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"THE EFFECTS OF HEMODIALYSIS ON VOICE CHARACTERISTICS OF PATIENTS WITH CHRONIC RENAL FAILURE"

Research project submitted in fulfilment of internship program for

BASLP (Bachelor of Audiology and Speech Language Pathology)

Degree course in

Father Muller College of Speech and Hearing, Mangalore.

By

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Under the guidance of

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FATHER MULLER COLLEGE OF SPEECH AND HEARING

MANGALORE

CERTIFICATE

This is to certify that this research work on "The Effects of Hemodialysis on Voice characteristics of patients with Chronic Renal Failure" has been done by **Ms. Shri Rajalaxmi &Ms. Andria Vinitha Lobo**under my supervision. I am satisfied with the work presented by the candidates towards the research activity during internship program of BASLP (Bachelor of Audiology and Speech Language Pathology) degree course.

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Place: Mangalore

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Principal

SERIAL NO.	CONTENT	PAGE NO.

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INDEX

1	ABSTRACT	1 - 3
2	INTRODUCTION	4-5
3	REVIEW OF LITERATURE	6-8
4	NEED AND AIM	9
5	METHOLOGY	10-11
6	RESULTS	12-14
7	DISCUSSION	15-16
8	CONCLUSION	17
9	REFERNCES	18-19
10	APPENDIX	20-21

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Ms. Shri Rajalaxmi

Ms. Andria Vinitha Lobo

ABSTRACT

INTRODUCTION:

Voice is the sound production with the coordination of respiratory, phonatory, resonatory and articulatory system. It contributes to the individual's complete well-being. Any change in voice affects the communication and quality of life.

Kidney disease can affect almost every part of your body. It is due to the build-up of waste products and excess fluid in the body. Possible complications that are commonly seen are; Fluid retention, which could lead to weakness, shortness of breath, lethargy, swelling in your arms and legs, high blood pressure, or fluid in the lungs (pulmonary edema) and can be fatal(Hirano M., 1981).

Dialysis is a medical procedure or a treatment that artificially does some of the things which are normally done by the healthy kidneys. In hemodialysis, an artificial kidney(hemodialyzer) is used to remove waste products, extra chemicals and extra fluid from the blood and to correct electrolyte imbalances (Hirano M., 1981). Hemodialysis is used to treat both acute (temporary) and chronic (permanent) kidney failures. But it is anessential treatment process for end-stage renal failure(McGrawHill., 2011).

Some patients complaint hypotension, cardiovascular complications, Nausea/vomiting, headache, chest pain, etc.,are also reported, and these problems are usually triggered by several basic mechanisms (BregmanH, Daugirdas J.T, Ing TS,2003).The hemodialysis treatment affects laryngeal volume and muscle function. Few patients who are treated with hemodialysis (HD) frequently complain about hoarseness of voice (Ori y, Sabo R, et al., 2014).

With the advanced voice analysis techniques, it is easier to determine the consequences of dialysis on voice parameters and estimate the significant changes in voice, subjectively and also to justify the variability of the complaints in different patients undergoing hemodialysis (Nu´n˜ezBatalla F, et al., 2014). Thus this study has made an effort to weigh up the influence

of hemodialysis (HD) on vocal mechanism by acoustical analyzing the voice using vocalacoustic parameters like: Fundamental frequency (*fo*) Hz, Jitter (%), Shimmer (dB), Noise-to-Harmonic Ratio (HNR) and estimated the voice change (VC).

The results of the study will help professionals to carry out discussions with the patient about his or her voice related consequences and to facilitate counseling, treatment plans, and patient follow ups.

OBJECTIVES OF THIS STUDY:

•To study the vocal characteristics of individuals with chronic renal failure pre-and post-hemodialysis**.**

MATERIALS AND METHODS:

The study consisted of 40 Subjects, who were under the specific study criteria. Males and females within the age range of 20 - 40 years were taken as participants for the study. The participants were of 2 groups, patients with pre-hemodialysis andpatients with post-hemodialysis. The informal case history along with medical history was enquired, as the participants had to fall under the research criteria and the voice sample was taken using Praat. The acoustic parameters taken from Praatwere used in analysis.

