Gendang Melayu Sarawak (GMS) – Sarawak Malay Drum, the Dying and Forgotten Tradition

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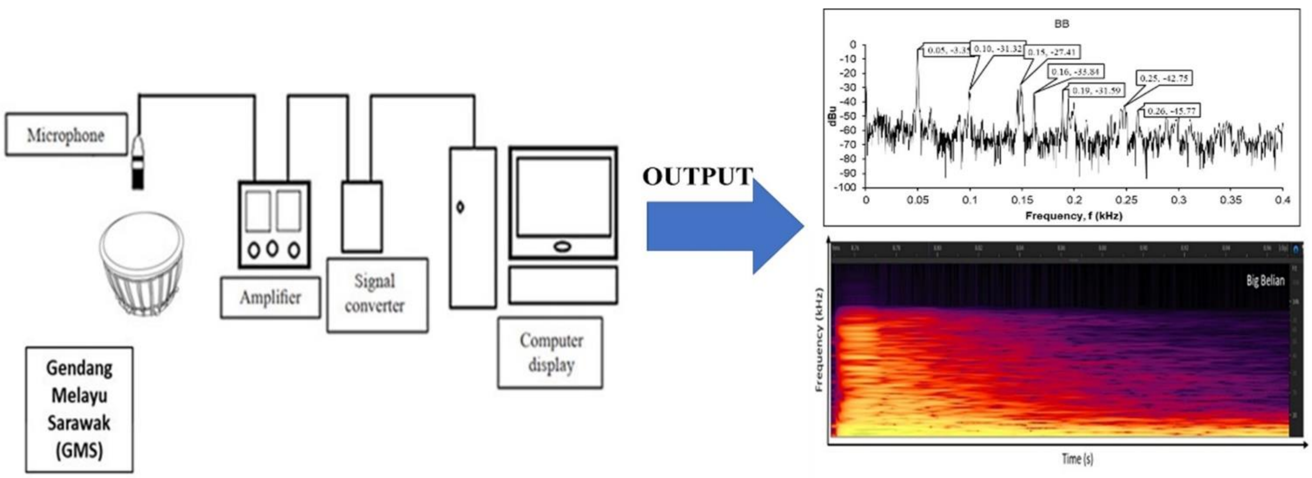
GRAPHICAL ABSTRACT



Gendang Melayu Sarawak (GMS) – Sarawak Malay Drum, the Dying and Forgotten Tradition

Aaliyawani E. Sinin,[a,]* Sinin Hamdan,[b] Khairul A. Mohamad Said,[b] Santrol Abdullah,[c] and Ahmad F. Musib [d]

This work was conducted using the Picoscope signal extraction procedure, which revealed significant insights regarding the belian wood and its application in Gendang Melayu Sarawak (GMS) production. The amplitude of belian wood GMS signal remains constant, allowing it to sustain its timbre for a longer duration compared to durian wood GMS using the same procedure. Considering that the dimensions of the big belian (BB) and big durian (BD) GMS are almost the same, both GMS yield almost the same note, *i.e.* G1# (51.9 Hz). Considering that the dimensions of both the small belian (SB) and small durian (SD) GMS are almost the same, both GMS yield almost similar note, *i.e.* F3 (174 Hz) and E3 (164 Hz). Although both BB and BD showed consistent harmonics, BD only displays 2 harmonics. The SB and SD both display consistent harmonics. Both BB and BD showed pleasing tonal qualities. These occurred due to the closeness of the principal overtones to the consonant interval.

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Keywords: Gendang Melayu Sarawak (GMS); Harmonics; Overtone; Consonant

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INTRODUCTION

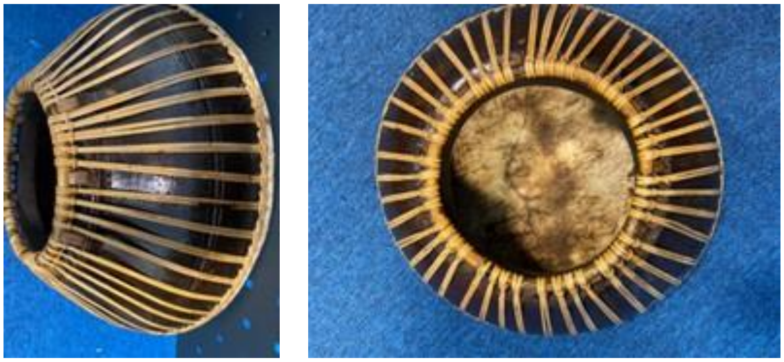
Gendang Melayu Sarawak (GMS), a Sarawak Malay Drum, is a traditional musical instrument that has various functions. GMS are frequently associated with a tradition called ‘bermukun,’ which is presented when celebrating a wedding ceremony, after completion of al-Quran recitation, and other great events in Malay and Melanau society. The GMS history of Sarawak involves a few areas such as in Kalaka District, Kuching, and Samarahan division (Hassan 2012). Acoustic and human cognition technology enable us to address the relationship between instrumental timbre, musical form and perception of pitch, consonance, and harmony (McAdams and Seidenburg 2019). Through exposure to electronic sound generation and sound recording technology, it is possible to explore complex sound sources. The timbral implications of a range of a single-headed frame of Gendang Melayu Sarawak (GMS), adapted from the Arab culture, were inspired by instruments from old musical tradition. Using acoustic spectrum and spectogram, the authors analyzed the frequency and harmonicity of the note. The acoustic spectra disclosed the uniqueness of the GMS by comparing different GMS material and size.

