

COMPARATIVE STUDY OF RESPIRATORY FUNCTION TESTS BETWEEN HEALTHY PATIENTS AND CARRIERS OF IDIOPATHIC PARKINSON'S DISEASE¹

ESTUDO COMPARATIVO DOS TESTES DE FUNÇÃO RESPIRATÓRIA EM INDIVÍDUOS SAUDÁVEIS E EM PORTADORES DE DOENÇA DE PARKINSON IDIOPÁTICA

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SUMMARY

Objective: verify the changes in the respiratory function in patients with idiopathic Parkinson's disease. **Method:** assessed respiratory-the mechanics of 78 people with Parkinson's disease, divided into groups according to the time evolution of the disease (zero to five years, five to ten and more than ten years), via spirometry, manovacuometry, oxigenio and peripheral saturation perimetry thoracic-abdominal, comparing the respective values of healthy individuals (control group). **Results:** it was noted that there was no statistical difference between the groups, except for the maximum pressure values in expiratory, manovacuometry, between Parkinson groups with evolution between five and ten years and with more than ten years, when compared to the control group. **Final considerations:** patients with Parkinson's disease have great risk to respiratory disorders.

KEYWORD: Parkinson's disease, respiratory evaluation, tests of respiratory function.

INTRODUCTION

Parkinson's disease is the most frequent movement disorder related to neurodegenerative, with the prevalence of 1 to 3% in people aged over 55 years, should prevail in males.^{1,2,3} Pathological view, Parkinson's disease is a degenerative disease characterized by death of Neuron dopaminergics of substantia nigra and inclusions inter cytoplasmatic known as Lewy body, which is the protein alpha-Synuclein, in addition to other proteins, contributing significantly to the process of degeneration of dopaminergics neuron in the brain.^{4,5}

The cause of Parkinson's disease remains unknown. However their possible risk factors are Caucasian race; genetic susceptibility factors, as the presence of genes called park 1, 2 (parkin), 3, 4, 5, 6 and 7; rural life habits; tergigi water ingestion; work in agriculture and industrial chemical exposure, herbicides and pesticides.⁵

The clinical picture of disease is composed of

Bradykinesia (akinesia or hypoknesia), stiffness of plastic type, resting tremor and postural instability. However, people with Parkinson's disease have also decreased respiratory arising from changes of the magnitude of the thorax and lung volumes. Pulmonary complacency decreases by limiting the extent of

the trunk and thorax of the magnitude and articulate vertebral column, secondary to the thoracic arthrosys and other changes such as kyphoscoliosis or pleural fibrosis.⁶

The general objective of the study was to verify the changes in the respiratory function in patients with idiopathic Parkinson's disease. And, as specific objectives, identify the spirometric values of the forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV1); check the respiratory muscle strength; see and compare the values of the saturation of peripheral oxyhaemoglobin (SpO₂), in both groups studied.

METHOD

Cross-sectional study, comparison and quantitative, performed in the school of physiotherapy clinic in University of Amazonia (Fisioclinica), in the period from January 2007 to June 2008, with 78 peoples, aged ranging between 40 and 80 years, divided into two groups: people with Parkinson's disease (Parkinson group – PG) and control group (CG), with 39 individuals each.

The Parkinson group was divided according to the time evolution of the disease into three subgroups: Parkinson group from zero to five years of evolution of the disease (PG 0-5); Parkinson group from five to ten years of

1. Pesquisa realizada na clínica-escola de fisioterapia (Fisioclínica) da UNAMA, entre janeiro de 2007 e junho de 2008.

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disease's evolution (PG 5-10); and Parkinson group above ten years of the disease's evolution (PG over 10).

The volunteers were selected randomly and should be in accordance with the inclusion criteria.

Inclusion criteria to the Parkinson group: aged between 40 and 80 years, of both sexes; without restriction about the disease's time evolution; be in regular use of Levodopa, using or not another antiparkinson agents medication; classified in the modified Hoehn-Yahr between 1.5 to 4 stages; preserved cognitions; walking patients; good capillary perfusion peripheral.