RESULT:

The results revealed differences in *fo* values in general category and differences in*fo* and HNR values in Male and Female categories which indicate that mass of vocal folds was affected and thus presence of abnormal voice. Whereas Jitter, Shimmer in both general and experimental categories showed no significant change when compared.Butthe HNR values also gave no much differences in general categories.Thus indicating that stability of vocal folds is affected and thus there will be presence of abnormal voice.

CONCLUSION:

Based on the results obtained, we can conclude that voice characteristics of individuals with Chronic Renal Failure shows limited changes. Hemodialysis causes minor changes in the

acoustic voice parameters of patients with Chronic Renal Failure, thus no significant difference in voice quality and hence no impact on communication and quality of life.

INTRODUCTION

Awell-coordinated functioning of respiratory and phonatory system produces sound which is known as Voice or Vocalization. The functioning of these coordinated system completely mirrors the patient's behavioral and medical conditions (Hamdan AL, Medawar W, et at., 2005).It is the voice quality of the individual thatgives self-belief and helps in socialization of that individual in the society. The vocal tract and resonating system are non-identical in every individuals which helps in producing sound which is unique to every individual and that is the hallmark of his/her personality.Perhaps these temporary problems areaffecting the communication and quality of life of patients who undergo hemodialysis, thus interrupts the individual's complete well-being (Unver S, Hardal U, et al., 2015).

Dialysis is a medical procedure or a treatment that artificially does some of the things which are normally done by the healthy kidneys. In hemodialysis, an artificial kidney (hemodialyzer) is used to remove waste products, extra chemicals and extra fluid from the blood and to correct electrolyte imbalances (Hirano M., 1981). Hemodialysis is used to treat both acute (temporary) and chronic (permanent) kidney failures. For patients with end-stage renal failure, hemodialysis is an essential treatment process (McGrawHill., 2011).

Acute complications commonly occur during routine hemodialysis treatments. Hypotension is the commonly reported complaint and cardiovascular complications of 25% to 55% of all the treatments. Cramps (5–20%), nausea and vomiting (5–15%), headache (5%), chest pain (2–5%), back pain (2–5%), itching (5%), and fever and chills (< 1%) are also reported, and these problems are usually triggered by several basic mechanisms (Bregman H, Daugirdas J.T, Ing TS,2003).The hemodialysis treatment affects laryngeal volume and muscle function. Changes in voice may be a frustrating, persistent condition in few hemodialysis patients. Patients with end-stage renal disease (ESRD) who are treated with hemodialysis (HD) frequently complain about hoarseness of voice (Ori y, Sabo R, et al., 2014).

Due to the advanced voice analysis techniques, it is easier to determine the consequences of dialysis on voice parameters in order to do an outline and estimate the significant changes

4

in voice, as it is expressed subjectively and also to justify the variability of the complaints in different patients undergoing hemodialysis (Nu´n˜ezBatalla F, et al., 2014). Thus this study makes an effort to weigh up the influence of hemodialysis (HD) on vocal mechanism by

acoustic analysis of voice and to estimate the voice change (VC). The vocal acoustic parameters studied include fundamental frequency, jitter, shimmer, noise-to-harmonic ratio.

The insight obtained from the study would help the professionals to find out the rate of occurrence of voice related complications in individuals with renal failure after the hemodialysis, which may further facilitate rehabilitative measures.

REVIEW OF LITERATURE

Chronic Renal Failure:

Chronic renal failure is a process consisting of multiple etiologies or causes resulting in reduction of nephron number and loss of its functions (Hassan ES., 2014). In the year 1990, chronic renal failure was the 27th leading cause of death and became 18th leading cause in 2010 (Hasan M, Sutradhar I, et al., 2018). It is an irreversible medical condition that affects proper functioning of the kidneys(Hassan ES., 2014). Patients with this condition are at a very high risk to develop end stage renal disease(Hasan M, Sutradhar I, et al., 2018). It has an effect on a person's various body systems such as nervous, cardiovascular, respiratory, endocrine, musculoskeletal and metabolic systems. Patients with this disease have reported significant changes in their respiratory system(Hassan ES., 2014). It is stated that patients with chronic renal failure had decreased strength of respiratory muscles when compared with healthy individuals(Bark H, et at., 1988, Hassan ES., 2014).The problems experienced due to the renal failure maybe the cause for respiratory muscle weakness in dialysis patients (Karacan Ö, Tutal E, et al., 2006).