The available literature on the manufacture and acoustic behavior of GMS is very scarce. The traditional GMS, a feature of traditional musical from Sarawak, Malaysia, are essential in a variety of social and cultural contexts. It is a common accompaniment to traditional Malay wedding processions and ceremonies, adding a rhythmic passion to these festive occasions. Beyond wedding festivities, Sarawak's rich Malay tradition is proudly displayed through GMS, which enhances dance and music spectacles. Additionally, Sarawak Malay groups use these drums to generate an exciting and joyous atmosphere at festivals and community events. The Malay community’s religious celebrations also carry the resonance of GMS, strengthening ties across cultural divides. Cultural groups and institutions also conduct workshops and exhibitions that provide a platform for the preservation and promotion of this beloved legacy, giving people the opportunity to learn the skill of drumming. The effort to sustain the tradition so that it will not be forgotten has been commendable, with cultural groups and institutions conducting workshops and exhibitions that provide a platform for the preservation and promotion of this beloved legacy, giving people the opportunity to learn the skill of drumming. In parallel, ongoing research seeks to explore the acoustic properties of GMS in light of recent changes in its manufacturing. This includes the transition from the traditional use of belian wood (*Eusideroxylon zwageri*), known for its hardness, to less dense wood varieties.

The GMS can be employed either as a standalone accompaniment for a solo singer or as an integral component within an ensemble that features various instruments, including the violin and a resonant Asian gong. Rhythmically, the GMS establishes and maintains the tempo and beats for traditional Malay dance performances. In instances where the GMS takes center stage as the primary musical instrument in a performance, the occasion is termed ‘bergendang,’ during which singers and dancers come together to deliver both musical compositions and choreographed dances. The GMS player, who often doubles as a singer, vocalizes songs presented in poetic form, while the dancers synchronize their movements with the rhythmic patterns produced by the GMS.

Fig. 1. Rattan palms belonging to subfamily Calamoideae

Hardwood is used so that the final product is of high quality. The batter head is made from goat skin, and 'segak' rattan is used for tensioning the skin. Rattan belongs to the subfamily *Calamoideae* (Fig. 1). Figure 2 shows the application of rattan for tensioning the batter head. The air within the shell vibrates when the batter head is struck. The energy from that atmosphere vibrates the resonant head. Therefore, the material of the GMS shells will affect the eventual sound of the drum.



(a) **(b)**

Fig. 2. The application of rattan for tensioning the batter head (a) side view (b) back view

Rattan also has been called 'Manila' cane or 'Malacca' cane, based on its trade origins (Meicherczyk 1989). The greatest diversity of rattan palm species is found in the tropical forests of Southeast Asia (Dransfield 2002). Rattan supplies are now rapidly threatened due to deforestation and overexploitation (Stiegel *et al*. 2011).

The GMS shell (locally called as 'aran') is commonly made from hardwood as belian (*Eusideroxylon zwageri*) (Fig. 3). The 'aran' normal size is 50 cm diameter by 20 cm high. The smaller GMS shell had a 30 cm diameter and 10 cm height. The shell is manufactured manually or by machine.

Fig. 3. Belian (*Eusideroxylon zwageri*) tree

The type of wood used is not critical because the GMS only needs the shell to hold high tension, which depends on the hardness of the wood. A thicker shell amplifies more vibration to the drum head, and thus produces less resonance. A thinner shell contributes more to the sound coming from the drum, thus producing more resonance. Relatively thin shell GMS (1.5 cm for small GMS) and thick shell GMS (3.5 cm for big GMS) absolutely yield some distinctive character to the sound. Therefore, the type of wood and size of GMS certainly makes a difference. Engineering wise, various drum shell materials (especially wood) are good.

It is a trend that belian wood (density of 835 to 1,185 kg/m^3 air dry) has been the choice for GMS construction because of strength and balanced tonality. Belian wood does not shrink, and the cell structure does not change with time. Belian is commonly used for making GMS, but it is rarely used for other musical instruments. As belian wood has become scarce, manufacturers have shifted to alternative woods such as durian wood (*Durio* spp.) with an air-dry density of 420 to 865 kg/m^3 (Fig. 4). GMS manufacturers choose belian wood due to its structural strength, not its tonality. The shell might be there primarily for structure, but when the skin is hit, the shell also vibrates. Therefore, the wood and shell contribute to the sound. Whatever the shells are made from, they contribute to the tonality of a drum.

Fig. 4. Durian (Durio spp.) tree

The front head of the GMS is called the batter head (striking side of the drum). The bottom head (non-striking surface) is the resonant head. The tone and duration that contribute to the resonating sound of the drum are significantly influenced by the characteristics of the resonant head. Whether a drum has an extraordinary or average sound depends mainly on the type of wood that was used to make the drumhead. One of the crucial elements in deciding the overall sound quality of the drum is the resonant head as well as the wood used.