Inclusion criteria to the Control group: good capillary perfusion peripheral; similar characteristics as age and sex of Parkinson's group.

Exclusion criteria for both groups: smokers habits; the presence of other respiratory problems (Asthma, COPD, pleural fibrosis, lung cancer); using bronchodilator before examinations; dyspnea serious; chest pain; hemoptysis; pneumothorax and tracheotomy; lung biopsy on the prior week; vertebral column surgery; systemic arterial hypertension uncontrolled; severe anemia; nail enamel.

The search was divided into four steps: the first step consisted in sorting sample, recruited in entities like Training Institute Helena Coutinho, Physiotherapy Clinic of Unama (Fisioclinic) and People with Parkinson's disease's Association of Para, where was obtained the consent of the individual or your legal guardian, for that be

possible to carry out the search; in the second step was explained the procedure to groups and collected data; in the third step was respiratory assessment of individuals on Fisioclinic or in the homes of same and analysis of results; while, in the fourth step, patients who were not under physical therapy's monitoring were forwarded to clinics UEAFTO and Fisioclinic.

Statistical analysis was carried out through MiniTab 15.0 and SPSS 13.0, applying the test t-Student, for two independent populations, for categorical variables, being considered the alpha level of 0.05 for rejection of the hypothesis of invalidity.

RESULTS

The study involved two groups of individuals: Parkinson group (PG) and control group (CG) according to age (years) females (male and female), the weight (kilogram – kg) and height (meters – m), being subdivided into time evolution of Parkinson's disease: PG from zero to five years of evolution of the disease [PG (0-5)]; PG from five to ten years of disease's evolution [PG (5-10)] and PG above ten years of the disease's evolution [PG (over 10)].

Tables 1 and 2 refer to the sample distribution between the PG (0-5) and the CG, being evaluated the xiphoid appendix perimetry and umbilical scar during inspiration and expiration, where, in both, there was no significant difference between the medium values of groups, CG and PG (0-5), the significance level of 5%.

Table 1. Distribution of values related to the xiphoid appendix level, during inspiration and expiration, for PG (0-5) and GC.

	Xiphoid Appendix Level			
	Inspiration		Expiration	
	PG 0-5	CG	PG 0-5	CG
Medium	85.2	90.31	83.69	89.38
Standard deviation	10.6	8.3	9.26	8.52
Probability of significance	0.181		0.116	
Confidence interval 95%	(-12.867; 2.559)		(-1.510; 12.895)	

Source: Data from authors.

Table 2. Distribution of values related to the umbilical scar level, during inspiration and expiration, for PG (0-5) and GC.

	Umbilical Scar Level			
	Inspiration		Expiration	
	PG 0-5	CG	PG 0-5	CG
Medium	90.2	95.62	88.62	95.23
Standard deviation	11.1	9.18	9.95	9.22
Probability of significance	0.184		0.091	
Confidence interval 95%	(-2.782; 13.705)		(-14.379; 1.148)	

Source: Data from authors.

Tables 3 and 4 refer to the sample distribution between the PG (5-10) and the CG, being evaluated the perimetry at xiphoid appendix and umbilical scar during inspiration and expiration,

where, in both, there was no significant difference between the medium values of groups, CG and PG (5-10), the significance level of 5%.

Table 3. Distribution of values related to the xiphoid appendix level, during inspiration and expiration, for PG (5-10) and GC.

Xiphoid Appendix Level				
	Inspiration		Expiration	
	PG 5-10	CG	PG 5-10	CG
Medium	85.2	90.31	83.69	89.38
Standard deviation	10.6	8.3	9.26	8.52
Probability of significance	0.181		0.116	
Confidence interval 95%	(-12.867; 2.559)		(-1.510; 12.895)	

Source: Data from authors.

Table 4. Distribution of values related to the umbilical scar level, during inspiration and expiration, for PG (5-10) and GC.

