years old. Age three is the minimum age of speech testing accounted for 28.9% of the total selected articles while the maximum age of six years old at 15.8%. However, three articles did not mention the intended age of the developed speech tests. Interestingly, two of these articles recruited adults as participants (Munthuli et al., 2015; Xi et al., 2012) even though the test was intended for the use for the paediatric population. While one article (Elberling et al., 1989) reported only about the development of new Danish speech material known as DANTALE with no participant recruited.

Test format and method of response

Three test formats were identified from the reviewed articles which were open-set (where the participants responded subjectively), closed-set (responded objectively) and multi response mode (both open and closed-tests format). Both closed-set and open-set each accounted for 41%, while 15% used the multi response mode. However, one article (3 %) did not specify the type of test format used in the procedure (named as THAI in this article) (Munthuli et al., 2015).

There were different methods of responses used across the selected articles. Verbal repetition and pointing to pictures or toys were reported at 41% each. Six of the 15% of the articles that applied the multi response mode, used verbal repetition, pointing to words or pressing button followed by 6% that used raise hand or pointing to pictures or words. An example of a speech test that allowed verbal repetition or verbal description, gesture, drawing, or writing was the Cantonese Spoken Word Recognition Test (CanSWORT) (Ng et al., 2016). While the raised hand and picture point was the procedure of the Urdu speech perception test (USPT) (Noor & Arif, 2018). The remaining 3% utilized a combination of verbal repetition, gesture, drawing or writing while another 3% did not specify the method of responses. Figure 2 illustrates the types of test format in relation to the method of responses in the selected articles.

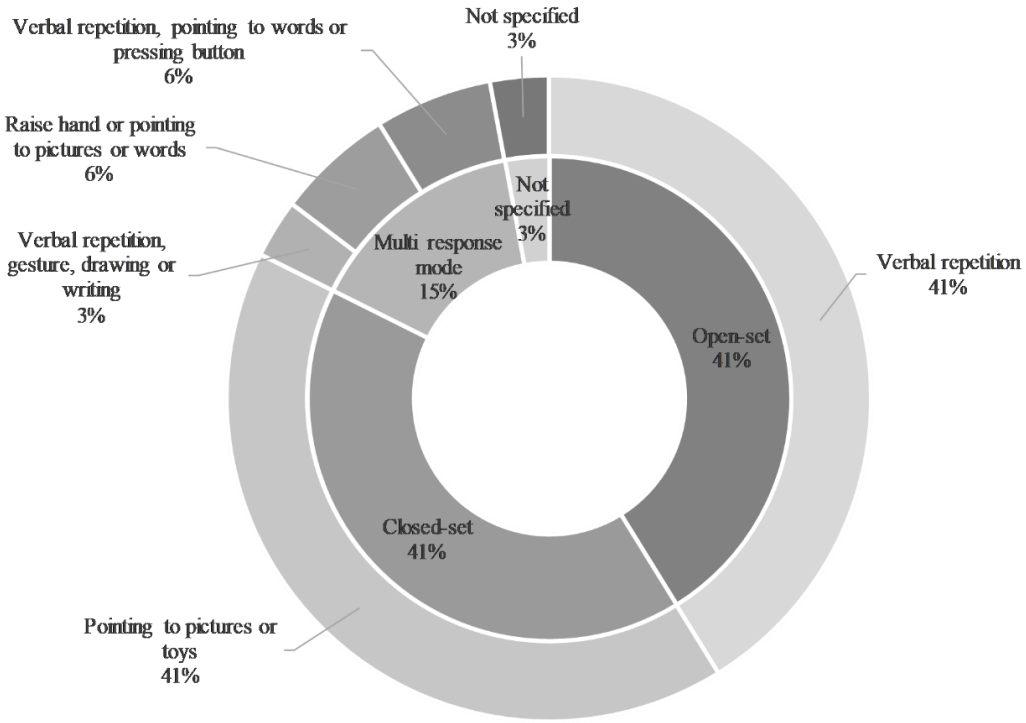

Figure 2 The percentage of method of response and test format used in the selected articles

Types and selection of the test stimuli

The types of speech stimuli in this review were divided into three different categories; words, sentences and a mixture of both words and sentences. The words were either mono-, bi- or tri-syllables and a few tests used word pairs with minimal difference in phonemes as stimuli. As for sentences, the sentence can vary from three-word utterances or have a length between three to 12 words or between five to eight syllables per sentence. However, many of those articles, especially for tests that selected the sentences from adult tests materials, did not specify the length of the sentences. Our findings revealed that 59% of the articles used words as the test stimuli followed by sentences at 35% and both words and sentences at 6%.