The research's novelty lies in the examination of drums precise pitches generated by two types of wood, namely the durian and belian. The process of learning these pitches through note memorization plays a crucial role in learning the patterns of the GMS. The learning method contributes to the creation of an interlocking beat when two to three drums are used in an ensemble, are in syncopated beats, serving as a monitoring mechanism or cue in a musical piece. Beyond the musical function, this precision in pitches not only advances GMS but also holds potential in training future generations in community music, hence aim to revive interest among the younger generation in playing GMS, a traditional musical art on the brink of extinction.

EXPERIMENTAL

The acoustic data were obtained through the use of Adobe Audition analysis and the PicoScope oscilloscope as a research tool. The diameter of the GMS ranges widely, from around 30 mm to more than 50 mm. The artisans have produced GMS using whatever accessible method, with the majority of their labor being unrecorded. A lathe machine tool is used in manufacturing to rotate a workpiece around an axis of rotation for a variety of operations, including cutting, sanding, and turning. The workpiece is also subjected to tools to create an item with symmetry about that axis. Hardwood has been utilised less in GMS production recently (typically because of financial concerns). Acoustic spectra were recorded on the GMS in order to determine which elements are necessary to generate a certain connection between vibrational overtones and wood type and size. The various spectra will be covered by this data. Changes in size and kind of wood cause significant variations in the GMS spectrum. The big durian (BD) GMS, small durian (SD) GMS, big belian (BB) GMS, and small belian (SB) GMS batter heads are displayed in Figs. 5 and 6, respectively. The 77-year-old local manufacturer, Mr. Ramli Salam, claimed to have begun the business more than 60 years ago and was the source of all the GMS purchased. Figure 7 shows the turning machine used for manufacturing the ‘aran’.

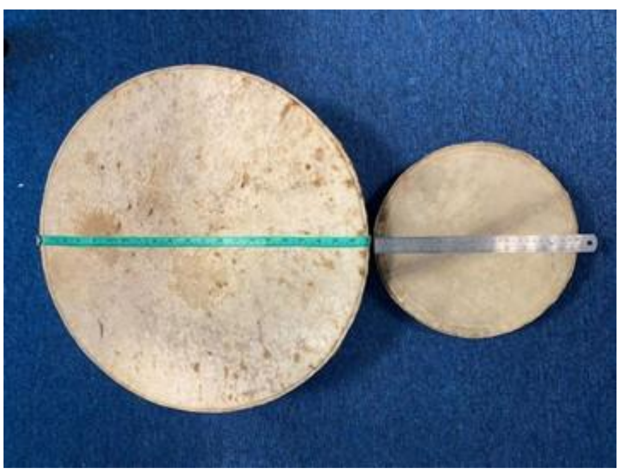


Fig. 5. The batter head of big Belian (BB) GMS and small Belian (SB) GMS

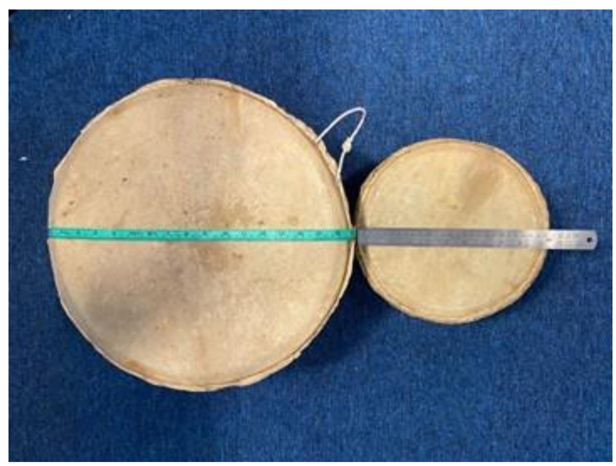


Fig. 6. The batter head of big Durian (BD) GMS and small Durian (SD) GMS

Using a PicoScope oscilloscope and microphone data acquisitions, the GMS sound were digitally captured. The microphone was placed so that it was less than 20 cm away from the drum head (see Fig. 8). The right hand’s palm was used to strike the GMS to excite it. The oscilloscopes (Pico Technology, 3000 series, Eaton Socon, UK) was used to carry out the Fast Fourier transform (FFT) operation, the results of which were then analyzed using PicoScope software (version 6), with a focus on FFT, voltage-based triggers, and spectrum analysis. The recordings of the sound were acquired with a sample rate of 48 kHz. The experiment was carried out in the Music Department of Universiti Malaysia Sarawak (UNIMAS) in an anechoic chamber. Using Adobe Audition, the Time

Frequency Analysis (TFA) was carried out based on the unique intensity in hertz, which distinguishes the strength of the partial frequencies, with magnitudes measured in seconds. Using this method, tone systems are investigated in the majority of sound analysis and re-synthesis (Hamdan *et al*. 2020). For comparison, the first through fifth partials for every GMS sound are plotted.

