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RESEARCH

Trends in Pulmonary and Respiratory Medicine

Effect of Ketogenic Diet Versus Regular Diet On Voice Quality Of Patients with Parkinson's Disease

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Abstract

Purpose: *Diets which have influence on wellness could alter in their structure. Apart from weight control, different diets are used in the treatment of many diseases. Ketogenic diet(KD) has been ventured to remedy of neurological diseases and obesity. Multiple sclerosis(MS) is a complex progressive disease of the central nervous system and it has an influence on quality of voice. Voice Handicap Index (VHI) is an assay that presents data to clinical and physiological appraisal about voice. We measured the effect of KD and RD on voice quality(VQ).*

Methods: *Sixty-eight subjects with MS who narrated a voice disorder associated to their disease were indiscriminately distributed to the KD or regula diet(RD) groups. We studied the VHI alter of patients before and 3 months after diet.*

Results: Sixty-five MS subjects accomplished the study. Baseline VHI rates did not diverge seriously between groups. In the KD group, statistically improvement was seen in all VHI parameters 3 months after diet ($p< 0.001$).

Conclusion: *Presently there are many therapies that aim speech and voice disorders in patients with MS. As such KD may be an option therapy to renovate VQ of patients with MS. A bigger sample size is required to find the function and pathophysiology of KD on VQ of MS patients.*

Keywords: *multiple sclerosis; ketogenic diet; regular diet; voice quality; voice handicap index*

Introduction

Parkinson's disease (PD) patients may have dysarthria that aggravates with the progression of the disease [1]. Nearly 90% of PD patients are negatively affected in speech that decreases quality of life [2]. Symptoms change from a breathy voice to a voice that is neither hearable nor conprehensible [3]. Levodopa (L-dopa) treatment has positive impact on the quality of speech in patients with PD [4].

It is recognised that foods may confer a positive impact on health and moreover a mixture of foods can rarefy signs and features of some neuromuscular disorders. Interest in ketogenic diet (KD) has risen in the last decade. KD is used in patients with treatment resisant epilepsy [5]. KD has been trialled in different diseases such as cancer, obesity and diabetes [6-8]. Many studies have called attention to the positive effects of KDs on a variety of neurological and neuromuscular disorders however few have investigated the underlying pathophysiological mechanisms of this state [5]. A regular diet (RD) is a typically chatacterised by 30% of calories from fat [9]. Processes such as videolaryn¬gostroboscopy, acoustic and aerodynamic analysis, patient-re¬ported assessments are also applied to measure dysphonia [10]. Assessment of the patient's self-perception is extremely important, and the magnitude of their speech and voice disorder should also be quantified. The impact of a speech and voice disorder on a patient's quality of life is dependent on different factors that change from person to person and is the most significant aspect of the assessment [11]. There are different patient-re¬ported evaluation methods for speech and voice disorders, the most common patient-reported scoring system is the Voice Handicap Index-10 (VHI-10) [12]. To date, there are no published studies which have examined the effect of diet on speech and voice disorders in PD. The aim of the present study was to compare the effect of RD and KD on speech and voice disorders in patients with PD quanitified by scores on the VHI-10.

Method

Seventy-four patients with PD (51 males) with a speech and voice disorders who were drug-free between 2014-2016 enrolled in the study.

The Local Ethics Committee approved the study. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

Health and sociodemographic data of all cases were recorded in the report form, and all patients underwent ENT and neurologic examinations. PD was defined according to International Parkinson's Disease and Movement Disorder Society diagnostic criteria [13]. On the VHI-10 form, patients were required to grade the feasible dilemmas which subjects with dysphonia can sustain in their regular life on a scale of 0 to 4 (0=never, 1=almost never, 2=sometimes, 3=almost always, 4= always).

Statistical analysis

Statistical analysis was performed to compare the level of

investigated variables before and 3 months after diet (Johns Hopkins protocol) [14]. Median, standard deviation, lowest, highest, and ratio values were used in the descriptive statistics of the data and statistical analyses were performed by using SPSS for WINDOWS software (version20; SPSS Inc, USA). Distribution of patients by gender ratio and mean age was analyzed using the Pearson's Chi-Square and Mann Whitney U tests. The Mann Whitney U test was also performed to compare the VHI scores of the subjects between the RD and KD groups. Test results were reported as significant for $p < 0.01$.

Results

The 74 patients were equally divided in to two groups. Sixty-eight PD patients (49 males and 19 females) aged between 56-81 completed the study. Six patients dropped out of the study. Gastrointestinal side effects including nausea, vomiting, diarrhea and poor feeding were observed in 5 patients (3 in KD, 2 in RD) and cardiac arrhythmia was noted in one patient in RD group. Distribution by age and gender of cases who completed the study are given in (Table 1).

