Descriptive analysis of variables theoretically associated to the risk of falls in elder women

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ABSTRACT

Falls are a public health problem among elderly persons having in mind the mortality and morbidity rates, and the social and economical costs they cause. The purpose of this study was to analyze the relationship of the historic of falls reported in a group of individuals with more than 65 years old participating in a physical activity program, with variables defined by the literature as being associated to the risk of these kind of event: lack of sight, use of drugs, related diseases, poor strength and balance. After an interview with an initial group composed by 72 individuals, it was selected a sample of 30 persons whose reports indicated major frequency of falls in the previous twelve months, with ages after 65 years old. The exposition variables were tested in this subgroup, and the results were compared with the frequency of falls by means of a descriptive statistics (absolute and relative values) using contingency charts for each variable. Results indicated that the deterioration of sight, the simultaneous use of drugs (especially diuretics and psycho-actives) and reduced flexibility (hips and ankles) seem to be associated with the frequency of falls in the period observed. Such factors should be considered in programs designed to prevent falls in the elderly.

INTRODUCTION

Falls may cause functional[1,2] dependence in elderly persons, besides of representing one of the major causes of death among such population[3]. It is known that the number of falls among elderly persons is high, thus causing a radical changing in their daily life both due to the fall itself, and because of the fear of recurrence: restriction of activities, a higher social isolation, decreasing of health and increasing risk of institutionalization are some of the impacts caused in an elder's life after an episode of fall[3-5]. Near 30% individuals above 65 years old fall at least once in a year, and half of this number, in a recurrent way[6,7]. Besides the physical and psychological damages, such accidents generate an increase in the health care costs, expressed by the use of specialized services, and an increasing number of hospitalizations. Thus, there are several studies analyzing falls in elderly persons, both as to the epidemiology, etiology, and the risk factors associated and related to the consequences these events cause[1,2,4,5,8-13]. Possible interventions aiming to avoid them are also subject of investigation[3,7,14-16].

Despite the interest in this subject, it can be observed a few divergences in the approaches used to investigate the risk factors for falls. Publications diverge, for instance, as to the methodological criteria used mainly related to the selection of the sampling: while some discuss those elderly living in shelter homes and hospitals[1,2,13] others observe individuals living in the comunity[4,5,16]. Furthermore, falls happen, at least partially, in function of physiological limitations of balance, strength, sight or reaction timing[3,7], and also as consequence of diseases, and in some cases, due to the therapeutic strategies when dealing with them[17]. Factors such age, gender, diseases, use of drugs, deficient sight, functional skill damages, low balance, muscular weakness and environmental hazards have been pointed out in a major grade by the literature as predetermining for falls[1-5,8-13,15-18]. This result may vary from group to group, and it is important to be aware of the elderly persons' peculiarities when dealing with them, in order to define the strategies which may contribute to decrease the risk.

Among the Brazilian population, studies on the theme are still rare. Perracini[4] performed a study trying to identify the risk factors associated to falls in a group of elderly persons living in the São Paulo City. Coutinho and Silva[2] evaluated the use of some drugs as a risk factor for severe fractures caused by falls in individuals above 60 years old interned in public hospitals in the city of Rio de Janeiro. Despite of the results of these studies have raised important information, there are still some gaps that should be further investigated to find a better definition on the influence of the risk factors into the motor, environmental and behavior contexts. Within such perspective, the purpose of this study was to analyze the relationship among theoretically associated variables to the risk of falls having in mind the historic of these events among elderly persons who participate in a program of physical activities.

MATERIALS AND METHODS

It was a transversal retrospective study containing data obtained in two steps. In the first step, it was identified the prevalence of falls among 72 students distributed in three groups of a physical activities program at the Rio de Janeiro State University. It was included in this step those women who reported a higher number of falls in the previous year to the research (n = 30). From the analysis of the number of falls suffered by the whole sampling, it was attained a minimum amount of fall occurred in the last year as a cut point. Thus, the elderly women who fulfilled this condition were included in the subgroup, up to the amount of 30 individuals in the sampling. Whenever it there was more than one participant presenting the same minimum amount of falls, the decisive criterion to choose was the higher number of the amount of falls occurred in individuals above 65 years of age. The research was approved by the Institutional Ethics Committee, and every volunteer was duly informed on the research's procedures, that followed the recommendations of the Resolution 196/96 designed by the National Health Council.