Its reported that patients with chronic renal failure had generalized weakness, shortness of breath, fatigue which had an effect on their voice causing it to be weak when evaluated perceptually (Hamdan AL, et al., 2005). With respect to respiration,utilizing the pattern of breathing indicated that the laryngeal muscles is also affected in these patients. Pierson reported that the functioning of the respiratory muscles is characterized by reduction in the maximal inspiration and expiration pressure. Since respiration plays a major role for the production of voice, vocal dysfunctions are said to be present in patients with chronic renal failure (Hassan ES., 2014).

6

Hemodialysis:

Hemodialysis is an essential treatment procedure which is useful and done for patients with end stage renal disease (Longo DL, Fauci AS, et al., 2012). This treatment plays a very major role as it helps in filtering and washing away excess toxins and fluids our body stream

efficiently. It also helps in improving proper acid base balance(Jung SY, Ryu JH, et al., 2014).

Overall Effect of hemodialysis on voice:

Patients who have undergone hemodialysis have reported that they have experienced significant hoarseness of voice at the end of this treatment. The phonatory effort may also depend on hydration level of the vocal folds (Ori y, Sabo R, et al., 2014). A study made a comparison between psychosomatic state of patients undergoing dialysis and the acoustic parameters during the production of the vowel 'e'. From this study they concluded that changes in vocal parameters was obtained post dialysis and the findings they obtained were correlating with the psychophysiological state of the patients(Nesic et al., 1996).

Incidence and Prevalence of Chronic Renal Failure (CRF)in India:

Chronic renal failure is a global threat to health and for the developing countries because the treatment is very expensive and it must be continued life-long. Incidence of CRFin India has increased in last 15 years and over one million people survive on dialysis. Two studies were conducted in India; a) Study 1- Population Screening in New Delhi.In this study 4,712 subjects had participated in Blood Biochemistry Test. Mean age was 42.36 ±12.54 years, out of which 56.16% were males, 37 individuals were found to have CRF. b) Study 2- This study involved 48 hospitals distributed overall India. They collected data based on the investigations conducted over a period of 1-3months in these 48 hospitals. Consisting of 4,145 Chronic Renal Failure disorder. This study showed that prevalence of CRF is 0.8% (De Nicola L, Zoccali C., 2015).

Incidence and Prevalence of Chronic Renal Failure (CRF) in Other South Asian Countries:

For the underdeveloped countries of South Asia, with 2 billion population, CRF is a major health problem. The exact incidence and prevalence in the region is not known, but estimates suggest that the prevalence may be more than that reported in Western societies (Vivekanand J, 2009).The studies on CKF were found from India, Pakistan, Bangladesh, and Nepal. Sri Lanka, Bhutan, Afghanistan and Maldives had no studies published until 2010 except India had published a study done in the year 2009 and Pakistan had a study published in 2005 respectively(Hasan M, Sutradhar I, et al., 2018). 2 studies done from Bangladesh reported gender segregated incidence and prevalence of CRF. Simultanous rise in the incident rate of patients with CRF has increased from 33.3% to 68% in 2005. Anand, et at., reported that prevalence of CRF was higher among females (28.0%) than males (24.7%) (Hasan M, Sutradhar I, et al., 2018).It is estimated that annual incidence of new cases of CRF is > 100 per million population in Pakistan and the overall CRF prevalence seen in adults was 21.2% and the lowest prevalence was 12.5% (Ullah K, Butt G, et al., 2015).In the county Nepal community based cross sectional survey design was done. One thousand individuals of ages 20 participated in the study. From this study it was estimated that incidence of CRF is increased from 30% to 50% from the years 1991 to 1999, and the prevalence of CRF in males is 48% and females is 52% and is seen higher in female population than male population (Hada R, Khakurel S, et al., 2009).The population of Afghanistan is estimates to be 33 million, where a study was done and the results showed that the incidence of chronic renal failure is said to be 48% and the prevalence of CRF were higher in rates (Abraham G, Varughese S, et al., 2016).In Bhutan, a study was done in the year 2008 to 2012 around 62% of total population is affected by CRF and resulting in increased death rate. This is due to increment of non-communicable diseases such as hypertension and diabetes. According to another study done in the year 2015, 12 patients are diagnosed every month with CRF (Abraham G, Varughese S, et al., 2016).In accordance to the South Asian Epidermic, the World Health Organization (WHO) has given an estimation of prevalence in Sri Lanka that about 0.4 per 1000 population

with CRF is due to diabetes, hypertension and stone disease. But still the actually cause of CRF remains unknown (Abraham G, Varughese S, et al., 2016).