The test stimuli were selected from a variety of sources. 20% of the tests selected their stimuli by adapting the adult speech tests while 17% were obtained from spoken corpus and 15% selected theirs through adaptation of other paediatric speech tests. Meanwhile, test stimuli chosen from textbooks or stories recorded 12% and another 12% of the paediatric speech tests did not specify the sources of the test stimuli. The remaining speech tests obtained the test stimuli from written corpus (9%), frequency dictionary (6%), modification of adult test (6%) and dictionaries (3%) (Figure 3). The majority of the speech tests selected the stimuli from one of these sources, however, an exception were made for six tests: the Norwegian Hearing in Noise Test (NHINT-C) (Myhrum et al., 2016), the MTIT (Zhu et al., 2014, 2016), the Galker Test (Lauritsen et al., 2015, 2016), the CanSWORT (Ng et al., 2016), the Pediatric Spanish–English Speech Perception Task (Calandruccio et al., 2014) and the THAI (Munthuli et al., 2015) which selected stimuli from two different sources.

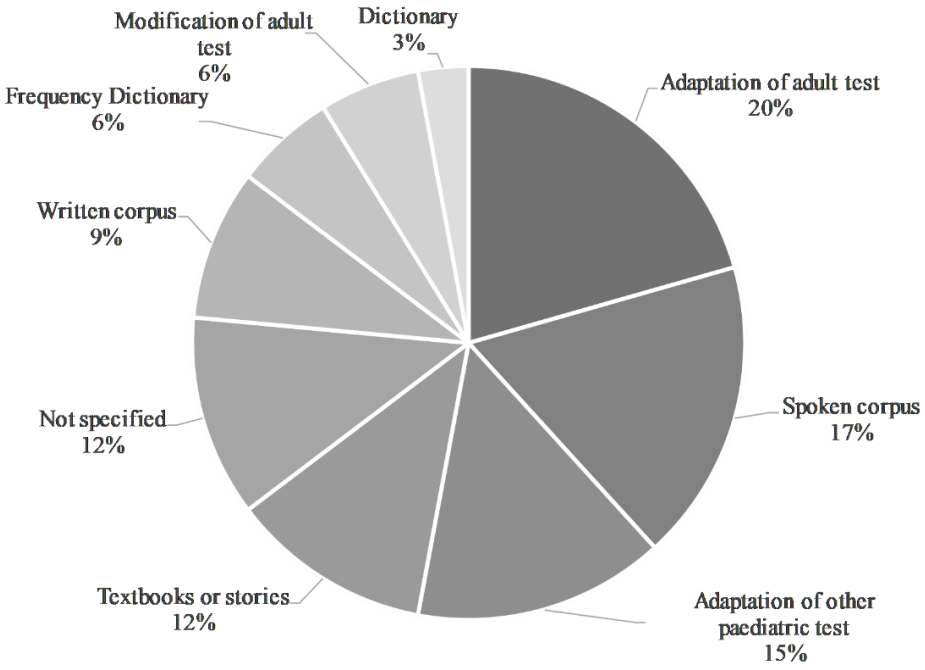

Figure 3 The percentage of sources for selection of test stimuli used in the reviewed paediatric speech tests

Masker

This review also looks at the masker used in these paediatric speech tests. The paediatric speech tests included were either conducted in quiet conditions or in noise conditions or in both test conditions (Figure 4). 41% of the tests were conducted with background noise, 32% were conducted in quiet conditions and 24% of the tests were conducted in both conditions. In the noise conditions, there were different types of masking noise applied namely; single talker sentence, two-talker babble, four-talker babble, multi-talker babble, amplitude modulated noise, broadband noise, steady state speech shaped noise, white noise, pink noise and cafeteria noise. The majority tests had only one masker except for two tests; the Paediatric Spanish–English Speech Perception Task (two-talker babble and steady state speech shaped noise) (Calandruccio et al., 2014) and the Toy Discrimination Test (two-talker babble and pink noise) (Lovett et al., 2013). Eight reviewed paediatric speech tests applied both quiet and noise procedural parameters; the Cantonese Hearing in Noise Test (CHINT-C) (Wong