In the second step, every participant had between 66 and 86 years old (75 ± 5 years). The "falling historic" was obtained by means of a semi-structured interview, trying to identify the amount of falls during the previous year, as well as the complementary information related to them, such as: place of the occurrence, environmental features, reason, strange feelings by the moment of the fall, general conditions (walking speed, type of shoes and clothes used, changing of direction during the movement), difficulty to raise from the ground after the fall, need of medical assistance after the accident). It was included in the second step of the study ten individuals with fall prevalence during the previous year from each of the three groups of the physical activities program. These individuals were evaluated as to the sight, use of drugs, associated diseases, flexibility, strength and balance. Demographic and socio-economical variables were not collected. Each individual was submitted to two motor tests (strength/balance test and flexibility test) and answered two questionnaires applied in the form of interview (sight and associated disease tests/use of drugs). All the interviews were conducted by trained interviewers. Some data were obtained by phone, whenever the elder women were not able to recall some information by the moment of the interview in the classroom, or due to recurrent absence during the period of the interviews. As the major part of the answers was obtained by means of recalling strategies, some tests required a contact with a reliable person (doctor, relative, neighbor, etc.) in order to increase the reliability of the data. In his study, Rozenfeld et al.[19] used similar methodology for the interviews in his data collection, where interviews performed by phone were used to make a comparison to the data collected in face-to-face interviews with individuals.

The sight problems were analyzed by means of three questions on subjective analysis of the sight skills of the elder individual, presence of some sight handicap as well as its influence in her daily activities. To the "associated diseases and use of drugs" test, it was conducted an interview equally composed by three questions on the existence of diseases (cardiovascular, neurological, metabolic and/or muscular-articular diseases) that could be directly or indirectly associated to the falls and the use of drugs.

The ranking used to classify drugs associated to the falls was the same suggested by Rozenfeld[17], since it is a simplified form to gathering all data. Thus, the four classes considered to the drugs were: cardiovascular, diuretics, and topic ocular medications. In the same test, the elder individuals were also inquired on the alcohol beverage ingestion on the day of the fall.

For the flexibility test, it was used the Fleximeter®, an instrument that determines the magnitude level in grades of the individual's articular movement[20]. It was tested the hip and ankle's articulations for the flexion and extension movements in both sides of the body. The interaction of the strength in the lower limbs and the balance in a functional situation was analyzed by means of the "seat and raise movements from a chair around two cones" test proposed by Clark[21] and adapted by Andreotti and Okuma[22], with the purpose to evaluate the elderly's skill to seat, rise, and move herself with agility, balance, and attention. As the agility is a physical quality determined by the interaction between strength, balance and speed, it was chosen to adopt this sole test to analyze these variables in a functional perspective. Upon the execution of the test, a 40 cm height from the seat to the ground chair (with arms that could be used according to the individual's need) was put in the middle of a wide room, and two cones were diagonally disposed 5 m far from it. The individual started the test seat in the chair having her feet off the ground. Upon hearing the signal, the individual stood and walked around one cone to the right, and coming back to seat in the chair taking her feet off the ground, and with no hesitation, she performed the same procedure to the left, ending the movement with her feet off the ground. Immediately after that, she repeated the same circuit. The elder

individual was instructed to perform the path as fast as possible, walking and/or running, and the time to accomplish the test was recorded in seconds. Individuals performed the test two consecutive times (with an interval of at least 60 seconds between them), and the best performance was recorded.

The relationship between variables observed and the amount of fall were analyzed by means of descriptive analysis, considering the contingence charts to the absolute and relative frequencies (%) in each classification of the independent (exposition variables) and dependent (amount of falls) variables.

The type of ranking adopted to construct the contingence charts to the dependent variables was based on the comparison between the total of falls observed in the sampling with the scores attained through the tests for each of the independent variables. We started from the premise that if the prevalence of falls above the mean of the sampling (in this case, two or more falls along the previous year, or four or more falls after 65 years of age) also presented reduced scores for a given variable (fixed through different criteria) it could be traced a relationship between it and the reported events of fall.