NEED FOR THE STUDY

Though the voice change is not a predominant complaint but complications related to voice during or after the process of hemodialysis can affect significantly the communication ability and quality of life drastically. There are only few studies which contribute evidences on the influence of HD on vocal mechanism by acoustic analysis and to ascertain the diversity voice change (VC). So the current study may throw light on these issues.

AIM OF THE STUDY

This study aims at acoustically analyzing the voice characteristics caused due to hemodialysis in patients with chronic renal failure.

METHODOLOGY

The longitudinal descriptive study of random sampling was carried after the approval by the Research Ethics Committee of Father Muller Charitable Institutions, Mangalore. This study was performed on 40 individuals who were under treatment for kidney problems at the Nephrology department of Father Muller hospital, Mangalore. The informed consent forms were given to the participants and were also explained about the purpose of the study and ethical approval was obtained before the study.

Participants:

The study included 20 patients Pre-Hemodialysis and 20 patients Post-Hemodialysis. Thus, the study was done on a total of 40 patients with kidney problems. The participants were selected using the following criteria:

Inclusion Criteria:

- Individual with normal voice quality before hemodialysis
- Individual with chronic renal failure
- Individual who are in the age range of 20-40 years
- Individual who has undergone more than one course of hemodialysis (HD)

Exclusion Criteria:

- Individual with associated medical/surgical history of problems of laryngeal system
- Individuals who are below 20 years and above 40 years of age
- Individuals who have respiratory disorders and on bronchodilators

Procedure:

About 40 subjects wereselected based on inclusion and exclusion criteria, with presence or absence of vocal complaint among whom 20 were Pre-HD and 20 subjects after HD. All

of the participants were counselled regarding the aim, need and the procedure of the study and an informed consent was obtained prior to the assessment. The individuals who agreed to participate signed an informed consent and co-operated in completing the data

collection.Medical history of each individual was recorded. Acoustic evaluation using an acoustic voice analysis Praat, was done on the voice samples of all individuals.

PRAAT:

Following the completion of the Praat, a recording sample of the participant phonating */a/* was used for acoustic analysis.

Instruction to the patient:

The participants were instructed to sit in upright position with a distance of 6 inches away from the microphone, a demonstration recording was taken first, followed by the required sample of the participant phonating */a/* for at least 10 seconds. Using Praat Software, Fundamental Frequency, Jitter, Shimmer and Harmonics-Noise Ratio were calculated and the results were noted.The results obtained was subjected to statistical analysis.

Statistical Analysis:

Statistical analysis was done using T-test, for comparison of Praat results, where Fundamental Frequency, Jitter, Shimmer and Harmonics-to-noise ratio data was used for comparison between the results of the two groups; Pre-Hemodialysis (Pre-HD) v/s Post-Hemodialysis (Post-HD) in male to male, female to female and male to female population.

11

RESULTS

A total of 40 individuals were analyzed in this study. The study investigated the impact of Hemodialysis on voice in individuals with Chronic Renal Failure. The voice acoustic analysis Pre- and Post-hemodialysis in patients with renal failure are given in the table1 and table 2(Refer Appendix for additional information) below.

Parameters	Group	N	Mean	Std. Deviation	P- Value
fo	pre	20	243.80	70.81	<0.05
	post	20	182.90	49.97	<0.05
JITTER	pre	20	0.63	0.24	>0.05
	post	20	0.70	0.24	>0.05
SHIMMER	pre	20	0.28	0.08	>0.05
	post	20	0.32	0.13	>0.05
HNR	pre	20	21.71	4.08	>0.05
	post	20	22.49	2.96	>0.05

TABLE 1: COMPARISON OF VOICE ACOUSTIC ANALYSES PRE- AND POST-HEMODIALYSIS IN PATIENTS WITH RENAL FAILURE

On overall comparison of the parameters between two groups (Pre-HD and Post-HD groups); the *fo* levels in the Post- HD group decreased significantly in PRAAT ($p<0.05$), whereas the other parameters like Jitter, Shimmer and HNR valueswere significantly higher than those of the Pre-HD group when compared (Table 1).