Fig. 7. The turning machine for manufacturing the 'aran'

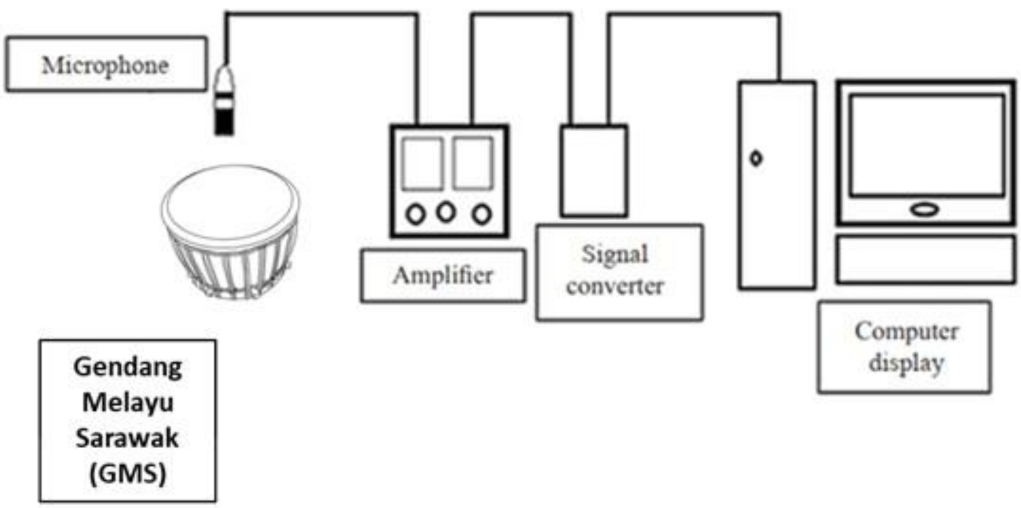


Fig. 8. Schematic diagram of the microphone data acquisitions

The sound waves that result from these vibrations give rise to the notes that we hear in music. Numerous variables affect the sound produced, such as the drum head's tension, diameter, height, and exact hitting method used. Furthermore, a variety of factors, including drum head tension, diameter, hitting technique, resonance, and the particular acoustic characteristics of the drum, have a significant impact on the final sound. In order to guarantee consistency in the hitting pattern and extreme caution, it is customary to work with a professional GMS player who is knowledgeable about these subtleties. These elements interact together to create the rich, melodic tones that are characteristic of the GMS. The audio signals were recorded in a mono 24-bit resolution format at 48 kHz sampling rate. For additional processing, the audio profile was stored in .wav format. To guarantee ideal settings, a calibration was done before recording the session. The test tone was restricted to a 1 kHz sine wave as part of the calibration process, and the European Broadcasting Union (EBU) approach was used. EBU states that the device's digital recording of 0 VU must be produced at +4 dBu or -18 dBFS in analogue or digital format. There are no other devices nearby that may have increased or decreased the signal amplitude during the calibration process. The audio interfaces (Steinberg UR22mkII), microphone (Audio-Technica AT4050), amplifier (Behringer Powerplay Pro XL, Behringer, China), and cable (XLR) comprised the recording system configuration. The microphone was set up to record at low cut (flat).

RESULTS AND DISCUSSION

The research findings provide acoustic information and understanding of the performances of the GMS from different woods. Figure 9 shows the Picoscope signals recorded about 3 seconds after excitation for BB and BD (Fig. 9a), 1 second and 0.5 second for SB and SD respectively (Fig. 9b). The belian wood GMS sustained the sound longer compared to durian wood for both the big and small GMS. Figure 10a shows the frequency spectrum from BB and BD GMS. Figure 10b shows the frequency spectrum from SB and SD GMS.