RESULTS

There was an amount of 58 falls in a 72-individuals sampling. Falls after 65 years of age occurred in 78% individuals (n = 56). In the previous year to the research, 43% individuals researched fell (n = 31). As to the sites where the falls occurred, it was attained the following percentages: on the street – 55% (32 falls); at home – 12% (7 falls); other closed environments (home of friend or relative, supermarkets, restaurants, churches, etc.) – 33% (19 falls). They presented several reasons for the fall, almost ever due to the bad conservation state of the sites (holes, loosen stones, unevenness, very high steps, unstable or slipping grounds): stumbling – 38% (22 falls); sliding – 19% (11 falls); slippery stepping – 17% (10 falls); unbalances (from staircase or benches) – 5% (3 falls); falls from the bed – 2% (1 fall); sudden fall (with no apparent reason) – 19% (11 falls). The elderly persons were normally alone, feeling well, with their hands free (when occupied, they were carrying low weight things), and wearing appropriate clothes, except for their shoes: most of them were using heeling shoes (even low heels ones), or open as sandals or slippers, and with the back of the heel loosen (such as sabots).

As to the movement speed, most of them was walking in a normal rhythm, but some were walking fast (to cross a street or for getting used with this type of walking). When reporting falls with no apparent reason, the elderly persons were walking normally, feeling well, and suddenly, they fell down on the ground (with no loss of consciousness). Almost all of them reported the mobilization of one or more persons to help them after the fall, and good part of them admitted to have some difficulty (or even impossibility) to get up from the ground upon the absence of help.

Distraction was a common element in the majority of the reports: from the total of falls reported, 53% were influenced by the distraction or lack of attention during the movement. The major part of the elderly persons was passing through known places at the moment of the fall (a site nearby their homes or a common path in their daily life), and this could partially justify the distraction. After the fall, 41% individuals needed to get medical assistance with severe or minor body injuries due to fractures, dislocation, deep cuts, or strong pain, but in the major part of the events, the fall caused no severe consequences except hematoma or bruises.

In the second step of the study, it was attained the following results in this group: 53% (16 individuals) suffered 1 fall; 37% (11 individuals) suffered 2 or 3 falls; 10% (3 individuals) had 4 or more falls. The group that fell one time had ages between 66 and 84 years (men = 75 ± 5 years); the group with 2 or 3 falls, 67 to 86 years (mean = 74 ± 2 years). As to the tests to evaluate the inde-

pendent variables, there was loss of three individuals (10% of the sampling) due to recurrent absences during the data collection period. Thus, from 30 individuals included in the second step of the study, 27 accomplished the final data collection.

Sight

Twelve individuals considered their sight skill good or very good, 11 considered it fair, and 4 considered it bad or very bad/awful. Upon being questioned if their sight would have negative influence on their daily life impeding the accomplishment of tasks that would demand displacements, 21 individuals (78%) answered negatively, while six of them (22%) recognized their limitations. Table 1 shows the absolute and relative frequency of individuals and falls within the periods observed. It is noted that individuals who said they had no sight problems had less occurrence of falls during the previous year and after 65 years of age, compared to those who reported the problem. These last individuals presented a mean amount of falls higher than the value found among those who reported absence of sight problems both to events occurred in the previous year and after 65 years of age.

TABLE 1
Sight problems and occurrence of falls (n = 27)

	Total individuals	Total of falls in the previous year (2 or +)	Total of falls after 65 years of age (4 or +)
Individuals with sight problem	21	n = 11 (52%)	n = 10 (49%)
Individuals with no sight problem	6	n = 2 (33%)	n = 2 (33%)

Use of drugs

The results of this item are shown in table 2, describing the relationship between the amount of drugs used, and the incidence of falls, classes of drugs used and their usage profile in the sampling, and the relationship in each of the classes and the prevalence of falls among individuals. The major part of individuals consumed drugs due to cardiovascular problems, followed by topic ocular drugs, diuretics and psycho-active drugs. The test made questions on the possible alcoholic consumption on the day of the fall: only one individual answered positively. Considering the total of the sampling, it was attained a mean consumption per individual of 3.5 drugs associated to the risk for falls.