The comparison of Mean and Standard Deviation betweenPre- and Post-hemodialysis in patients with renal failure on overall measures are as follows:

The comparison of Mean and Standard Deviation for *fo*,on Pre-hemodialysis in patients with renal failure is243.8097±70.81251 andthe comparison of Mean and Standard Deviation, Post-hemodialysis in patients with renal failure is182.9084±49.97406. The comparison of Mean and Standard Deviation for Jitter, on Pre-hemodialysis in patients with renal failure is0.630±0.24637and the comparison of Mean and Standard Deviation, on Post-hemodialysis in patients with renal failure is 0.7061±0.24362. The comparison of Mean and StandardDeviation for Shimmer, on Pre-hemodialysis in patients with renal failure is 0.2850±0.08650

12

and the comparison of Mean and Standard Deviation, Post-hemodialysis in patients with renal failure is 0.3221±0.13508.The comparison of Mean and Standard Deviation for HNR,

on Pre-hemodialysis in patients with renal failure is 21.7151±4.08539and the comparison of Mean and Standard Deviation, Post-hemodialysis in patients with renal failure is 22.4948±2.96251.

The voice acoustic analysis in Pre- and Post-hemodialysis in Male and Female categories of patients with renal failure are given in the table 3 and table 4(Refer Appendix for additional information) below.

Gender	Parameters	Group	N	Mean	Std. Deviation	P- Value
F	*fo*	pre	14	286.33	27.20	<0.05
		post	6	254.15	13.95	
	JITTER	pre	14	0.62	0.28	>0.05
		post	6	0.70	0.38	
	SHIMMER	pre	14	0.30	0.08	>0.05
		post	6	0.30	0.11	
	HNR	pre	14	23.24	3.69	<0.05
		post	6	20.57	3.92	
M	*fo*	pre	6	144.59	15.97	<0.05
		post	14	152.37	15.10	
	JITTER	pre	6	0.65	0.15	>0.05
		post	14	0.70	0.17	
	SHIMMER	pre	6	0.23	0.05	>0.05
		post	14	0.32	0.14	
	HNR	pre	6	18.13	2.44	<0.05
		post	14	23.31	2.11	

TABLE 3: COMPARISON OF VOICE ACOUSTIC ANALYSESIN PRE- AND POST-HEMODIALYSIS IN MALE AND FEMALE CATEGORIES OF PATIENTS WITH RENAL FAILURE

On comparison of the parameters between two groups (Pre-HD and Post-HD groups) in Male and Female categories; the *fo* and HNR values in the Post- HD group decreased significantly in PRAAT ($p<0.05$), whereas the other parameters like Jitter, Shimmer and HNR valueswhen comparedhad significantly no much differences than those of the Pre-HD group (Table 3).

The comparison of Mean and Standard Deviationin Pre- and Post-hemodialysis in Male and Female categories of patients with renal failure are as follows:

In Females,The comparison of Mean and Standard Deviation for *fo*, on Pre-hemodialysis in patients with renal failure is 286.3309±27.20437and the comparison of Mean and Standard Deviation, Post-hemodialysis in patients with renal failure is 254.1563±13.95185. The comparison of Mean and Standard Deviation for Jitter, on Pre-hemodialysis in patients with renal failure is 0.6209±0.28113and the comparison of Mean and Standard Deviation, on Post-hemodialysis in patients with renal failure is 0.7022±0.38194. The comparison of Mean and Standard Deviation for Shimmer, on Pre-hemodialysis in patients with renal failure is 0.3067±0.08965and the comparison of Mean and Standard Deviation, Post-hemodialysis in patients with renal failure is 0.3092±0.11961. The comparison of Mean and Standard Deviation for HNR, on Pre-hemodialysis in patients with renal failure is 23.2488±3.69477and the comparison of Mean and Standard Deviation, Post-hemodialysis in patients with renal failure is 20.5737±3.92584.

In Males, The comparison of Mean and Standard Deviation for *fo*, on Pre-hemodialysis in patients with renal failure is 144.5933±15.97947 and the comparison of Mean and Standard Deviation, Post-hemodialysis in patients with renal failure is 152.3736±15.10625. The comparison of Mean and Standard Deviation for Jitter, on Pre-hemodialysis in patients with renal failure is 0.6528±0.15588and the comparison of Mean and Standard Deviation, on Post-hemodialysis in patients with renal failure is 0.7077±0.17500. The comparison of Mean and Standard Deviation for Shimmer, on Pre-hemodialysis in patients with renal failure is 0.2343±0.05602 and the comparison of Mean and Standard Deviation, Post-hemodialysis in patients with renal failure is 0.3276±0.14510. The comparison of Mean and Standard Deviation for HNR, on Pre-hemodialysis in patients with renal failure is 18.1365±2.44464 and the comparison of Mean and Standard Deviation, Post-hemodialysis in patients with renal failure is 23.3181±2.11329.