Umbilical Scar Level				
	Inspiration		Expiration	
	PG 5-10	CG	PG 5-10	CG
Medium	90,2	95,62	88,62	95,23
Standard deviation	11,1	9,18	9,95	9,22
Probability of significance	0,184		0,091	
Confidence interval 95%	(-2,782; 13,705)		(-14,379; 1,148)	

Source: Data from authors.

Tables 5 and 6 relate to the distribution of the sample between the PG (over 10) and the CG, being evaluated the perimetry at xiphoid appendix and umbilical scar during inspiration and

expiration, where, in both, there was no significant difference between the medium values of groups, CG and PG (5-10), the significance level of 5%.

Table 5. Distribution of values related to the xiphoid appendix level, during inspiration and expiration, for PG (over 10) and GC.

Xiphoid Appendix Level				
	Inspiration		Expiration	
	PG over 10	CG	PG over 10	CG
Medium	95.5	93.67	94.1	93.0
Standard deviation	11.3	5.95	11.1	6.35
Probability of significance	0.575		0.75	
Confidence interval 95%	(-8.6; 4.86)		(-7.85; 5.71)	

Source: Data from authors.

Table 6. Distribution of values related to the umbilical scar level, during inspiration and expiration, for PG (over 10) and GC.

Umbilical Scar Level				
	Inspiration		Expiration	
	PG over 10	CG	PG over 10	CG
Medium	98.8	97.2	97.7	95.9
Standard deviation	13.1	6.13	13.0	6.15
Probability of significance	0.67		0.63	
Confidence interval 95%	(-9.39; 6.19)		(-9.59; 5.99)	

Source: Data from authors.

Table 7 refers to the distribution of the sample between Parkinson groups [PG (0-5), PG (5-10) and PG (over 10)] and the CG, being evaluated the pulse oximetry, where there was no significant

difference between the medium values of groups, regardless of the range of years of disease's evolution, on the significance level of 5%.

Table 7. Distribution of values related to the pulse oximetry for PG (0-5), PG (5-10), PG (over 10) and CG.

Pulse Oximetry						
	PG 0-5	CG	PG 5-10	CG	PG over 10	CG
Medium	96.31	98.08	96.93	97.73	97.27	98.36
Standard deviation	5.45	0.86	1.33	1.03	1.68	1.21
Probability of significance	0.27		0.077		0.095	
Confidence interval 95%	(-1.567; 5.105)		(-0.092; 1.69)		(-0.209; 2.391)	

Source: Data from authors.

Table 8 refers to the distribution of the sample between Parkinson groups [PG (0-5), PG (5-10) and PG (over 10)] and the CG, being evaluated the spirometry. There was no significant

difference between the medium values of groups, regardless of the range of years of evolution of the disease, the significance level of 5%.

Table 8. Distribution of values related to the spirometry for PG (0-5), PG (5-10), PG (over 10) and CG.

Spirometry						
	PG 0-5	CG	PG 5-10	CG	PG over 10	CG
Medium	3031	2946	3080	3240	3027	2918
Standard deviation	805	746	610	659	662	759
Probability of significance	0.783		0.496		0.723	
Confidence interval 95%	(-712.543; 543.312)		(-314; 634)		(-742; 524)	

Source: Data from authors.

Table 9 refers to the distribution of the sample between Parkinson groups [PG (0-5), PG (5-10) and PG (over 10)] and the GC, being evaluated the maximum inspiratory pressure (PI_{max}), where

there was no significant difference between the medium values of groups, regardless of the range of years of evolution of the disease, the significance level of 5%.

Table 9. Distribution of values related to the maximum inspiratory pressure for PG (0-5), PG (5-10), PG (over 10) and CG.

Maximum Inspiratory Pressure (PI_{max})						
	PG 0-5	CG	PG 5-10	CG	PG above 10	CG
Medium	125.4	170.0	125.4	170	105.0	132.7
Standard deviation	51.9	68.7	51.9	68.7	119.0	58.3
Probability of significance	0.074		0.074		0.489	
Confidence interval 95%	(-4.660; 93.891)		(-4.660; 93.891)		(-111.6; 55.2)	

Source: Data from authors.