The mean total VHI-10 score at baseline in the RD group was 22.2±5.1; and in the KD group was 21.2±4.9. After 3 months, the mean total VHI-10 score of the RD group was 20.9±4.8; and the KD group was 5.3±1.2. Distribution of the mean VHI-10 scores in the two groups and statistically significant differences among the scores are shown in (Table 2). When each parameter was reviewed individually, scores for VHI-10 parameters were found to be higher in the beginning versus 3 months after KD ($p<0.01$). VHI-10 scores were not significantly different in RD group between the scores in the beginning versus 3 months after diet (Table 2).

Table 1. *Demographic, clinical presentation (signs/symptoms), and comorbidities of 1245 confirmed COVID-19 cases admitted to the hospitals.*

		Group			
		Regular Diet (n/%)	Ketogenic Diet (n/%)	Total (n/%)	p
Gender	Male	10 / 30.3	9 / 28.1	19 / 29.2	0.143
	Female	23 / 69.7	23 / 71.9	46 / 70.8	
Age (Mean ± Standart Deviation)		48.3±6.7	45.2±5.9	47.8± 6.1	0.125

Table 2. *Distribution of and comparison of median VHI-10 scores before and 3 months after diets*

	Regular Diet Group (Mean±SD)		p	Ketogenic Diet Group (Mean±SD)		p
	Begining	3 months later		Begining	3 months later	
VHI(1)	2.3±1.1	2.2±1.1	0.195	2.1±0.9	0.3±0.1	<0.01
VHI(2)	1.7±0.8	1.7±0.9	0.199	1.6±1.0	0.6±0.2	<0.01
VHI(3)	2.1±1.0	1.9±1.0	0.165	2.0±1.1	1.0±0.6	<0.01
VHI(4)	1.4±0.6	1.5±0.8	0.185	1.7±0.9	0.7±0.2	<0.01
VHI(5)	2.2±1.2	2.1±1.2	0.173	1.9±1.1	0.6±0.2	<0.01
VHI(6)	1.6±0.7	1.5±0.8	0.184	1.6±0.8	0.7±0.3	<0.01
VHI(7)	1.9±1.1	1.7±1.0	0.151	1.8±0.9	0.6±0.3	<0.01
VHI(8)	2.5±1.3	2.4±1.2	0.191	2.3±1.4	0.8±0.5	<0.01
VHI(9)	2.1±0.8	2.0±0.9	0.164	2.2±1.0	0.7±0.3	<0.01
VHI(10)	2.2±1.2	2.1±1.1	0.183	2.0±1.2	0.8±0.4	<0.01
VHI Total	21.6±4.7	20.6±4.3	0.172	20.9±4.2	7.7±1.4	<0.01

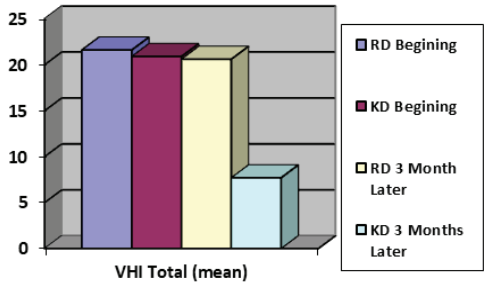

Figure 1: *Comparison of mean VHI Total scores before and 3 months after diets*

Discussion

CPD is typically characterized by bradykinesia, rigidity, tremor and postural instability, which may be paired with non-motor symptoms including dysarthria, dementia and mood disorders that diminish quality of life [15-17]. Speech and voice disorders affect nearly 90% of PD patients although the underlying pathophysiologcal mechanisms of these disabling symptoms are not well understood. Despite the high prevalence of speech and voice disorders in PD only 3-4% of patients receive speech treatment. Treatment modalities include pharmacological intervention, surgery, deep brain stimulation and vocal fold augmentation [18,19]. Levodopa is regarded as the gold standard therapy drug for PD and significantly reduces all neurologic symptoms [20]. KD is comprised mostly of fats and is gaining popularity as a nonpharmacological intervention for neurologic diseases [21]. High-fat diet consumption increases dopaminergic activation in central nervous system [22,23]. Purported pathophysiological mechanisms of KD in epilepsy include activation of adenosine triphosphate sensitive potassium channels by mitochondrial metabolism, inhibition of rapamycin pathway, and inhibition of glutamatergic transmission [24]. The dopamine-like effect of KD can be via the dopamine receptor and tyrosine that is a precusor of dopamine.

Conclusion

KD may be considered as an alternative treatment for speech and voice disorders in PD patients who do not want medical or surgical treatment. Future studies with a larger sample size are needed to explain pathophysiology mechansms of this finding.