Thus, as there is maximum differences in *fo* values in general category andmaximum differences in *fo* and HNR values in Male and Female categories which will indicate that stability of vocal folds will be affected and thus there will be presence of abnormal voice.

DISCUSSION

As there is less number of studies to prove the voice complications experienced by Post-HD, this study helps in throwing light onthese aspectsinorder to improve the communication ability and quality of life. This study has shown that there is difference in *fo* values in general category and maximum differences in *fo* and HNR values in Male and Female categories which confirms that there is significantly higher rate ofinstability of vocal fold vibrations than the Male and Female categories with Pre-HD (general group). Thus proving the presence of an abnormal voice in the Male and Female categories with Post-HD (experimental group).The different domains of voice are experimented in this study, i.e., Fundamental Frequency (*fo*), Jitter (%), Shimmer (dB) and HNR parameters. This study affirms the fact that the voice characteristics gets affected on undergoing hemodialysis. The Vocal Fold behavior with respect to pitch is attributed to Fundamental Frequency (*fo*). The results confirmedthat there waschange in voice quality in patients who undergo Hemodialysis. Therefore establishing the impact of Hemodialysis on Vocal function or laryngeal function producing the voice characteristics.

Most important feature of the voice is frequency which is number of vibrations of the vocal folds per second. The Fundamental Frequency (*fo*) means the frequency of fundamental voice which is occurs at the level of larynx. Mean *fo* value during normal speech is between 100–180Hz in the males and 180–250Hz in the females. HNR is the ratio of total energy of the fundamental voice which is said as harmonic components to the energy of the noise. The dB is the unit used to measure and higher values show that the ratio of noise is high in the voice (Unver S, Hardal U, et al., 2015).

The change in fundamental frequency is already proved in various studies (Hamdan AL, Medawar W, et al., 2005). The increased subglottic pressure and decreased vocal fold thickness along with other factors like length, tension, and elasticity of vocal fold is affected after hemodialysis causing vocaldistructions (Jung SY, Ryu JH, et al., 2014). According to the few authors the reduced Vocal Fold volume due to the delayed muscle fiber contraction which is responsible for reduced muscle strength (Hassan ES, 2014). During the Hemodialysis there will be removal of excessive body fluid accumulated in interstitial space, thereby

expecting the excessive fluid in Reinke's Space of Vocal folds (Superficial Lamina Propria) will also be removed. This results implies in reduction of thickness of vocal folds (True VF) (Ori Y, Sabo R, Binder Y, et al., 2006). There will be improved respiratory functions due to increased muscle function after removal of excessive fluid from interstitial space and uremic toxins from the body. Thus improved lung function affects the subglottic pressure and transglottal airflow rate (Jung SY, Ryu JH, et al., 2014). The negative fluid imbalance after hemodialysis results in reduction of intravascular and extravascular volumes of lung fluids along with reduction of fluid in Lamina Propria, after which there will be increment in pitch and decrement in mass or volume. According to the study by Nesic M, Veljkovic S,et al., in 1996., as it is unable to rule-out the both vocal intensity and perturbation changes, the Jitter and Shimmer remains unexplained. As the laryngeal efficiency mirrors the voice turbulence index and noise/harmonics ratio, incomplete closure of glottis or prolonged glottis opening gives rise to excessive airflow becoming turbulent and perceived as aperiodic noise, which has no harmonics and the energy of it gets scattered over all frequencies resulting no much effects on HNR values (Hamdan AL, Medawar W, et al., 2005). But degree of hoarseness is related to the glottal closure. So it is known that glottal gap and hoarseness decreases after hemodialysis (Jung SY, Ryu JH, et al., 2014). It is also said that the reduced vocal fold volume also results in hoarseness of voice and increases vocal gap, thus arising incomplete glottal closure (Ori Y, Sabo R, et al., 2006). There are additional problems suffered after HD, along with hoarseness and coughing, i.e., heart related complication, abdominal discomfort, yawning, sighing, vomiting, restlessness, cramping, anxiety, etc. (Zumrutdal A, 2013).

