A STUDY OF FUNDAMENTAL FREQUENCY OF VOICE IN AN INDIAN POPULATION

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The Fundamental Frequency (FF) of voice of 616 subjects (age range 7-20 years) was measured using an SPL meter and a Tacho Unit. Whereas, in males the vocal mutation starts from the age 11 years, in case of females it was observed to start from the age 9 years. After the age of 14 years the FF of both sexes were found to be significantly different.

Various investigators dating back to 1939 have provided data on various vocal attributes at successive developmental stages from infancy to old age. Studies by Fairbanks (1940,1949) Mysak (1959), Curry (1940) Basel (1976) indicate that the aging trend for males with respect to pitch central tendency is one of a progressive lowering of pitch level from infancy through middle age, followed by a progressive rise in old age.

The results of these studies also showed that in females, the general progressive lowering of pitch levels occour from childhood to adulthood to advanced age.

Many studies have been reported using fundamental frequency analysis as a tool for voice therapy and also for diagnosis of voice disorders. (Shantha 1973 I Morton Couper 1974; Asthana 1977).

An attempt has been made by Nataraja and Jayarama (1973) to use fundamental frequency for classification and diagnosis of voice disorders.

Jayaram (1975) has studied fundamental frequency of dysphonics and normals and has concluded that ' computing the optimum frequency and habitual frequency for dysphonic would help in differential diagnosis of dysphonias.'

The study of Normal development of voice would be useful in the derivation of norms for the purpose of distinguishing normal from abnormal and thus in diagnosis. The norms derived would also be useful in therapy ; i. e. to decide the pitch to be used as a goal in voice therapy with dysphonias based on age and sex.

An attempt is made in this study to find the normal development of voice through the study of habitual pitch. The physical attribute of habitual is the

fundamental frequency. Hence the study is intended to get information about the development of voice through the study of fundamental frequency.

METHODOLOGY

The study included 616 subjects consisting of both males (318) and females (298) ranging in age from 7-20 years. The subjects were selected from different educational institutions located in Mysore City.

Every second person was selected from the attendance register as subject of the study. The subjects were examined by the investigator. Only those subjects who had no speech and hearing problems were selected for the study.

Each subject was directed to a quiet room and seated in a chair. Each subject was instructed to phonate vowel / a / for three successive trials.

The phonation was tape recorded. The volume control of the tape recorder was kept constant during all recording sessions. The distance between the mouth of the subject and the microphone of the tape recorder was approximately 6 inches, which was also kept constant.

The fundamental frequency was determined by analysing the recorded voice. The instrumental set up and the procedure for finding out fundamental frequency was same as the one used by Nataraja (1972).

The recorded voice was played in front of the microphone of the SPL meter and speaker of the tape recorder was approximately one foot. The fundamental frequency was read directly from the tacho unit. The filter network was set to 125 Hz / 250 Hz depending upon the frequency of voice. The volume of the recorder voice was adjusted to get reading of 60-70 dB SPL on the SPL meter suitable scales were also selected on tacho unit i. e., from 0 to 150 and 0 to 500 Hz range to read the fundamental frequency.

Whenever the investigator suspected that the tacho unit reading was high (as it is possible to get the first harmonic if a higher filter net work is selected) the next lower filter network was selected and readings were checked to obtain, correct fundamental frequency, i. e., lowest frequency in the complex sound wave.

To check the reliability of the procedure for finding fundamental frequency, the tests were repeated once again on randomly selected subjects. No significant difference was found between the two readings.

RESULTS AND DISCUSSION

A lowering in the fundamental frequency with advancing age was observed in case of both males and females. Vocal mutation in males seem to start at least by the age of 11, and a rapid lowering of fundamental frequency seems to occur upto the age of 14. After the age of 14, even the voice continues to change (in terms of fundamental frequency) it is more gradual.

TABLE A

Showing the means, standard deviations and ranges of the fundamental frequencies of males from 7 to 20 years.

Age	Sex	Mean F.F.	Standard deviation	Ranges L		H
7	M	269.5	11.7	240	—	290
8	M	265.75	14.21	230	—	300
9	M	266.6	22.2	220	—	300
10	M	269.7	17.5	240	—	290
11	M	263.1	23.1	220	—	310
12	M	231.1	26.1	135	—	280
13	M	229.5	25.5	125	—	260
14	M	158.9	23.8	125	—	250
15	M	168.6	37.4	105	—	240
16	M	151.2	37.4	125	—	180
17	M	149.2	20.2	110	—	180
18	M	141.0	18.52	110	—	170
19	M	135.8	16.7	105	—	170
20	M	138.0	11.4	120	—	150

F. F : Fundamental frequency.
L : Lowest fundamental frequency in the group.
H : Highest fundamental frequency in the group.
M : Males.

TABLE B

Showing the means, standard deviations and ranges of the fundamental frequencies for females.

Age	Sex	Mean F.F.	Standard deviation	Ranges L		R
6	F	276.5	20.5	240	—	300
7	F	273.5	23.7	240	—	340
8	F	270.6	16.3	240	—	300
9	F	275.5	18.1	240	—	320
10	F	268.0	23.93	240	—	310
11	F	258.6	14.9	230	—	280
12	F	243.63	10.6	220	—	280
13	F	243.2	30.3	200	—	275
14	F	239.4	21.3	160	—	280
15	F	242.1	27.6	205	—	260
16	F	241.1	17.6	200	—	260
17	F	240.2	18.9	180	—	255
18	F	248.8	31.6	180	—	300
19	F	232.9	28.4	180	—	250
20	F	248.2	18.8	220	—	280

F. F : Fundamental frequency.
F : Famale
L : Lowest fundamental frequency in the group.
H : Highest fundamental frequency in the group.

In females the vocal mutation seems to start earlier than in males i. e., atleast by the age of 9 and it is completed by the age of 12. After the age of 12 only very slight decrease is seen in the fundamental frequency upto the age of 20.

Samuel (1973) has concluded that there is a definite lowering of the fundamental frequency in males at least after 10 years, though the lowering is so gradual that significance is not seen between successive age groups. Thus the results of this study agrees with the results of the present study.

The results of the Samuel's (1973) study did not show a significant difference between the age groups 11 and the older age groups i.e., 12-14 years in case of females unlike in the present study.

The voice of adults and children are different both in males and females in terms of fundamental frequency. After 14 years the voice of males and females are significantly different in terms of fundamental frequency.

Present study shows that the vocal mutation of males start only by the age of 11. Where as in the females a change of voice seem to occur at the age of 9.

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