

Sensory function and dependence in older adults with chronic disease

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ABSTRACT

Introduction: With aging there are changes in the senses and consequently, alterations in the function of taste and smell that influence the decompensation of chronic diseases. **Objective:** Know the sensory function and its association with dependence to perform basic and instrumental daily life activities in older adults with chronic diseases. **Methodology:** Correlational study in a sample comprised by 96 participants. The Instruments used were: Snellen Letter, Manual Hearing meter, Semmes-Weinstein monofilament, flavor test, Basic Tastes, and Barthel Index. The statistic analysis implied the use of descriptive and inferential statistics, Spearman Correlation, and Mann-Whitney U Test. **Results:** Seventy one percent (71%) had visual impairment; 48% got normal hearing in the left ear and 43% in the right ear; 24% rated with tactile alteration in the left foot and 30% with tactile alteration in the right foot; 77% presented alteration of smell and taste. Forty percent (40%) had dependence on Basic Activities (ABVD by its acronym in Spanish) and 24% in Instrumental Activities (AIVD by its acronym in Spanish). The relationship between touch in both feet and auditory acuity was identified with ABVD ($p = <.05$). Age and AIVD ($p = <.001$), sharp touch in the left foot ($p = <.031$), auditory ($p = <.005$), smell ($p = <.018$), and taste ($p = <.047$). The dependence on ABVD had no difference in the test with eyeglasses ($U = 146,000$; $p = 754$) and without eyeglasses ($U = 127,500$; $p = 079$); AIVD with eyeglasses ($U = 115,000$; $p = 079$) and without eyeglasses ($U = 160,000$; $p = 202$). **Conclusions:** The greater the function in the touch and hearing senses, the less the dependence to perform ABVDs and the greater the functions in the touch, hearing, and smell senses, the less the dependence on AIVDs.

Keywords: Sensation; Gait; Cognition; Daily Life Activities; Older Adult (DeCS).

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Función sensorial y dependencia en adultos mayores con enfermedad crónica

RESUMEN

Introducción: Con el envejecimiento se presentan cambios en los sentidos y en consecuencia, alteraciones en la función del gusto y olfato que influyen en la descompensación de enfermedades crónicas. **Objetivo:** conocer la función sensorial y su asociación con la dependencia para realizar Actividades básicas de la vida diaria e Instrumentales en adultos mayores con enfermedad crónica. **Metodología:** Estudio correlacional en una muestra de 96 participantes. Instrumentos utilizados: Carta Snellen, Audiómetro Manual, monofilamento de Semmes-Weinstein, prueba de aromas de Gustos Básicos e Índice de Barthel. El análisis estadístico implicó estadística descriptiva e inferencial, correlación de Spearman, U de Mann-Whitney. **Resultados:** El 71% de los participantes presentó alteración visual. 48% obtuvo audición normal en oído izquierdo y 43% oído derecho, 24% calificó con alteración táctil del pie izquierdo y 30% en pie derecho. Alteración de olfato y gusto en 77%. Presentaron dependencia en actividades Básicas (ABVD) 40%, 24 % en Instrumentadas (AIVD). Se identificó relación entre el tacto en ambos pies y agudeza auditiva con ABVD ($p = <.05$). La edad y AIVD ($p = <.001$) agudeza tacto pie izquierdo ($p = <.031$), auditiva ($p = <.005$), olfato ($p = .018$) y gusto ($p = <.047$). La dependencia en ABVD no presentó diferencia en la prueba con anteojos ($U = 146.000$; $p = <.754$) y sin anteojos ($U = 127.500$; $p = .079$); de igual manera en AIVD con anteojos ($U = 115.000$; $p = <.079$) y sin anteojos ($U = 160.000$; $p = .202$). **Conclusión:** A mayor función en los sentidos de tacto y oído, menor dependencia para realizar las ABVD y a mayor función del tacto, oído, olfato y gusto menor dependencia en las AIVD.

Palabras clave: Sensación; Marcha; Cognición; Actividades cotidianas; Adulto mayor (DeCs).