TABLE 2
Relationship between the amount of drugs with the amount of falls (n = 27)

	Total individuals	Total of falls in the previous year (2 or +)	Total of falls after 65 years of age (4 or +)
1) Up to 2 drugs	10	n = 4 (40%)	n = 4 (40%)
2) 3 or 4 drugs	11	n = 4 (36%)	n = 3 (27%)
3) 5 or more drugs	6	n = 5 (83%)	n = 5 (83%)

	Total individuals	Total of falls in the previous year (2 or +)	Total of falls after 65 years of age (4 or +)
1) Class I (2 or +)	13	n = 7 (54%)	n = 7 (54%)
2) Class II (1 or +)	9	n = 7 (78%)	n = 7 (78%)
3) Class III (1 or +)	10	n = 6 (60%)	n = 6 (60%)
4) Class IV (1 or +)	14	n = 8 (57%)	n = 6 (43%)

Results indicate that the amount of drugs seems to influence the frequency of falls: compared to individuals who consumed 5 or more drugs, the frequency percentage revealed to be significantly higher than those found in other categories. Besides, al-

though the major part of individuals was using cardiovascular and topic ocular drugs (74% and 52%, respectively), those classes apparently more associated to falls were the psycho-actives and diuretic drugs, once elder consumers of such classes of drugs presented events of falls statistically higher both to events occurred in the previous year and after 65 years of age.

Associated diseases

The associated diseases were divided in two groups: directly and indirectly associated diseases, according to the manifestations of the symptoms presented and their implications for a possible occurrence of fall. In order to facilitate the visualization of the presentation of the results found, each group was subdivided in pathological classes: cardiovascular diseases, neurological diseases, osteo-myo-articular diseases, metabolic diseases, and sight alterations (figure 1).
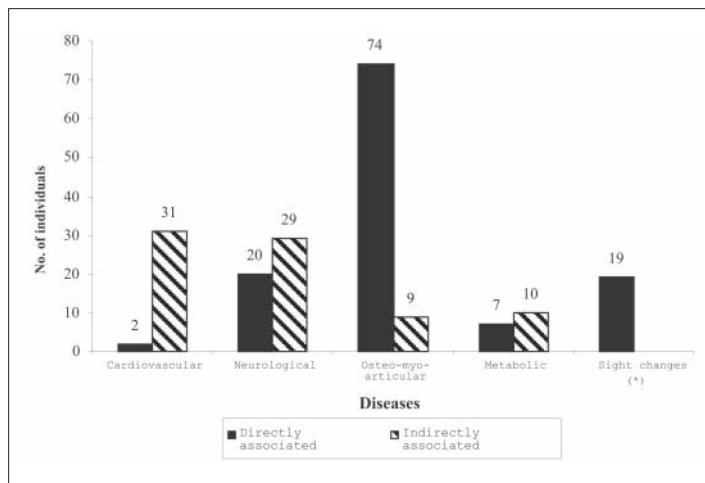

Fig. 1 – *Frequency of diseases associated to falls in the sampling observed. (*) Exclusively directly associated. Types of diseases directly associated to falls: Cardiovascular – blood hypotension, Strokes with sequel; Sight changes – sight diseases (cataract, glaucoma, eyes dry eyes, allergies); Neurological – labyrinthitis/dizziness, Parkinson's disease/epilepsy/shakings, loss of sensitivity in the feet (neuropathy)/sleepiness in the feet; Osteo-myo-articular – arthrosis/arthritis in the column and/or in the lower limbs, pain in the articulations of the column and/or the lower limbs, tendinitis in the lower limbs, deformities in the feet/problems in the toe's nails/pain in the feet/callosity/use of narrow shoes, inappropriate or uncomfortable, rheumatism/gout/bico de papagaio/esporão ósseo, postural deviations (scoliosis, hyperkyphosis); Metabolic – diabetes. Types of diseases indirectly associated to falls: Cardiovascular – blood hypertension, arrhythmias/tachycardia/palpitations/angina, hypercholesterolemia; Neurological – Alzheimer disease, depression, anxiety, hearing loss; Osteo-myo-articular – arthrosis/arthritis/tendinitis/bursitis in the upper limbs; Metabolic – hypothyroidism, osteoporosis.*

As to diseases considered as directly associate to the falls, the major prevalence was for osteo-myo-articular diseases. Cardiovascular and neurological diseases were predominant among those indirectly associated to the falls.