et al., 2019), the Listen-Say test (Mentzer et al., 2018), the Hearing in Noise Test (HINT-Brazil) (Novelli et al., 2018), the Estonian words-in-noise (EWIN) test (Veispak et al., 2016), the NHINT-C (Myhrum et al., 2016), the Mealings, Demuth, Dillon, and Buchholz Classroom Speech Perception Test (MDDB CSPT) (Mealings et al., 2015), the Mandarin Pediatric Speech Intelligibility (MPSI) (Meng et al., 2013), and the IHR-McCornick Automated Toy Discrimination Test (ATT) (Palmer et al., 1994).

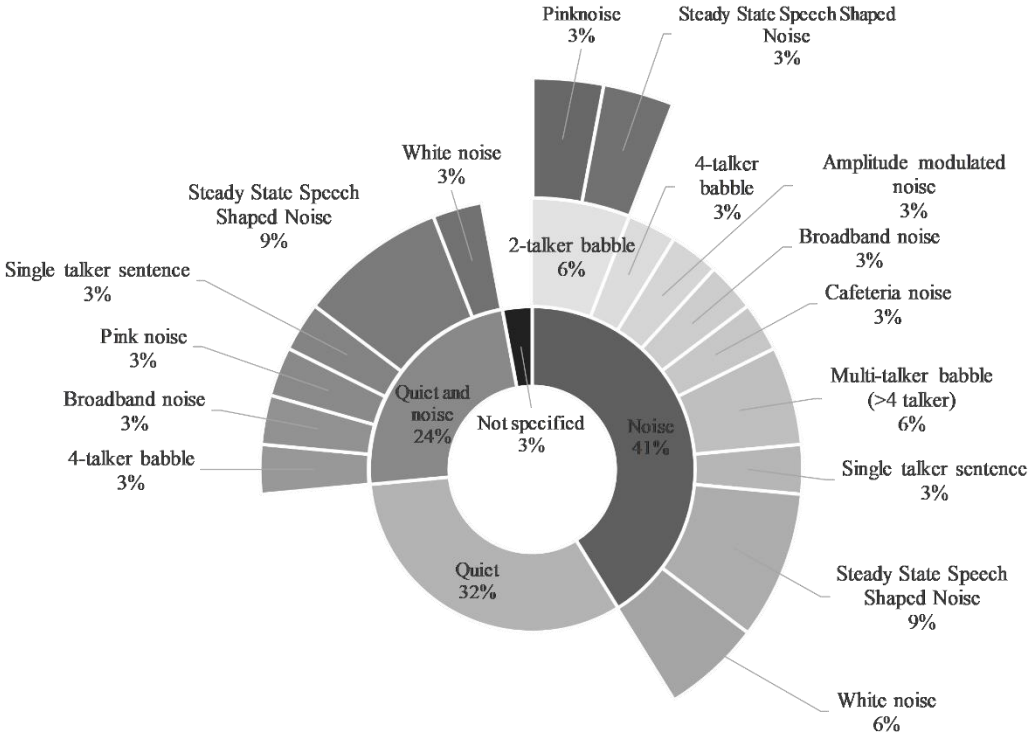

Figure 4 The proportion of maskers based on the test conditions of the paediatric speech tests

Discussion:

The 38 articles identified through this scoping review gave insights into the country of origin, language used, target age ranges, test formats, method of responses, types and selection of speech stimuli and masker of paediatric speech tests, between 1980 to 2019.

An increased trend in the development of paediatric speech tests in the year between 2010 to 2019 from various countries was observed. In the early decades, the speech tests were developed in Europe and the United States of America (USA). However, in the 2010s, other countries were found to have also developed speech tests in their own native language. This trend is in line with findings by Warzybok et al. (2015) and van Wijngaarden et al. (2002) that acknowledged that normal non-native listeners tend to have higher speech thresholds than the normal native listeners especially with background noise. Thus, speech recognition conducted in one's native language is recommended to prevent inaccurate diagnosis. Furthermore, the differences in the sound system across languages might also motivate the development of multilingual speech tests. One major limitation of "an unpublished article or published in other languages than English" as one of the exclusion criteria in this review was English might be overestimated as the major language used in the speech tests.