Função sensorial e dependência em idosos com doença crônica

ABSTRATO

Introdução: Com o envelhecimento há mudanças nos sentidos e, conseqüentemente, alterações na função do paladar e do olfato que influenciam a descompensação das doenças crônicas. **Objetivo:** Conhecer a função sensorial e sua associação com a dependência para realizar Atividades Básicas da Vida Cotidiana e Instrumental em idosos com doença crônica. **Metodologia:** Estudo correlacionado em uma amostra de 96 participantes. Instrumentos utilizados: Gráfico Snellen, Audiometer Manual, Monofilamento Semmes-Weinstein, Teste de Smell de Sabores Básicos e Índice Barthel. A análise estatística envolveu estatísticas descritivas e inferenciais, correlação de Spearman, Mann-Whitney U. **Resultados:** 71% dos participantes apresentaram deficiência visual. 48% obtiveram audição normal no ouvido esquerdo e 43% ouvido direita, 24% qualificadas com alteração tátil do pé esquerdo e 30% no pé direito. Olfato e paladar perturbam em 77%. Eles tinham dependência de Atividades Básicas (ABVD) 40%, 24% em Instrumentos (AIVD). A relação foi identificada entre o toque em ambos os pés e a acuidade auditiva com a ABVD ($p = <05$). Idade e AIVD ($p = <001$) toque agudo do pé esquerdo ($p = <031$), auditivo ($p = <.005$), cheiro ($p = <.018$) e paladar ($p = <.047$). A dependência da ABVD não mostrou diferença no teste com óculos ($U=146.000$; $p = <.754$) e sem óculos ($U=127.500$; $p = <.079$); da mesma forma em AIVD com óculos ($U=115.000$; $p = <.079$) e sem óculos ($U=160.000$; $p = <.202$). **Conclusão:** A maior função nos sentidos de tato e audição, menor dependência para realizar ABVDs e maior função de toque, audição, olfato e menos dependência dos AIVDs. .

Palavras-chave: Sensação; Marcha; Cognição; Atividades da vida; Idoso (DeCS).

INTRODUCTION

Chronic diseases are a global health problem⁽¹⁾. In Mexico, the highest prevalence of diabetes mellitus, arterial hypertension, and dyslipidemia is common in the adult population⁽²⁾, and as people age other problems arise such as sensory disturbance and consequently the reduction in the ability to perform basic and instrumental daily life activities⁽³⁾.

The sensory function is the ability to receive and interpret sensations from the outside through the sense organs and the literature indicates that with aging there are important changes in each of them. It is important to study the alteration of olfactory and gustatory acuity because they alter the ability to taste and prepare food, they are also related to insecurity (consumption of spoiled food, leaving the gas knob open, etc.) and personal hygiene⁽⁴⁾. It has been documented that people with impaired olfactory acuity have problems perceiving flavors⁽⁵⁾, consequently, the alterations in the function of taste and smell influence the decompensation of chronic diseases such as diabetes mellitus and hypertension, among others, since people who do not perceive the flavors can increase the consumption of sugar or salt in food⁽⁶⁾.

The sense of touch decreases due to the number of receptors and changes its structural integrity, so that by not perceiving the qualities of the objects such as pressure, temperature, hardness, roughness, or softness, the risk of injury increases. In older adults with chronic diseases such as diabetes mellitus, the injuries lead to complications that can culminate in the loss of a limb of the upper or lower extremities⁽⁷⁾.

Additionally, in the ear, high-frequency sounds of 2000 Hz and higher are the first ones that are not perceived, resulting in impaired communication and isolation of older adults. Communication is important to perform all kinds of basic activities and others such as shopping, including food selection to control the chronic disease, talking on the phone, and moving from one place to another. Undoubtedly, the sense of sight is the one that has the greatest impact on older people.⁽³⁾ It has

been documented that when the sense of sight deteriorates, the dependence of the elderly increases because it affects all activities.⁽⁸⁾ The National Health and Nutrition Survey (2018)⁽²⁾ reported that in patients with diabetes mellitus decreased vision is the main problem, followed by loss of sensation in the feet soles.

The literature review has shown little scientific evidence in which sensory function and functional dependence are studied, therefore, it was considered important to perform a study that determine visual, olfactory, gustatory, tactile, and auditory acuity and its association with dependence to perform basic and instrumental daily life activities, in addition to exploring whether dependence to perform basic (BADL) and instrumental daily life activities (IADL) is different in older adults with visual impairment compared to those with normal visual acuity. The objective of this work was to know the sensory function and its association with the dependence to perform BADL and instrumental activities in older adults with chronic disease.

It is expected that the results of this work contribute to an increase in the knowledge of these phenomena and serve as the basis for proposing interventions aimed at delaying the alteration of sensory function in older adults with chronic diseases.

METHODOLOGY

This is a descriptive and correlational study performed in an urban population who attends a consultation at a Health Center in Monterrey, Nuevo León, Mexico. The sample consisted of 96 older adults who reported suffering from a chronic disease, identified through a non-probabilistic convenience sampling. The following were considered as inclusion criteria: older adults with the ability to listen and respond coherently to the interviewer; but those who reported were ill for less than one year were excluded.