Table 10 refers to the distribution of the sample between Parkinson groups [PG (0-5), PG (5-10) and PG (over 10)] and the CG, being evaluated the maximum expiratory pressure (PE_{max}). There was no significant difference between the median values of PG (0-5) and CG groups, the

significance level of 5%. However, between the PG (5-10) and PG (over 10) and their respective control groups, statistical difference was noted, at the same level of significance.

Table 10. Distribution of values related to the maximum expiratory pressure for PG (0-5), PG (5-10), PG (over 10) and CG.

	Maximum Expiratory Pressure (PEmax)					
	PG 0-5	CG	PG 5-10	CG	PG above 10	CG
Medium	127.7	109.2	77.3	113.3	72.3	105.5
Standard deviation	37.7	33.3	30.9	42.0	29.9	27.0
Probability of significance	0.198		0.012		0.013	
Confidence interval 95%	(-10.313; 47.236)		(8.4; 63.58)		(7.9; 58.5)	

Source: Data from authors.

DISCUSSION

Parkinson's disease is a degenerative disease of the central nervous system,^{2, 4} whose main symptoms are: resting tremor, muscle rigidity, akinesia/bradikinesia and postural instability.⁶

The first symptoms of the disease have initiated after 50 years of age, with extremes ranging from 17 to 89 years, with a progressive evolution.^{2,4}

Although it is recognized that the aging process isolation is not the factor responsible for Parkinson's disease, the contribution of that mechanism in association with other ambiental and organics factors are considered paramount to the outbreak of the disease.^{2,4} Assumed the existence of hereditary predisposition, although cases in family members are not very frequent (10%).⁷

The literature refers to disease's cases between the both sexes, with slight predominance of males (1,25 men to 1 woman).⁷ In this sample, the data agree with literature, since the sample of individuals with Parkinson males was 25 and of female individuals was 14.

In this study, SpO2 assessed values through pulse oximetry not revealed significant differences between the averages of Parkinson and control groups, regardless of the time evolution of the disease, as well as in some data found in literature.⁸

The measures related to xiphoid appendix and umbilical scar level, at inspiration, as in expiration, did not show significant differences between the median values of Parkinson and control groups, regardless of the time evolution of the disease. However, in a study conducted with individuals classified with Parkinson's disease, at Hoehn-Yahr scale in stages I to III, demonstrated statistically significant differences between the median values of the two groups, since the values are minors in Parkinson's group in relation to the control, with a sharp decrease in thoracic mobility during respiration, passes on muscle's work, with consequent decrease pulmonary expandability in inspiration and thoracic depression in expiration.⁶

The thoracic rigidity and resistant to chest at fast movements causes progressive reduces at the ventilation. The flexion posture and the intercostals muscle rigidity undertake thoracic mobility, as well the kyphoscoliosis and arthrosis reduces vertebral column mobility.⁶

The PImax values measures did not, in this study, statistically significant differences compared with median values of Parkinson and control groups, regardless of the time evolution of the disease, as well as in studies found in literature.⁸ However in work with an individual with Parkinson's disease, evolution of the disease of 17 years, they were assessed their lung function, the result was that the PImax value was reduced, but the same author believes that the value obtained must be due to muscular coordination to conduct the manoeuvres of the assessment.⁹

This fall, for some authors, is associated with muscle fatigue,^{10,11} although other authors believe that the reduction should be closely related to the seriousness of the neurological framework.¹²

In this research, the values of the PEmax of people with Parkinson's disease, with zero development time five years did not show significant difference when compared to the median values of the control group.

However, the Parkinson group, between five and ten years and with more than ten years of evolution of the disease, presented significant statistical difference when compared to the values of the control group, since in Parkinson group the median values stood less than healthy individuals (control group).