It was observed that the target age range for the selected paediatric speech tests in this review was somewhat consistent throughout the decades. Previous studies reported that children age 13 years old demonstrated similar speech recognition results as adults (Myhrum et al., 2016; Wong et al., 2019). Nevertheless, a few of the included paediatric speech tests applied target age ranges of 13 years old and older in order to evaluate the effect of age on speech understanding. Even though this review focuses on paediatric speech tests, adults' participation in some of the tests were either as evaluators for the familiarity of the test materials or to evaluate the homogeneity of the speech stimulus. As these tasks took time, adults'

responses are more accurate because they are considered to be less likely to be affected by fatigue and short attention spans (Case et al., 1982). Moreover, a previous study by Wagener and Kollmeier (as cited in Puglisi et al., 2021) found similar results between adult and children when lists equivalency was evaluated. Thus, assumptions can be made that results for adults are valid with children as well, in regards to lists equivalency.

With respect to test format, there were emerging trends observed across the decades. The closed-set was prominent in the 1980s, closed-set and multi response mode in the 1990s, followed by only open-set in the 2000s and closed-set and open-set in the 2010s. Previous studies have acknowledged that performance of participants in the open-set was different from those in the closed-set format as the former is more difficult than the latter (Clopper et al., 2006). This is because in the open-set task, the listeners respond by comparing what they heard with potential words in their lexical memory. On the other hand, listeners are presented with options or alternatives to choose as a response. However, the difficulty level for the closed-set test format can be increased by adding more alternatives or creating the options that closely resemble to each other (Theunissen et al., 2009). In terms of method of response, most of the speech tests employed pointing to pictures or toys in the 1980s but in the 2010s verbal repetition is more prevalent followed by pointing to pictures or toys and multi response mode.

Regarding types of speech stimuli, from 1980 to 1983, the focus was on the combination of words and sentences in these paediatric speech tests while only words dominated between 1984 and 2010. For 2012 and onwards, words and sentences were used as the major types of stimuli. Even though, sentences were more accurate to represent everyday communication, it required more cognitive demands especially in the elderly and child population (Nittrouer & Boothroyd, 1990). While words are still relevant as speech stimuli because it minimizes the effect of working memory and fatigue on children and elderly and can be administered faster than sentences (Mendel, 2008). However, Mendel (2008) encouraged both words and sentences test material as the minimum assessment of speech recognition for children.

The selection of the speech stimuli can be from various sources depending on the objective of the speech test or the available sources. For example, there were three HINT tests for children that used the sentences from the adult HINT corpus of material: the CHINT-C (Wong et al., 2019) and the NHINT-C (Myhrum et al., 2016) objective was to develop a children's version of the HINT test while the objective of the Hearing in Noise Test (HINT-Brazil) (Novelli et al., 2018) was to evaluate the adult HINT among children. Based on the selected articles, the development of test material can be grouped into three main options: the development of own material, adaptation of available material and combination of own and available material, as suggested by Theunissen et al. (2009). Tests that were developed by selecting the stimuli through spoken corpus, written corpus, dictionary, frequency dictionary, textbook or story books fall under their own material options while adaption of adult and other paediatric tests and modification of adult tests were under the adaption of available material. However, only two tests fall under the combination of own and available material options. The Galker test (Lauritsen et al., 2015, 2016) and Paediatric Spanish–English Speech Perception Task (Calandruccio et al., 2014) are both tests where speech material was selected by adapting other available paediatric speech tests and compiling expert panel suggestions and textbook or storybook respectively.

The type of noise could be further categorized into two most used maskers that are multi-talker babble and steady-state speech-shaped noise. The former noise provides informational masking while the latter noise serves dynamic masking features. In this review, two paediatric speech tests, the Paediatric Spanish–English Speech Perception Task (Calandruccio et al., 2014) and Toy Discrimination Test (Lovett et al., 2013) applied both type of noises to take advantages of each noise. The multi-talker babble mimics everyday listening situations while steady state speech-shaped noise serves as an effective masker to give consistent speech recognition results (Wilson et al., 2007). In addition, different types of noises do influence the speech recognition results (Wilson et al., 2007). Thus, the selection of the masker depends on the aims of the paediatric speech test. Although recent speech tests centre on using maskers to represent everyday listening situations, the number of speech tests developed for testing in quiet, in noise and in both listening situations were similarly distributed during the 2010s. This showed that speech tests in quiet are still valued and relevant for testing children.