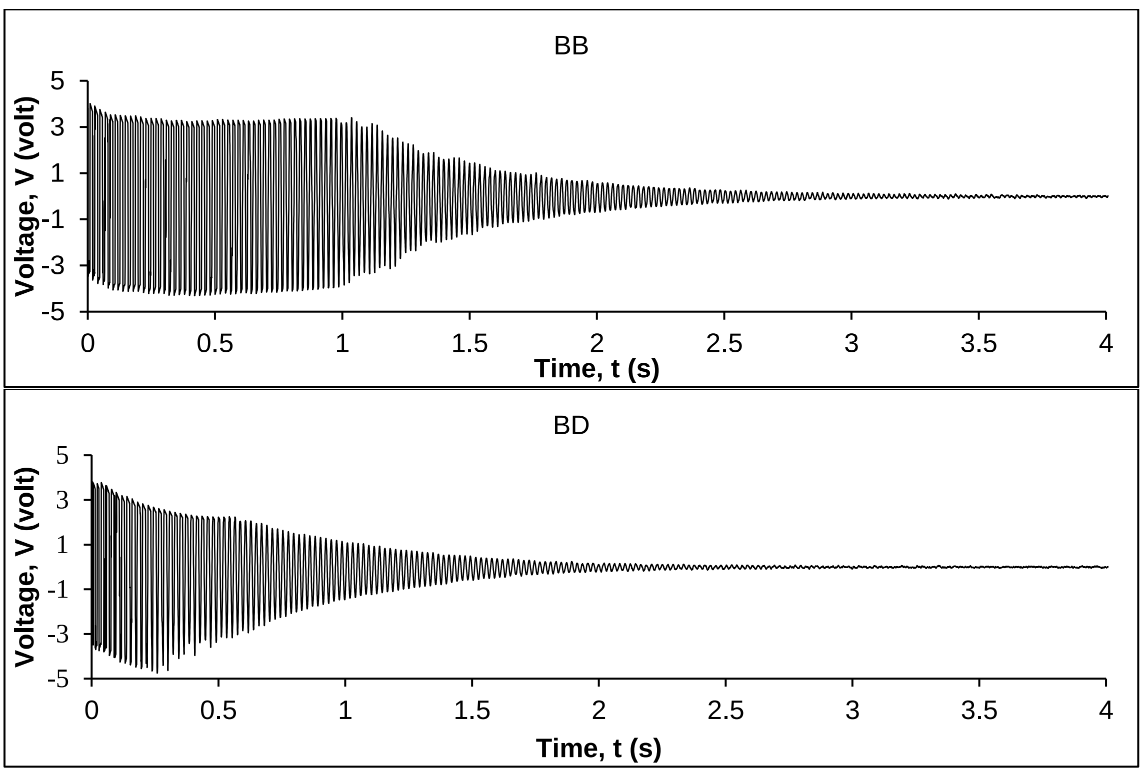


Fig. 9a. Picoscope signal from Big Belian (BB) and Big Durian (BD)

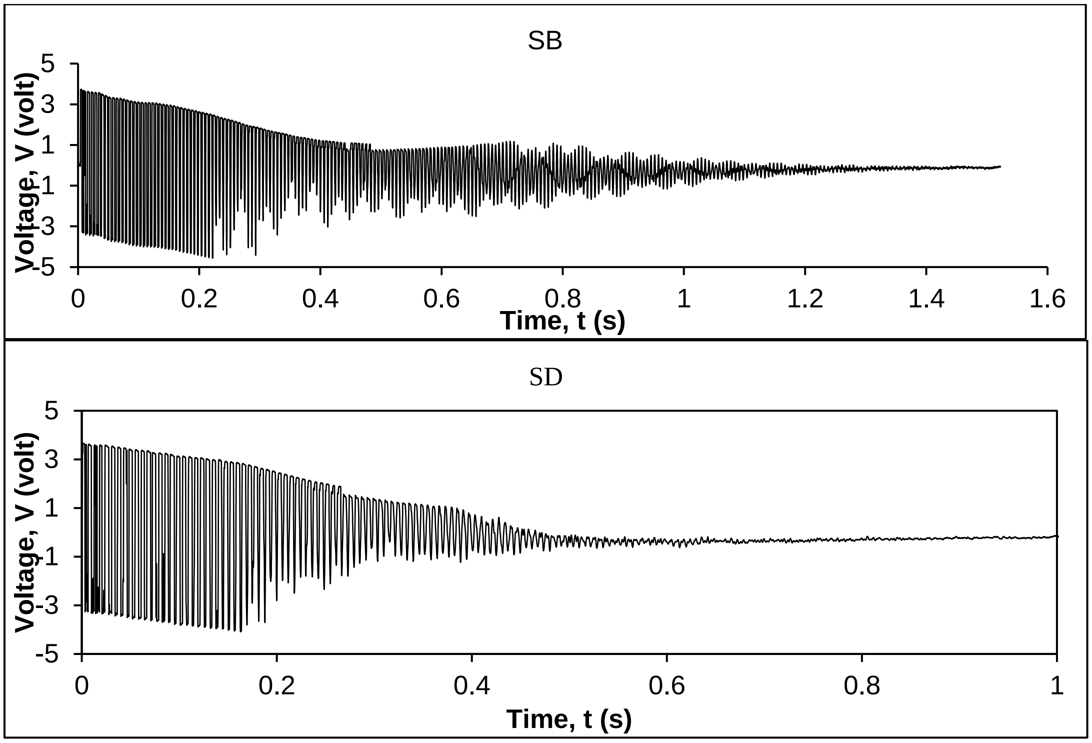


Fig. 9b Picoscope signal from Small Belian (SB) and Small Durian (SD)