The older adults that made up the study sample indicated that 37.5% (f = 36) suffer from diabetes mellitus, 34.4% (f = 33) have high blood pressure, 15.6% (f = 15) have diabetes mellitus, high blood pressure, and hypercholesterolemia or hypertriglyceridemia, and 12.5% (f=12) hypercholesterolemia or hypertriglyceridemia.

Sensory function included the assessment of visual, auditory, tactile, olfactory, and taste acuity. Visual acuity was measured with the Snellen Chart of letters and/or pictures. Normal vision was considered when the parameters were 20/15 or 20/20. Hearing acuity was measured with a Welch Allyn brand 232TM Manual Audiometer. The overall results were grouped into six levels of hearing for both ears: 1) from -10 to 26 dB, normal hearing, 2) from 27 to 40 dB, mild hearing loss, 3) from 41 to 55 dB, moderate hearing loss, 4) from 56 to 70 dB, slightly severe hearing loss, 5) from 71 to 90, severe hearing loss, and 6) > 91 dB, deep hearing loss. For the purposes of correlations, the dB value in which the subject indicated that he could hear was reported. A higher score represents greater hearing impairment⁽⁹⁾.

For the acuity of touch in the elderly, the sensitivity of the back and sole of the feet was assessed with a 10g Semmes-Weinstein monofilament. It was touched at one point on the back and nine points on the sole on each foot. The total of points perceived by the subject (0 to 10) was considered, the greater the number of points perceived, the greater the sensitivity, being normal when 10 points were reported.

The olfactory acuity was measured with the smell test, five natural smells were used (cumin, pepper, anise, cinnamon, and rosemary); the substances were covered with cotton and the containers were labeled with the corresponding name. The same substances were placed in other containers and the containers were tagged with codes. The subject was given the indication to smell from left to right each substance labeled with names and to memorize the smell, then he was given to smell coffee to neutralize the smells and was asked to smell the containers that were in the coded containers

and say to what substance it corresponded. A summation of the distinguished smells was made, the higher the score the better the olfactory acuity.

Taste acuity was measured with the Basic Tastes Test with Caul's selection method, which measures the ability to recognize four basic flavors (sweet, salty, sour, and bitter). Sucrose (16g/l), sodium chloride (5g/l), citric acid (1g/l), and quinine water (.5, undiluted) were used. The substances were weighed on an AND brand, HR-200 series, analytical scale; later, they were diluted in containers with one liter of water. Twenty (20) ml of the diluted substances were placed in containers; the containers were coded from 1 to 4 according to the type of substance, and were presented to each subject to identify the flavor of each one. A bottle of water was given for the subject to rinse or drink water as many times as necessary before or after testing each substance. Once the test was performed, a summation of the flavors that were distinguished was made, and it was considered that the higher the score the better the gustatory acuity.

To measure dependency, the Barthel Index was used for the basic daily life activities (BADL) with Cronbach's alpha of .86-.92; when the older adult had 100 points (10), he was considered independent. The instrumental daily life activities (IADL) were evaluated with the Lawton and Brody index, with an intraclass reliability of 0.95⁽¹¹⁾, when the subject reported performing autonomously the eight activities evaluated by the instrument he was considered independent.

Data were processed and analyzed using the Statistical Package for the Social Sciences (SPSS), version 20, for Windows. Descriptive and inferential statistics were used. Kolmogorov-Smirnov normality test with Lilliefors correction was used and according to the results the Spearman correlation coefficient and Mann-Whitney U Test were used. In order to carry out this study, we had the approval of the committees of Research and Ethics in Research of the School of Nursing of the Universidad Autonoma de Nuevo Leon, of the Committee of Teaching, Health Research, and Quality Direction of the Ministry of Health of Nuevo

Leon, and the authorization of the Ministry of Health to invite the elderly to participate. The study was classified within the minimum risk category since sensory functionality tests were performed.

RESULTS

Ninety six (96) subjects participated, 79.2% (f = 76) of whom were women, who on average were 69.33 years old (SD = 6.53) and had 9.02 years of schooling (SD = 4.69); they reported consuming an average of 3.31 medications (SD = 2.01). None of the participants wore ear plug or had excess wax. Table 1 shows the descriptive data of sensory function and dependence.

Seventy seven dot one percent (77.1%) (f = 74) presented smell alteration and 77.1% (f = 74) taste alteration. In the tactile acuity test, it was found that 24.0% (f = 23) of the older adults presented alteration in the left foot and 30.2% (f = 29) in the right foot. Regarding hearing acuity, 47.9% (f = 46) of the older adults had normal hearing in the left ear and 42.7% (f = 41) in the right ear; Table 2 shows the classification according to the type of hearing loss.

