The Fundamental Frequency Relation of the Sapta Svaras of Karnatic Vocal Music

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Introduction:

The present study was undertaken to determine the fundamental frequency relation between the svaras of Karnatic vocal music. The review of literature on musical acoustics reveals that this relation has been studied only in instruments and not in human voice. The present study aims at calculating this relation and also studying the effect of the vocal register and the drone note on this ratio. For this purpose the fundamental frequency of the seven notes and its varieties were calculated.

Procedure:

Two males and three females in the age range of 25 to 40 years served as subjects. All of them were well trained and had a minimum of 7 years of singing experience. The sample recorded was that of all the notes with its varieties in the three registers, namely low, middle and high, and under two conditions, namely without and with the drone. The sample was analyzed for its fundamental frequency in Hz and semitones. The ratio between the fundamental frequency of adjacent notes were calculated. Repeated measures of ANOVA were used to check for the effect of vocal register and the drone note on the ratio. The Newman-Keul's Comparison Test was used for further comparison when significant differences were obtained.

Conclusions:

The fundamental frequency relation between the adjacent svaras is 1:1.056143 when the fundamental frequency is calculated in Hz, and is 1:1.022583 when it is in semitones. This ratio is unaffected by the presence or absence of the drone note. No significant difference was obtained between males and females when fundamental frequency is in Hz but a significant difference exists when fundamental frequency is in semitones. This ratio was also to be unaffected by the presence or absence of the drone note, or the vocal register when the fundamental frequency is in Hz. When the fundamental frequency is in semitones, the ratios of the low register was found to differ significantly from that of the middle and high register for the males, whereas that of the high register differed significantly from that of the low and middle register for females. A comparison of the practically obtained values of the fundamental frequency of the svaras with the theoretically calculated ones revealed a close correlation between the two. A maximum difference of 5Hz was observed.

Implication:

This study proves that with training the human vocal system is capable of producing notes which bear complex ratios with one another. It also highlights the fact that well trained singers have an inbuilt reference tone which minimizes the need for an external drone note.

Limitations:

1. Sample size is small.
2. Other styles of Karnatic music eg. Tanjore style has not been considered.

Recommendations for further research:

1. The study can be carried out on a large sample.
2. The study can be carried out with the 'alapana' sample of the notes.
3. A similar study can be done using ragas in which all the seven notes are included.
4. The effect of number of years of training on the ratio can be studied.