The mean number of diseases directly associated to the fall was 4 ± 2 diseases/individual, while the mean number of diseases indirectly associated was of 3 ± 2 diseases/individual. Thus, the mean total number of diseases (direct ± indirect) was of 8 ± 3 diseases/individual. Table 3 shows the results for an association between such variable and the amount of falls in the sampling observed (n = 27).

Flexibility, strength and balance

Table 4 exposes the relationship between flexibility and balance/strength located on the lower and upper third parts of the sampling, as well as all the events of fall reported by those individuals. Results suggested an inverse relationship between the

reduced levels of articular mobility and the incidence of falls. It was observed significant difference in the hip flexion and ankle extension movements that did not occur for other movements. Results of the association between the levels of strength and balance, and the incidence of falls did not presented as clear as those found to the flexibility.

TABLE 3
Relationship between diseases reported and amount of falls (total and by ranking) (n = 27)

	Total individuals	Total of falls in the previous year (2 or +)	Total of falls after 65 years of age (4 or +)
Up to 5 diseases	8	n = 2 (25%)	n = 5 (62%)
+ than 5 diseases	19	n = 11 (58%)	n = 7 (37%)
	Total individuals	Total of falls in the previous year (2 or +)	Total of falls after 65 years of age (4 or +)
Diseases directly associated (4 or +)	18	n = 10 (56%)	n = 8 (44%)
Diseases indirectly associated (4 or +)	11	n = 7 (64%)	n = 5 (45%)

TABLE 4
Relationship between the articular flexibility levels (lump sum of the right and left sides), strength/balance and number of falls (n = 27)

	Total individuals	Total of falls in the previous year (2 or +)	Total of falls after 65 years of age (4 or +)
Hip flexion (TS)	14	n = 5 (36%)	n = 4 (29%)
Hip flexion (TI)	13	n = 8 (62%)	n = 8 (62%)
Hip extension (TS)	13	n = 6 (46%)	n = 5 (38%)
Hip extension (TI)	14	n = 8 (57%)	n = 9 (64%)
Ankle flexion (TS)	16	n = 8 (50%)	n = 7 (44%)
Ankle flexion (TI)	11	n = 5 (45%)	n = 5 (45%)
Ankle extension (TS)	14	n = 5 (36%)	n = 6 (43%)
Ankle extension (TI)	13	n = 8 (62%)	n = 6 (46%)
Strength/Balance (TS)	13	n = 6 (46%)	n = 7 (54%)
Strength/Balance (TI)	14	n = 7 (50%)	n = 5 (36%)

TS – upper third; TI – lower third.

DISCUSSION

Initially, it was pointed out some limitations of the study. First, it could be discussed the accuracy of the data reported, once they were based on recalling strategies. The contact with the family and medical assistants contributed to decrease the bias risk, but even so, the problem is not neglectable. It should be recognized that the discriminating power of the descriptive statistic is limited, thus restraining the generalization power of the conclusions it may be attained.

On the other hand, to apply the inferential technique with different refinement grades (such as the chi-square or the logistic regression), it would be necessary the presence of a group that did not suffer any fall. A controlling group like this would allow the discrimination of the dependent variable (in this case, the falls), and without this, the mutually exclusive contingency charts were impossible to be constructed. For this reason, it was chosen a more modest approach of the data analysis for the presently obtained data.

In view of such limitations, the results presented seem to be illustrative as to the relationship of the exposition variables (pointed out in the literature as associated to falls in the elderly), and the prevalence of the phenomenon in the analyzed sampling. In some cases, all differences between amounts were quite evident, thus

allowing to develop some considerations on the relative importance of the variable in the context of a prevention for falls in the elderly. To facilitate the understanding, it was chosen to discuss the results in sections turned to each of the variables observed.