Regarding visual acuity, 91.7% (f = 88) were impaired in the test without wearing eyeglasses. Of the total sample, 53.1% (f = 51) mentioned they wear eyeglasses, so they were tested with

eyeglasses and it was found that 70.6% (f = 36) showed alteration. 39.6% (f = 38) resulted with dependence on the BADL and 24.0% (f = 23) with dependence on the IADL.

With the Spearman correlation test, a statistically significant relationship was identified between the acuity of touch in the left foot (rs = .266; p = .027) and right foot (rs = .230; p = .024) and hearing acuity of the right ear (rs = -.258; p = .011) with the BADL. Likewise, it was observed that age (rs = -.345; p = .001), acuity of touch in the left foot (rs = .220; p = .031), hearing of the left ear (rs = -.283; p = .005) and right ear (rs = -.286; p = .005), and smell (rs = .241; p = .018) and taste (rs = .203; p = .047) were related to IADL (Table 3).

To identify whether dependence to perform BADL and IADL is different in older adults with visual impairment compared to those with normal visual acuity, the Mann-Whitney U test was performed, with which it was observed that dependence to perform the BADL was not different in the test without eyeglasses (U = 127,500; p = .079) that in the test with eyeglasses (U = 146,000; p = .754). Likewise, it was found that the dependence to perform IADL was not different in the test without eyeglasses (U = 160,000; p = .202) that in the test with eyeglasses (U = 115,000; p = .079).

Table 1. Descriptive data regarding age, schooling, medications, sensory function, and dependence on basic and instrumental activities.

Variable	Min	Max	Mean	SD
Age	60	84	69.33	6.53
Schooling	0	23	9.02	4.61
Medications	0	10	3.31	2.07
Monofilament left foot	0	10	9.27	1.77
Monofilament right foot	1	10	9.17	1.83
Left ear audiometry	20	95	31.67	12.64
Right ear audiometry	15	90	32.76	13.62
Smell	0	5	2.98	1.56
Taste	0	4	2.50	1.10
BADL	60	100	95.68	8.00
IADL	0	8	7.19	1.84

Source: Results of the data card, monofilament test, basic taste tests, smell, and hearing acuity tests, and Index of Basic and Instrumental Daily Life Activities. n = 96.

Table 2. Classification of left and right ear hearing acuity

Categories	Left ear		Right ear	
	<i>f</i>	%	<i>f</i>	%
Normal	46	47.9	41	42.7
Mild hearing loss	35	36.5	39	40.6
Moderate hearing loss	9	9.4	11	11.5
Moderately severe hearing loss	5	5.2	3	3.1
Profound hearing loss	1	1.0	2	2.1

Source: Hearing test results.

n = 96

Table 3. Spearman's correlation between sensory function and daily life activities

	BADL		IADL	
	<i>r_s</i>	<i>p</i>	<i>r_s</i>	<i>p</i>
Age	-.066	.522	-.345	.001
Medications	-.151	.143	-.097	.347
Monofilament left	.226	.027	.220	.031
Monofilament right foot	.230	.024	.148	.150
Left ear audiometry	-.060	.526	-.283	.005
Right ear audiometry	-.258	.011	-.286	.005
Smell	.115	.266	.241	.018
Taste	.065	.529	.203	.047

Source: Monofilament test results, basic taste tests, smell and hearing acuity tests, and Index of Basic and Instrumental Daily Life Activities. *n* = 96

DISCUSSION

It was found that, in the taste and smell senses, more than three-quarters of older adults who participated in the study, resulted with alteration, indicating that in addition to the changes that occur during aging and due to chronic diseases that adults suffer, these senses are altered. However, there are other factors such as exposure to pollutants, drug use, and other diseases that affect taste and smell senses⁽³⁾; these factors were not the reason for this study, so it is recommended to include them in future research.

In relation to touch, approximately a quarter had impaired tactile acuity in the left foot and more than a quarter in the right foot. These data

matched that reported in the ENSANUT Survey,⁽²⁾ where people with diabetes mellitus were studied, who reported that one of the most frequent complications they have experienced with the disease is the loss of sensitivity in the sole of the feet, a situation that is worrisome, because the literature indicates that with aging the function of the meissner corpuscles located in the fingertips and skin of the foot decreases, which leads to altered perception of touch⁽¹²⁾, which puts older adults with chronic diseases such as diabetes mellitus at greater risk.