Inorder to understand in depth about the complications of voice after Hemodialysis, it is better to use more advanced technologies to estimate the further details and come out with better remedial measures.

CONCLUSION

The results of this study were based on the scores obtained from the PRAAT,the parameters taken (Pitch, Jitter, Shimmer and Harmonics to Noise ratio) from the two groups; in our study population.This study confirmed that there is change in voice quality pre and post HD. A detailed case history can help in gathering additionalinformation regarding demographic data, medical history, presenting complaints and symptoms, dietary patterns, the other environmental factors and familiar history that may lead to the development of health problems. It is essential to include other acoustical analysis using different instruments having different standards to arrive at better results that can assist in developing proper intervention measures. Thus, the researchers in further can take this research findings apply on different other population. Hence, this study would help the professionals to find out the rate of occurrence of voice related complications in individuals with renal failure after the hemodialysis and develop appropriate measures to manage them.

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APPENDIX

RESULTS:

TABLE 2: COMPARISON OF VOICE ACOUSTIC ANALYSES PRE- AND POST-HEMODIALYSIS IN PATIENTS WITH RENAL FAILURE

Gender		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
fo	Equal variances assumed	2.16	0.15	2.71	18	0.01	32.17	11.83	7.30	57.04
	Equal variances not assumed			3.48	17.10	0.00	32.17	9.23	12.69	51.65
JITTER	Equal variances assumed	030	0.58	-0.53	18	0.60	-0.08	0.15	-0.40	0.23
	Equal variances not assumed			-0.47	7.43	0.65	-0.08	0.17	-0.48	0.32
SHIMMER	Equal variances assumed	0.11	0.73	-0.05	18	0.96	-0.00	0.04	-0.10	0.09
	Equal variances not assumed			-0.04	7.52	0.96	-0.00	0.05	-0.12	0.12
HNR	Equal variances assumed	0.04	0.83	1.45	18	0.16	2.67	1.83	-1.17	6.53
	Equal variances not assumed			1.42	9.01	0.18	2.67	1.88	-1.58	6.93
fo	Equal variances assumed	0.03	0.85	-1.03	18	0.31	-7.78	7.49	-23.52	7.95
	Equal variances not assumed			-1.01	9.05	0.33	-7.78	7.67	-25.11	9.55
JITTER	Equal variances assumed	0.04	0.82	-0.66	18	0.51	-0.05	0.08	-0.22	0.11
	Equal variances not assumed			-0.69	10.66	0.50	-0.05	0.07	-0.22	0.11
SHIMMER	Equal variances assumed	7.31	0.01	-1.50	18	0.14	-0.09	0.06	-0.22	0.03
	Equal variances not assumed			-2.07	17.96	0.05	-0.09	0.04	-0.18	0.00
HNR	Equal variances assumed	0.19	0.66	-4.80	18	0.00	-5.18	1.07	-7.44	-2.91
	Equal variances not assumed			-4.51	8.38	0.00	-5.18	1.14	-7.80	-2.55

TABLE 4: COMPARISON OF VOICE ACOUSTIC ANALYSES IN PRE- AND POST-HEMODIALYSIS IN MALE AND FEMALE CATEGORIES OF PATIENTS WITH RENAL FAILURE

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
fo	Equal variances assumed	5.33	0.02	3.14	38	0.00	60.90	19.38	21.66	100.13
	Equal variances not assumed			3.14	34.16	0.00	60.90	19.38	21.52	100.27
JITTER	Equal variances assumed	0.25	0.61	-0.97	38	0.33	-0.07	0.07	-0.23	0.08
	Equal variances not assumed			-0.97	37.99	0.33	-0.07	0.07	-0.23	0.08
SHIMMER	Equal variances assumed	4.18	0.04	-1.03	38	0.30	-0.03	0.03	-0.10	0.03
	Equal variances not assumed			-1.03	32.34	0.30	-0.03	0.03	-0.11	0.03
HNR	Equal variances assumed	3.00	0.09	-0.69	38	0.49	-0.77	1.12	-3.06	1.50
	Equal variances not assumed			-0.69	34.65	0.49	-0.77	1.12	-3.07	1.51