Sight

The visual acuity seemed to be associated to the amount of falls both in the previous year and after the 65 years of age. A work accomplished by the American Society of Geriatry[15] pointed out the visual deficit as one of the intrinsic risk factors to the falls in elderly persons. That same study asserts that there are no randomized interventional studies as to visual problems, but there is an indication of a significant relationship between falls, fractures and visual acuity. Still, it is asserted that the hip fractures related to falls were higher in elderly persons with poor sight, and the measurement of the decreased visual function such as poor visual acuity, reduced sensitivity of contrast, limited visual field, cataract and use of drugs for glaucoma show a significant statistical relationship to two or more falls. Perracini[4], in a study analyzing those factors associated to the falls in elder residents in the community pointed out the deficient sight as one of the risk factors for falls among those individuals. According to that study, elderly persons with mild, moderate and severe decreasing in their visual acuity presented respectively 1.4, 1.0, and 2.2 times more odds to fall two or more times.

Those elderly persons with decreasing sensitivity to contrast had 1.1 more odds to experience fall, and the elderly with abnormal visual field had 1.5 more odds to experience recurrent falls than elderly without such limitation.

The elderly persons have high incidence of diseases such as cataract, glaucoma and retinopathy that can compromise their skill to judge an imminent fall and to get corrective action. The interpretation of the spatial information may be compromised because of the deficit in the visual acuity, restricted visual field, increasing susceptibility to the light, failure in the depth perception, or instability in their sight fixation[17]. The visual acuity may decrease 80% at 90 years old, affecting the skill to perceive the contrast of objects and spatial details (contrast sensitivity). The adaptation to the darkness decreases, there is more brightness due to the cataract and the accommodation to changes at distance also decreases quickly[12]. Furthermore, there is a shuffling of the peripheral sight and an increase in the timing to the visual response. Such loss in the visual acuity can also be a factor related to the loss of balance, once the sight constitutes a sensorial organ that supplies the major part of the environmental information. This can lead directly to the fall due to the decreasing postural stability, or indirectly through the reduction of the mobility and the physical function.

Drugs and diseases associated to the falls

The association between the use of certain drugs and the incidence of falls in elderly persons has already been shown[1]. Evidences of such relationship are so important that generally, drugs are almost always present among recommendations to prevent these events. The more frequent drugs related to the falls are: sedatives/hypnotic, anti-depressive drugs, diuretics, anti-hypertensive, vasodilator drugs, non-steroid anti-inflammatory drugs, analgesic drugs, digitalis, and topic ocular medication[17]. The results obtained trend to confirm this association in such extent: there was a certain relationship between the amount of falls and the use of diuretic and psychoactive drugs.

As to cardiovascular medications, the differences observed in the prevalence of falls were less evident. However, such possibility should not be rejected due to the collateral effects, such as bradycardia, hypotension, somnolence and fatigue.

The group of diuretic drugs may facilitate the falls due to the fatigue, or the hydroelectrolytic disturbances[17]. Moura *et al.* have associated the use of diuretics to falls due to the depletion of the

volume and hypokalemia, which may cause orthostatic hypotension and arrhythmia. Our results seem to confirm such possibility. On the other hand, Coutinho and Silva[2] recorded a reduction in the risk for falls followed by fractures in elderly persons using diuretic drugs. For him, the possible protecting effect of the diuretic drugs could be attributed to a reduction in the urinary excretion of calcium with a consequent increase in the bone density.

On the other hand, psychoactive drugs are pointed as originators of falls due to the postural hypotension, and also, they may cause sedation, arrhythmia, shakings, muscular relaxation or weakness. Several investigations have associated its use to falls. A pioneering study accomplished by Prudham and Evans[23] compared groups of individuals with and without falling records, and they have identified a relationship between them and the use of drugs actuating on the CNS (benzodisepinics and antipsychotics) gathered under the denomination of tranquilizers due to their ability to produce sedation. Wild et al.[24] observed that the elderly persons assisted in an ambulatory after falling events had a higher probability to have ingested drugs in the previous 24 hors – mainly hypnotics, tranquilizers, and sedatives – than those of the matched controlling groups, who generally were less sick or handicapped. Granek et al. have studies on the association between falls, drugs, and diseases in elderly persons interned in long permanence units, having identified the high use of anti-depressive and hypnotic sedative drugs among individuals with history of falls. Capezutti[9] reports the long-action hypnotic-ansiolitic drugs (including benzodiazepinics), tricycle anti-depressives, and antipsychotic drugs as classes of drugs correlated to the risk of falls and fractures.