Conclusion:

The most significant findings to emerge from this study is that material and methods in these paediatric speech tests varies extensively with no prominent emerging patterns in recent years. This scoping review provides the summary on factors that should

be considered in developing a new speech test, particularly in terms of the materials as well as the methodology. It also highlights how the variability of these factors emphasize why speech tests cannot be standardized. Therefore, multiple assessments are needed as there is no single speech test that is adequate for all purposes. Further research is highly recommended to investigate other factors related to testing children such as cognition, language, and fatigue. The authors accept that the keywords used in this study can be limiting as this topic involves a very large body of knowledge, therefore some articles may not be represented in this article.

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Appendix 1

List of the Paediatric Speech tests included in the scoping review

No	Name of the speech test	Year	Country	Test format	Method of response	Type of speech stimuli	Selection of test stimuli	Test condition	One masker	Two masker
1	Spanish Pediatric SRT Test (SPSRT) (Mendel et al., 2019)	2019	USA (United States of America)	Closed-set	Pointing to pictures/toys	Word	Frequency Dictionary	Quiet	Not Applicable	Not Applicable
2	Cantonese Hearing in Noise Test (CHINT-C) (Wong et al., 2019)	2019	China	Open-set	Verbal repetition	Sentence	Adaptation of adult test	Quiet and noise	Steady State Speech Shaped Noise	Not Available
3	Listen-Say test (Mentzer et al., 2018)	2018	Europe	Open-set and closed-set	Multi response mode	Word	Adaptation of other paediatric test	Quiet and noise	4-talker babble	Not Available
4	Arabic Words in Noise test (Arabic WIN) (Abdel Rahman, 2018)	2018	Egypt	Open-set	Verbal repetition	Word	Adaptation of other paediatric test	Noise	Cafeteria noise	Not Available
5	Hearing in Noise Test (HINT-Brazil) (Novelli et al., 2018)	2018	Brazil	Open-set	Verbal repetition	Sentence	Adaptation of adult test	Quiet and noise	White noise	Not Available
6	Urdu speech perception test (USPT) (Noor & Arif, 2018)	2018	Pakistan	Closed-set	Multi response mode	Word and sentence	Textbook/stories	Quiet	Not Applicable	Not Applicable
7	Greek sentence-based speech audiometry test (G-SEBSAT) (Koloutsou et al., 2017)	2017	Europe	Open-set	Verbal repetition	Sentence	Spoken corpus	Quiet	Not Applicable	Not Applicable
8	Cantonese Tone Identification Test (CANTIT) (Lee et al., 2017)	2017	China	Closed-set	Pointing to pictures/toys	Word	Spoken corpus	Quiet	Not Applicable	Not Applicable
9	Estonian words-in-noise (EWIN) test (Veispak et al., 2016)	2016	Europe	Open-set	Verbal repetition	Word	Textbook/stories	Quiet and noise	Steady State Speech Shaped Noise	Not Available
10	Norwegian Hearing in Noise Test (NHINT-C) (Myhrum et al., 2016)	2016	Europe	Open-set	Verbal repetition	Sentence	Adaptation of adult test	Quiet and noise	Steady State Speech Shaped Noise	Not Available
11	Not named (Cozma et al., 2016)	2016	Europe	Open-set	Verbal repetition	Word	Written corpus	Quiet	Not Applicable	Not Applicable