References

1. Pawlukowska W, Golab-Janowska M, Safranow K, Rotter I, Amernik K, et al. Articulation disorders and duration, severity and L-dopa dosage in idiopathic Parkinson's disease. *Neurol Neurochir Pol*. 2015; 49: 302-306.
2. Miller N, Noble E, Jones D, Burn D. Life with communication changes in Parkinson's disease. *Age Ageing*. 2006; 35: 235-239.
3. Miller N, Allcock L, Jones D, Noble E, Hildreth AJ, et al. Prevalence and pattern of perceived intelligibility changes in Parkinson's disease. *J Neurol Neurosurg Psychiatry*. 2007; 78: 1188-1190.
4. Okada Y, Murata M, Toda T. Effects of levodopa on vowel articulation in patients with Parkinson's disease. *Kobe J Med Sci*. 2016; 61: E144-154.
5. Wang HS, Lin KL. Ketogenic diet: an early option for epilepsy treatment, instead of a last choice only. *Biomed J*. 2013; 36: 16-17.
6. Paoli A. "Ketogenic diet for obesity: friend or foe?" *Int J Environ Res Public Health*. 2014; 11: 2092-2107.
7. Klementand RJ, Kämmerer U. "Is there a role for carbohydrate restriction in the treatment and prevention of cancer?" *Nutr Metab (Lond)*. 2011; 8: 75.
8. Accurso A, Bernstein RK, Dahlqvist A, Draznin B, Feinman RD, et al. Dietary carbohydrate restriction in type 2 diabetes mellitus and metabolic syndrome: time for a critical appraisal. *Nutr Metab (Lond)*. 2008; 5: 9.
9. Meksawan K, Pendergast DR, Leddy JJ, Mason M, Horvath PJ, et al. Effect of Low and High Fat Diets on Nutrient Intakes and Selected Cardiovascular Risk Factors in Sedentary Men and Women. *J Am Coll Nutr*. 2004; 23: 131-140.
10. Mau T. Diagnostic evaluation and management of hoarseness. *Med Clin North Am*. 2010; 94: 945-960.
11. Cohen SM, Dupont WD, Courey MS. Quality-of-life impact of non-neoplastic voice disorders: a meta-analysis. *Ann Otol Rhinol Laryngol*. 2006; 115: 128-34.
12. Franic DM, Bramlett RE, Bothe AC. Psychometric evaluation of disease specific quality of life instruments in voice disorders. *J Voice*. 2005; 19: 300-315.
13. Copeland JN, Lieberman A, Oravivattanakul S, Tröster AI. Accuracy of Patient and Care Partner Identification of Cognitive Impairments in Parkinson's Disease-Mild Cognitive Impairment. *Mov Disord*. 2016; 31: 693-698.
14. Hartman AL, Vining EPG. Clinical aspects of the ketogenic diet. *Epilepsia*. 2007; 48: 31-42.
15. Truong DD, Bhidayasiri R, Wolters E. Management of non-motor symptoms in advanced Parkinson disease. *J Neurol Sci*. 2008; 266: 216-228.
16. Blumin JH, Pcolinsky DE, Atkins JP. Laringeal findings in advanced Parkinson's disease. *Ann Otol Rhinol Laryngol*. 2004; 113: 253-258.
17. Whitfield JA, Gravelin AC. Characterizing the distribution of silent intervals in the connected speech of individuals with Parkinson disease. *J Commun Disord*. 2018; 78: 18-32.
18. Arnold C, Gehrig J, Gispert S, Seifried C, Kell CA. Pathomechanisms and compensatory efforts related to Parkinsonian speech. *Neuroimage Clin*. 2013; 4: 82-97.
19. Dashtipour K, Tafreshi A, Lee J, Crawley B. Speech disorders in Parkinson's disease: pathophysiology, medical management and surgical approaches. *Neurodegener Dis Manag*. 2018; 8: 337-348.
20. Fabbri M, Guimarães I, Cardoso R, Coelho M, Guedes LC, et al. Speech and Voice Response to a Levodopa Challenge in Late-Stage Parkinson's Disease. *Front Neurol*. 2017; 8: 432.
21. Paoli A, Bianco A, Damiani E, Bosco G. Ketogenic diet in neuromuscular and neurodegenerative diseases. *Biomed Res Int*. 2014; 2014: 474296.
22. Naneix F, Tantot F, Glangetas C, Kaufling J, Janthakhin Y, et al. Impact of Early Consumption of High-Fat Diet on the Mesolimbic Dopaminergic System. *eNeuro*. 2017; 4: ENEURO.0120-17.2017.
23. South T, Huang XF. High-fat diet exposure increases dopamine D2 receptor and decreases dopamine transporter receptor binding density in the nucleus accumbens and caudate putamen of mice. *Neurochem Res*. 2008; 33: 598-605.
24. Danial NN, Hartman AL, Stafstrom CE, Thio LL. How does the ketogenic diet work? Four potential mechanisms. *J Child Neurol*. 2013; 28: 1027-1033.

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