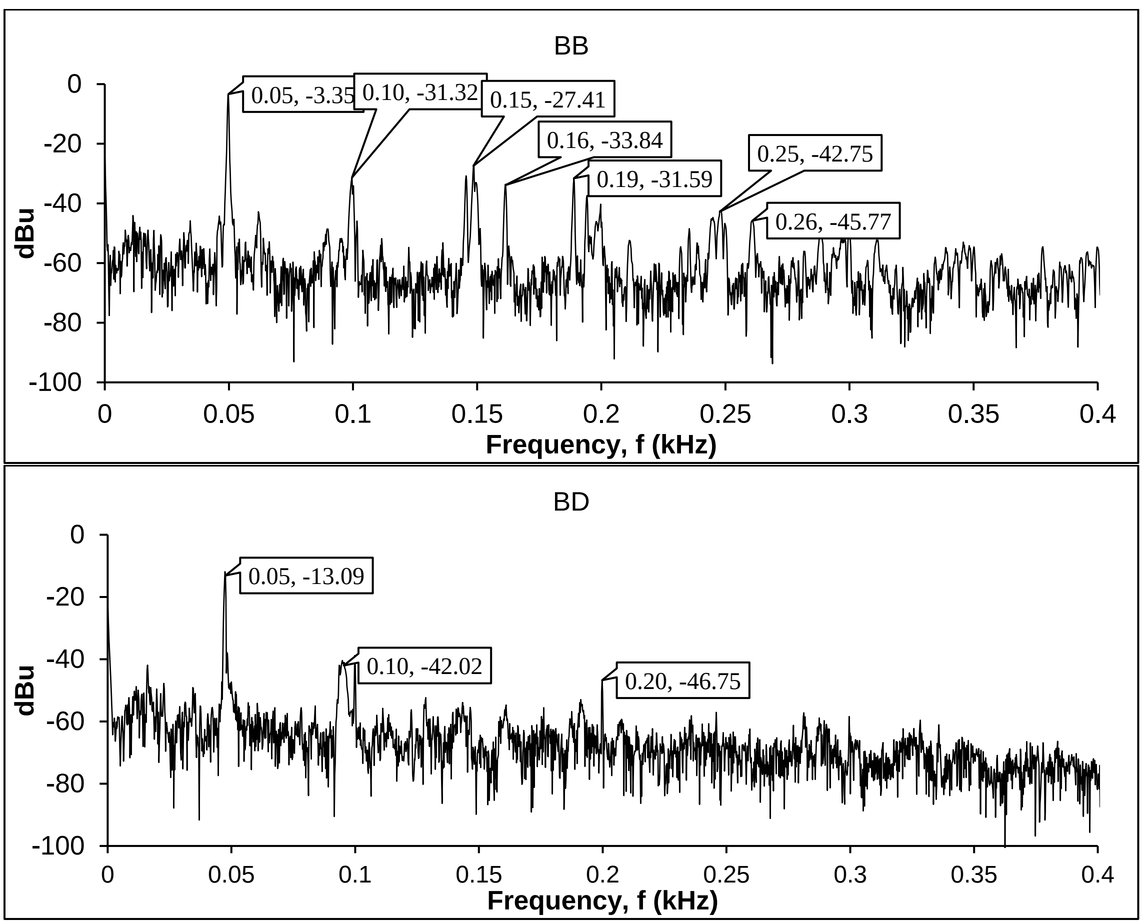


Fig. 10a. Frequency spectrum from Big Belian (BB) and Big Durian (BD)

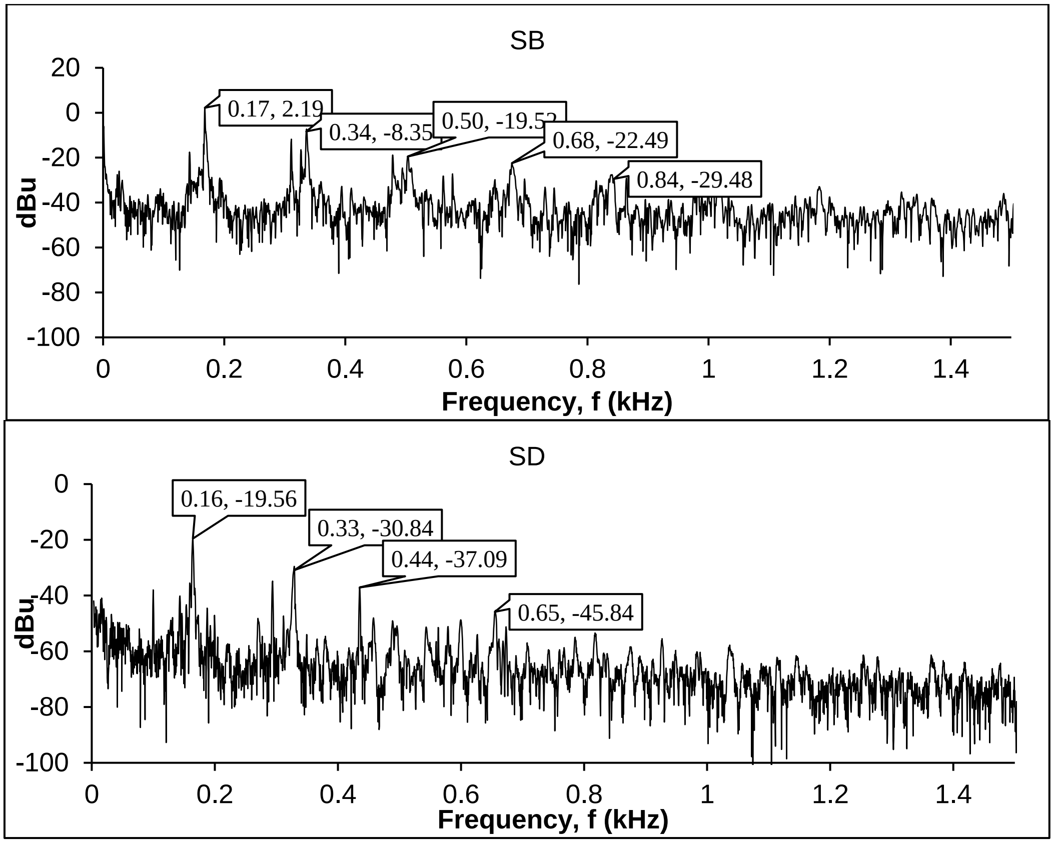


Fig. 10b. Frequency spectrum from Small Belian (SB) and Small Durian (SD)

