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ORIGINAL ARTICLE

Speech perception performance in subjects with type I diabetes mellitus in noise☆

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KEYWORDS
Type 1 diabetes mellitus;
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Abstract
Introduction: Diabetes mellitus (DM) is a chronic metabolic disorder of various origins that occurs when the pancreas fails to produce insulin in sufficient quantities or when the organism fails to respond to this hormone in an efficient manner.
Objective: To evaluate the speech recognition in subjects with type I diabetes mellitus (DMI) in quiet and in competitive noise.
Methods: It was a descriptive, observational and cross-section study. We included 40 participants of both genders aged 18–30 years, divided into a control group (CG) of 20 healthy subjects with no complaints or auditory changes, paired for age and gender with the study group, consisting of 20 subjects with a diagnosis of DMI. First, we applied basic audiological evaluations (pure tone audiometry, speech audiometry and immittance audiometry) for all subjects; after these evaluations, we applied Sentence Recognition Threshold in Quiet (SRTQ) and Sentence Recognition Threshold in Noise (SRTN) in free field, using the List of Sentences in Portuguese test.
Results: All subjects showed normal bilateral pure tone threshold, compatible speech audiometry and ''A'' tympanometry curve. Group comparison revealed a statistically significant difference for SRTQ ($p = 0.0001$), SRTN ($p < 0.0001$) and the signal-to-noise ratio ($p < 0.0001$).
Conclusion: The performance of DMI subjects in SRTQ and SRTN was worse compared to the subjects without diabetes.

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PALAVRAS CHAVE
Diabetes melito, tipo 1;
Percepção de fala;
Audição;
Percepção auditiva

Desempenho da percepção de fala no ruído em indivíduos com diabetes melito tipo I

Resumo
Introdução: O Diabetes Melito (DM) é um distúrbio metabólico crônico de várias origens, que começa quando o pâncreas deixa de produzir insulina em quantidade suficiente, ou quando o organismo não consegue responder a esse hormônio de maneira eficiente.
Objetivo: Avaliar o reconhecimento de fala em indivíduos com diabetes melito tipo I (DMI) no silêncio e no ruído competitivo.
Método: Estudo descritivo, observacional e transversal. Foram incluídos 40 participantes de ambos os sexos com idade entre 18 a 30 anos, divididos em um Grupo Controle (GC) de 20 indivíduos saudáveis sem queixas ou alterações auditivas, pareados por idade e sexo com o grupo de estudo, composto por 20 indivíduos com diagnóstico de DMI. Inicialmente aplicou-se uma avaliação audiológica (audiometria tonal, audiometria vocal e imitanciometria) para todos os indivíduos; a seguir, os mesmos foram avaliados para o Limiar de Reconhecimento de Sentenças no Silêncio (LRSS) e Limiar de Reconhecimento de Sentenças no Ruído (LRSR), em campo livre, usando a Lista de Sentenças em teste em Português.
Resultados: Todos os indivíduos apresentaram limiar tonal bilateral normal, audiometria da fala compatível e curva de timpanometria ''A''. A comparação dos grupos revelou uma diferença estatisticamente significativa para LRSS ($p = 0{,}0001$), LRSR ($p < 0{,}0001$) e a relação sinal-ruído ($p < 0{,}0001$).
Conclusões: O desempenho dos indivíduos com DMI para LRSS e LRSR foi pior em comparação com os indivíduos sem diabetes.

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder of various origins that begins when the pancreas fails to produce insulin in sufficient quantities or when the organism fails to respond to this hormone in an efficient manner. This leads to a condition characterized by hyperglycemia, which may damage certain organs, especially the eyes, kidneys, nerves, heart, and blood vessels.[1,2]

One of the less explored or reported consequences for patients with diabetes is dysfunction of the auditory system.[3] Patients with DMI do not secrete endogenous insulin or do so in a reduced manner due to the destruction of their pancreatic beta-cells. This situation affects about 20% of cases and is more commonly identified in children and adolescents.[2] In Brazil there are no studies reporting the exact prevalence of chronic complications in diabetic patients, such as retinopathy, nephropathy, neuropathy, arterial hypertension, cardiovascular changes, and otoneurologic symptoms such as tinnitus, vertigo and hearing loss.[4–6] This may be due to two particular factors: affected persons being unaware of their diseases, and the fact that, although aware of their chronic metabolic disorders, several affected individuals do not seek for medical care.[4]

Some studies have aimed to determine the relationship between DM and hearing loss, but there is no consensus in the international literature about the correlation between these two conditions. No definite cause–effect relationship has been confirmed between diabetes and deafness, and controversies regarding the audiological and histopathological findings attributed to diabetes still remain.[2,3,7–9]

Changes in the hearing function of diabetic patients have been identified through audiometry evaluations,[7–10] through otoacoustic emissions,[11–14] and through brainstem auditory evoked potentials.[8,12,13,15–17] Several studies have investigated the mechanism by which changes in glucose and insulin may produce changes in hearing perception and vestibular function. Labyrinthine structures, especially the stria vascularis, are known to be extremely metabolically active, and thus are susceptible to oxygen and glucose levels and to the availability of adenosine triphosphate, necessary for the preservation of the endocochlear potential. Thus, glucose metabolism significantly influences the normal performance of the inner ear considering that both hypoglycemia and hyperglycemia could impair its average performance.[18,19]

Today there is no consensus in the international literature concerning the etiopathogenesis of hearing loss in diabetics. Some investigators have argued that hearing changes may occur because of neuropathy while others have claimed they occur due to angiopathy. Some investigations also combine the two causes.[7–13,15–19]

The peripheral and central integrity of the auditory system is essential for an appropriate speech perception. Most sensorineural hearing losses initially affect ultra-high frequencies, that are necessary for consonant discrimination and speech recognition. Impairment of speech perception occurs because although vowel sounds comprise much energy, they provide poor acoustic information, while consonant sounds involve little energy but are rich in acoustic cues. Consonant sounds are important as they present high-frequency tone quality and are essential for hearing comprehension.[20]