12	Mandarin Tone Identification Test (MTIT) (Zhu et al., 2016) (Zhu et al., 2014)	2016 2014	China	Closed-set	Pointing to pictures/toys	Word	Dictionary	Noise	Steady State Speech Shaped Noise	Not Available
13	The Galker Test (Lauritsen et al., 2016) (Lauritsen et al., 2015)	2016 2015	Europe	Closed-set	Pointing to pictures/toys	Word	Adaptation of other paediatric test	Noise	White noise	Not Available
14	Cantonese Spoken Word Recognition Test (CanSWORT) (Ng et al., 2016)	2016	China	Open-set	Multi response mode	Word	Written corpus	Quiet	Not Applicable	Not Applicable
15	Mealings, Demuth, Dillon, and Buchholz Classroom Speech Perception Test (MDDB CSPT) (Mealings et al., 2015)	2015	Australia	Closed-set	Multi response mode	Sentence	Spoken corpus	Quiet and noise	Broadband noise	Not Available
16	Not named (Munthuli et al., 2015)	2015	Thailand	Not mentioned	Not mentioned	Sentence	Written corpus	Not Applicable	Not Applicable	Not Applicable
17	Speech recognition in noise (Hagerman & Hermansson, 2015)	2015	Europe	Open-set	Verbal repetition	Sentence	Modification of adult test	Noise	Amplitude modulated noise	Not Available
18	Pediatric AzBio Sentence Lists (Spahr et al., 2014)	2014	USA	Open-set	Verbal repetition	Sentence	Spoken corpus	Noise	Multi-talker babble (>4 talker)	Not Available
19	Digit Speech Recognition Threshold (SRT) (Ramkissoon et al., 2014)	2014	USA	Open-set	Verbal repetition	Word	Adaptation of adult test	Quiet	Not Applicable	Not Applicable
20	Pediatric Spanish–English Speech Perception Task (Calandruccio et al., 2014)	2014	USA	Closed-set	Pointing to pictures/toys	Word	Adaptation of other paediatric test	Noise	2-talker babble	Steady State Speech Shaped Noise
21	Mandarin pediatric speech intelligibility (MPSI) test (Meng et al., 2013)	2013	China	Closed-set	Pointing to pictures/toys	Sentence	Not mentioned	Quiet and noise	Single talker sentence	Not Available
22	Toy Discrimination Test (Lovett et al., 2013)	2013	Europe	Closed-set	Pointing to pictures/toys	Word	Not mentioned	Noise	2-talker babble	Pink noise
23	Oldenburg sentence test for children (Oldenburger Kinder-Satztest; OlKiSa) (Neumann et al., 2012)	2012	Europe	Open-set	Verbal repetition	Sentence	Modification of adult test	Quiet	Not Applicable	Not Applicable

24	Polish Pediatric Matrix Sentence Test (PPMST) (Ozimek et al., 2012)	2012	Europe	Closed-set	Pointing to pictures/toys	Sentence	Frequency Dictionary	Noise	Steady State Speech Shaped Noise	Not Available
25	Not named (Xi et al., 2012)	2012	China	Open-set	Verbal repetition	Sentence	Spoken corpus	Noise	4-talker babble	Not Available
26	Words-in-Noise Test (Wilson et al., 2010)	2010	USA	Open-set	Verbal repetition	Word	Adaptation of adult test	Noise	Multi-talker babble (>4 talker)	Not Available
27	Modern Greek Word Recognition Score Test (Trimmis et al., 2008)	2008	Europe	Open-set	Verbal repetition	Word	Textbook/stories	Quiet	Not Applicable	Not Applicable
28	IHR-McCornick Automated Toy Discrimination Test (ATT) (Palmer et al., 1994)	1994	Europe	Closed-set	Pointing to pictures/toys	Word	Not mentioned	Quiet and noise	Pink noise	Not Available
29	Not named (McCullough et al., 1992)	1992	USA	Open-set and closed-set	Multi response mode	Word	Adaptation of adult test	Noise	Broadband noise	Not Available
30	DANTALE (Elberling et al., 1989)	1989	Europe	Closed-set	Pointing to pictures/toys	Word	Adaptation of adult test	Noise	Steady State Speech Shaped Noise	Not Available
31	Monosyllabic Adaptive Speech Test (MAST) (Mackie & Dermody, 1986)	1986	Australia	Closed-set	Pointing to pictures/toys	Word	Adaptation of other paediatric test	Quiet	Not Applicable	Not Applicable
32	Saudi Arabic Speech Audiometry for Children (Ashoor & Prochazka, 1985)	1985	Saudi Arabia	Closed-set	Pointing to pictures/toys	Word	Textbook/stories	Quiet	Not Applicable	Not Applicable
33	Northwestern University-Children's Perception of Speech Test (NU-CHIPS) (Chermak et al., 2017)	1984	USA	Closed-set	Pointing to pictures/toys	Word	Not mentioned	Noise	White noise	Not Available
34	Pediatric Speech Intelligibility (PSI) test (Jerger et al., 1980) (Jerger et al., 1981) (Jerger et al., 1983)	1983 1981 1980	USA	Closed-set	Pointing to pictures/toys	Word and sentence	Spoken corpus	Noise	Single talker sentence	Not Available