Table 1 shows the fundamental and partial frequency for BB, BD, SB, and SD GMS. The BB and BD GMS exhibited similar fundamental and partial frequencies. Considering that the dimensions of the BB and BD GMS were almost the same, both GMS yielded almost the same note *i.e.* G1# (51.9Hz). The SB and SD GMS also had almost the same fundamental and partial frequencies. Considering the similarities of the dimensions of the SB and SD GMS, both GMS yielded almost the same note, *i.e.* F3 (174Hz) and E3 (164 Hz). Although both BB and BD showed consistent harmonics, BD only displayed 2 harmonics. The SB and SD both displayed consistent harmonics.

Table 1. Fundamental and Partial Frequency for BB, BD, SB and SD GMS

	BB (kHz)	f/f_o	BD (kHz)	f/f_o	SB (kHz)	f/f_o	SD (kHz)	f/f_o
F0	0.05	1	0.05	1	0.17	1	0.16	1
F1	0.10	2	0.10	2	0.34	2	0.33	2
F2	0.15	3	-	-	0.50	2.9	0.44	2.75
F3	0.19	3.8	0.20	4	0.68	4	0.65	4
F4	0.25	5	-	-	0.84	4.9	-	-

Both BB and BD showed pleasing tonal qualities. This is attributed to the closeness of the harmonic overtones to the consonant interval. Thus, the relatively thick shell for BB GMS (3.5 cm thick for big GMS) absolutely imparted character on the sound compared to BD with only 2 harmonics. This is due to the fact that the thicker shell from hardwood produces less resonance compared to less dense wood. The relatively thin (1.5 cm thick for small GMS) also displayed harmonic pitch. An increase in surface tension of the small

GMS increased the fundamental frequency of the small GMS (170 Hz for SB compared to 50 Hz for BB and 160 Hz for SD compared to 50 Hz BD). Comparing the spectral data in Table 1, it is suggested that the type of wood is an important factor in the behavior of these GMS. Figures 11a and 11b display the Adobe spectograms of big and small GMS respectively.