For some authors, respiratory manifestations appear with the time of evolution.¹³ For others, this decline occurs due to muscular fatigue caused by neurological picture, associated with the administration of *L-dopa*.¹⁰ In turn, the administration of *L-dopa* suggests an improvement in the respiratory dysfunction of patients with Parkinson's disease, because such drugs influence directly in the condition of

intercostals muscle's rigidity, according to the study with 14 patients in a rehabilitation centre in Ankara, Turkey.¹⁴

In this study, the spirometric value of forced vital capacity (FVC) was not statistically different from the values of Parkinson and control groups. Unlike in other literature, since significant differences were found between the groups, with median values of FVC of $69,6 \pm 22,2\%$ to Parkinson group and $82,7 \pm 16,6\%$ in the control group, showing a decrease in pulmonary expansibility, sorting through the spirometric examination as a pulmonary restrictive, usual in people with Parkinson's disease.^{6,15}

The time evolution of the disease is a determining factor for respiratory complications occur in anger, since the disease installation time is directly related to the emergence of such changes.¹³

Studies analysing the respiratory function in 63 individuals with Parkinson's disease with 67.1 ± 0.96 years revealed pulmonary decrease of complacency and presence of small atelectasis, 85% of cases, limiting the trunk extension, in articular maximum and in curviness pathologic of vertebral column articulate, listing the FVC with bradikinesia and thoracic rigidity, with obtaining values of $81,3 \pm 22,3\%$ measured in 58 individuals with Parkinson's disease with 67.7 ± 1.06 years old.¹⁶

These changes of thoracic muscles may be due to the pleural fibrosis.¹⁰

During the spirometric tests, body position changes can significantly alter the results. Although the majority of the pulmonary function laboratories recommend seating position, some larger indexes work showed a bigger spirometric

result in orthostatic position, what it's observed particularly in people of middle-aged and elderly individuals.¹⁷

Thus, this study found that there is evidence that the medium of most values of all variables and respiratory activity of individuals studied submitted similarity, both for people with Parkinson's disease, and healthy individuals (control group), except for the average of the values of maximum expiratory pressure (PEmax), which differ quite considerable, when compared groups Parkinson with five to ten years of evolution (PG 5-10) and more than ten years of evolution (PG over 10), with the control group (CG), spotlighting that the value of PEmax found for individuals of control group (GC) is greater than the values for the peoples of Parkinson's group.

FINAL CONSIDERATIONS

No statistically significant differences were found between the medium values of the Parkinson and control groups, except in relation to respiratory muscle strength during maximum expiration in individuals with the disease evolution time between five and ten years and over ten years.

It was found, as expected, that individuals with Parkinson's disease have a higher tendency to produce respiratory disorders, since these problems are closely related to tremors, bradikinesia, postural instability and muscular rigidity, widely found in patients with Parkinson's disease, still, being linked to the degree of neurological commitment and, consequently, while the pathology is installed.

RESUMO

ESTUDO COMPARATIVO DOS TESTES DE FUNÇÃO RESPIRATÓRIA EM INDIVÍDUOS SAUDÁVEIS E EM PORTADORES DE DOENÇA DE PARKINSON IDIOPÁTICA

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Objetivo: verificar as alterações da função respiratória em pacientes com doença de Parkinson idiopática. **Método:** verificou-se a mecânica respiratória de 78 portadores de doença de Parkinson, divididos em grupos, de acordo com o tempo de evolução da doença – zero a cinco anos, cinco a dez e com mais de dez anos – por meio da espirometria, manovacuometria, saturação periférica de oxigênio e perimetria tóraco-abdominal, comparando os respectivos valores com os de indivíduos saudáveis (grupo controle). **Resultados:** observou-se que não houve diferença estatística entre os grupos, excepto para os valores de pressão expiratória máxima, na manovacuometria, entre os grupos de Parkinson com tempo de evolução entre cinco e dez anos e com mais de dez anos, quando comparados ao grupo controle. **Considerações finais:** pacientes com doença de Parkinson têm grande risco de apresentarem disfunções respiratórias.

DESCRITORES: doença de Parkinson; avaliação reespiratória; teste de função respiratória

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