Regarding hearing acuity, more than half of the older adults presented alteration, despite the fact that there are few results with reports of

hearing in older adults with chronic diseases, the findings of this study matched those found in adults without any chronic disease⁽¹³⁾. This means that alterations in the sense of hearing occur due to changes during aging, where chronic diseases such as diabetes mellitus, hypertension, and dyslipidemias do not have great influence. However, it is necessary to perform more studies that verify what has been stated and explore the type of chronic disease and the time the older adult has suffered of such chronic disease.

In the assessment of visual acuity, almost all older adults had alteration when performing the test without wearing eyeglasses, and a little more than half of them had alteration in the test wearing eyeglasses. This finding is higher than that reported by other authors⁽¹³⁻¹⁶⁾. It should be mentioned that these studies were carried out in an open population of older adults, unlike the present study in which only adults with chronic diseases were included.

The results found regarding visual acuity are similar to those reported in the ENSANUT survey⁽²⁾ regarding the complications that people with diabetes mellitus present, who mentioned that the main complication was reduced sight. This finding justifies the importance of emphasizing self-care in older adults with chronic diseases, who at an older age have a greater probability of visual loss due to changes in the internal area of the eyes, such as decreased eyelid and iris musculature, atrophy of the lacrimal glands, and intraocular pressure.⁽³⁾

It is important to note that in the literature review, scientific evidence was found on sensory function mainly in older adults with diabetes mellitus, which limits the comparison of what was found in the present study where older adults with different chronic diseases were included. Likewise, there are few studies that were located in which the function of the acuity of the senses is related to the BADL and IADL, which makes it difficult to compare what was found in the present work. The literature indicates that some chronic diseases alter olfactory and gustatory acuity⁽³⁾, in turn, these conditions affect the way in which daily life activities are performed⁽¹⁷⁾; however, the results

of this study did not show statistically significant relationship between olfactory and gustatory acuity with BADL, it was only found that the greater the olfactory and gustatory function, the greater the independence to perform the IADL. It is thought that the lack of statistical significance could be related to the time of diagnosis of the disease, thus, it is suggested that future studies look for the relationship between the time they have had the disease and the alteration of the sensory function.

In this sense, the results of another study⁽¹⁸⁾ suggested that chronic disease especially in women is better managed than in men, since from the social point of view it is expected that in the case of women they take care of the domestic tasks involved in IADLs. Thus, the gender approach becomes a limitation when contrasting the relationship between sensory function and dependence, because the instruments used include daily life activities that in our context are socially and culturally assigned to women such as food preparation, housekeeping, and laundry.

It was found that the greater the function of touch, the greater the independence to perform the BADL and IADL; this finding is explained in that through this sense it is possible to perceive the qualities of objects. Therefore, when the elderly cannot perceive the characteristics of the objects, they have difficulty in carrying out their daily activities such as bathing or showering, preparing their food, or cleaning the house.

In addition, it was identified that the less hearing, the greater the dependence to perform the BADL and IADL. This data is congruent with findings^{(19), (20)} who reported that hearing dysfunction was associated with a greater probability of dependence to carry out daily life activities. This relationship is due to the fact that changes in the hearing organs can cause deterioration of posture control⁽³⁾ and, therefore, mobilization, which causes difficulty in performing daily activities, since, as stated by Aguilar et al.⁽²¹⁾ mobilization is essential to carry out life activities.

Finally, it was observed that the dependence to perform the BADL and IADL is not different in older adults with altered visual acuity compared to those who presented normal visual acuity.

This finding is different from that reported by other authors⁽⁸⁾, who found statistically significant evidence between visual acuity and performance of daily life activities.

CONCLUSIONS

In this study, it was empirically verified that the greater the function in the senses of touch and hearing, the less dependence to perform the BADL, and the greater the function of touch, hearing, smell, and taste, the less dependence in the IADL. It was observed that the dependence on BADL and IADL is not different in those who presented altered visual acuity compared to those who had normal visual acuity. Nevertheless, it is important to take into account that in this study non-probabilistic sampling and a low sample size were used, so it is recommended to take these results with caution.

It is considered necessary to strengthen and promote self-care through interventions and education in order to enjoy an active and healthy aging. The planning of interventions for older adults with chronic diseases needs to consider sensory function as factors that affect

the functionality of this population group, especially since the alteration of sensory function can be both a cause and a consequence of chronic diseases.

Limitations

The perception of health with respect to the senses from the participants and what the real difference would be in the participants is unknown. It was not verified whether there were complications typical of the chronic disease that could interfere with the results presented.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interests with respect to this article.

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