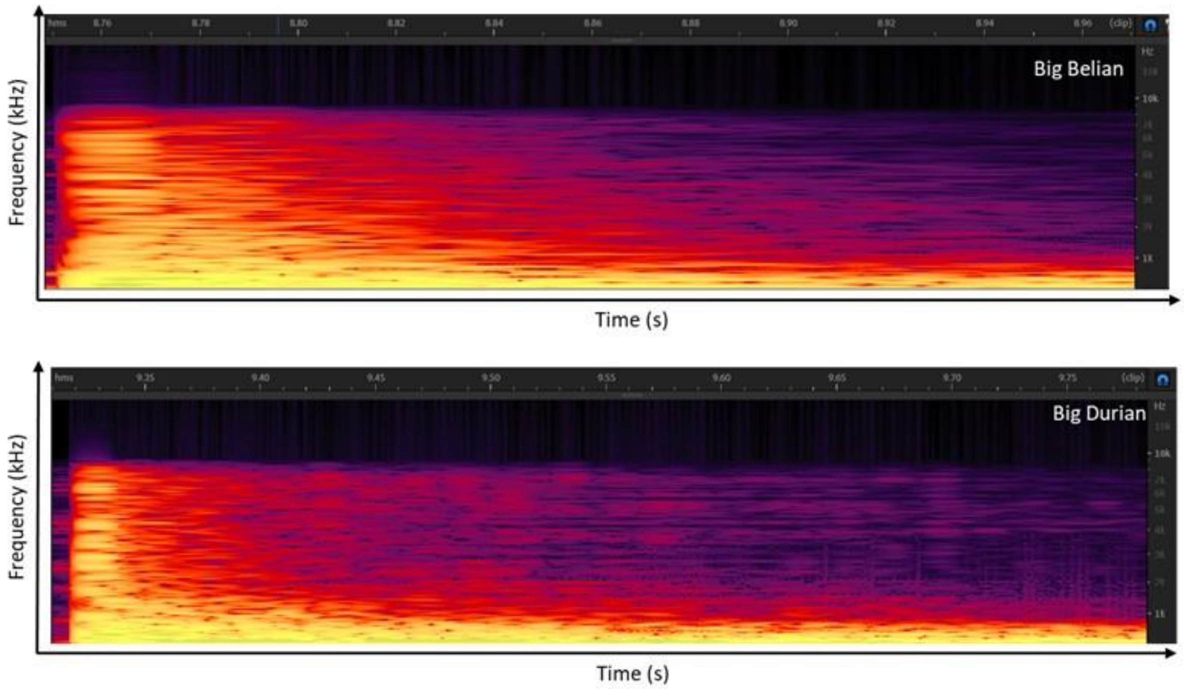


Fig. 11a. Adobe spectogram of BB and BD GMS

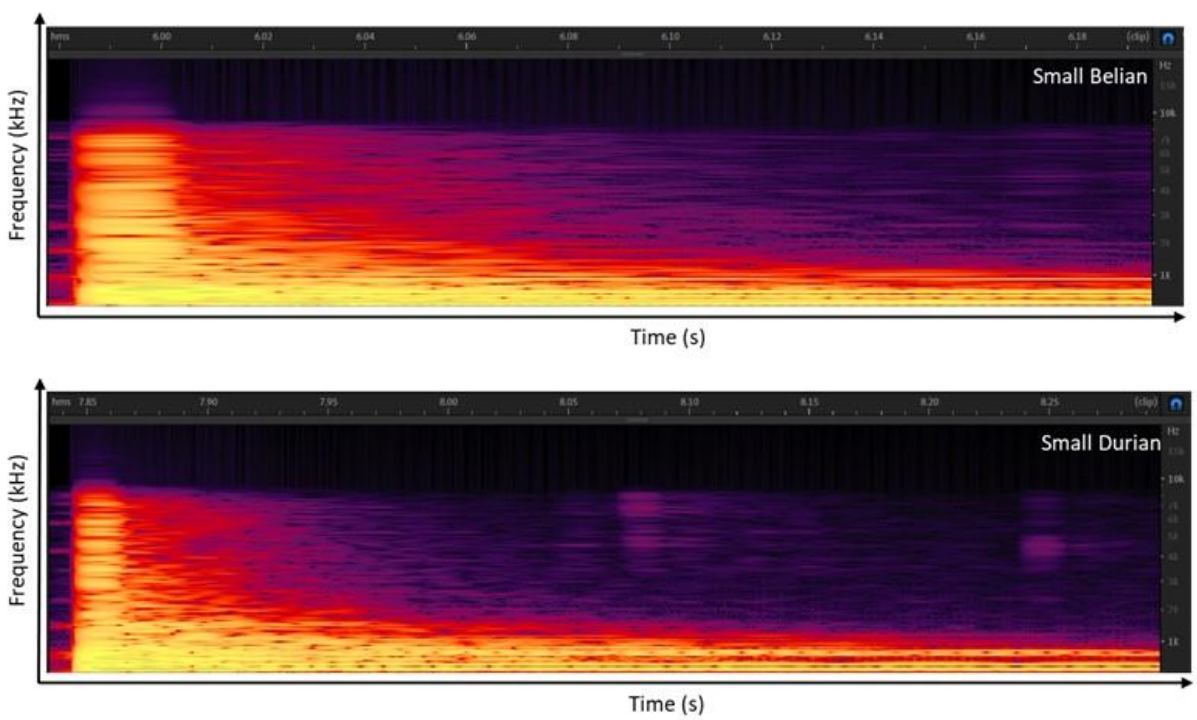


Fig. 11b. Adobe spectogram of SB and SD GMS

Although the Picosope displayed the BB and BD had principal overtones close to the consonant interval, the spectrogram showed that BB sound is brighter than the BD. The same phenomena occurred to the SB and SD, where SB sound is brighter than the SD.

The availability of belian wood may be limited, potentially impacting its feasibility for large-scale production. In contrast, the toughness of belian wood can make it more resilient to wear and decay, enhancing the durability of products. In the context of wood production in Malaysia, the choice between belian and durian wood should consider a balance between acoustic qualities, cost-effectiveness, availability, and durability. This holistic approach is crucial in guiding the selection of wood types for various applications in Malaysia's wood industry.

CONCLUSIONS

1. The analysis conducted using the Picoscope signal extraction procedure has revealed significant insights regarding the belian wood and its application in GMS production. The amplitude of belian wood GMS signal remains constant, allowing it to sustain its timbre for a longer duration compared to durian wood GMS using the same procedure. This finding corroborates the claim of belian wood's durability made by the manufacturer and demonstrates its ability to retain high-quality sound across the frequency spectrum.
2. It is evident that the choice of GMS materials made by the manufacturer was not solely based on structural considerations but was driven by their keen attention to wood's acoustic properties, assessed purely through their auditory perception.
3. The Picoscope analysis affirms the acoustical correctness of their choice. Furthermore, the meticulous techniques employed by the maker in GMS production contribute to the sustainability of Sarawak's intangible heritage, ensuring that this knowledge and tradition can be passed down from generation to generation.
4. This synthesis of craftsmanship, acoustic understanding, and sustainability principles underpins the significance of belian wood in the GMS manufacturing process. Furthermore, when considering the mass production of these GMS, it is essential to take into accounts not only the wood's hardness but also factors like cost, availability, and toughness. Belian's exceptional hardness, while advantageous for certain applications, can increase production costs due to the specialized tools and skills required, making it a less cost-effective option.

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