Finally, Coutinho and Silva[2], in a study searching for the evaluation of the role of the use of a set of drugs as risk factor for severe fractures caused by falls in elderly patients above 60 years of age has identified an increase of 109% in the risk for those patients among users of psychoactive type benzodiazepinic drugs (ansiolitics).

Rozenfeld[17] suggests that may have a relationship between falls and the topic ocular medication, as well as its prescription, that most of times are abusive for elderly patients with glaucoma. Its effect on the fall is probably due to more systemic (hypotension, bradycardia and syncope) than local order (pupil constriction). It worthwhiles to mention that there were reports on the use of ocular medication and acute damage to the sight – probably as consequence of inappropriate prescriptions (iatrogenics) – and therefore, negatively influencing the displacement ability. However, a more evident association among the use of such drugs and the prevalence of falls could not be confirmed through our data.

Still, our results indicated a higher prevalence of falls among individuals using higher amounts of drugs. The average figure of such events in the previous year and above 65 years old was continuing higher, according to the number of drugs used. Several studies presented the same finding: Granek et al. reported that the odds for falling down was two times higher in elderly persons living in long-permanence units using three or more medications compared to those that took less than that amount. In the same line, Moura et al.[10] reported elderly persons using four or more drugs with an increasing risk of falls. The American Society of Geriatrics[15] points out that reduction in the amount and the dosage of such prescribed medications has contributed to decrease the amount of falls in elderly persons living in communities and institutionalized. Moreover, elderly individuals who fell should have a review in their medication, having in mind the risk for future falls, as possible, to have these probabilities changed or interrupted. It should be given special attention to the reduction of drugs in elderly persons using psychotropics, and among those who use four or more medications. In the elderly population analyzed, 41% (11 individuals) presented such situation of pharmacologic usage. The abusive use of drugs represents not only a health problem to elderly persons, but it is also a socio-economical problem: most of the elderly persons had complained on the excessive cost of the drugs prescribed, and the incompatibility of such expenditures with their budget.

Results disclosed that the individuals observed presented a high amount of diseases, especially those directly associated to falls (mean of 4.4 diseases per individual against 3.1 diseases indirectly associated).

The higher amount of diseases accumulated per individual (total amount of diseases) the higher amount of falls suffered in the previous year and after the 65 years of age. The relationship of these diseases with the historic of falls suggested a possible positive association between the number of diseases presented and the amount of events reported. In general way, these findings are in accordance to the literature[1,5,8,10,17]. But the fact that diseases are considered to be directly or indirectly associated to the risk of falls seemed to be not determinant, once it was not identified any significant difference to the observations which were stratified.

Neuromotor variables: flexibility, strength, balance and agility

Flexibility in the lower limbs can be considered an important factor to determine the risk of falls, mainly because they are related to changes in the marching pattern[15,25]. Unfortunately, there are few available studies identifying the flexibility as a variable for the epidemiological exposition to falls in elderly persons or representing such physical quality as a risk factor to those events[3,25] to occur. Besides, it is known that the flexibility trends to decline in a very strong way with the aging[18,25,26]. So, the positive relationship found between the hip and ankle's mobility and the risk for falls in the individuals studied was expected in a theoretical plan, being consistent to the literature.

In a general way, aging causes a reduction in the amplitude of movements[25]. The decreasing flexibility is related to the occurrence of falls in elderly persons, mainly in function of the hip, knees, ankles and the columna vertebralis' mobility, generating changes in the marching pattern and difficulties to develop the daily tasks, such as using public transportation, trespass ground unevenness (sidewalks, staircases, etc.) or walking. Shepard[27] points out the hardening of articulations as one of the individual features for elderly persons that contributes to the poor marching mechanical efficiency. According to Moura et al.[10], the sustention foundation trends to enlarge, the steps become shorter and slow, and the trunk trends to be inflected to propitiate stability.

Furthermore, there is a limitation of the amplitude of the ankles' dorsiflexion, thus increasing the odds for stumbling. A decreasing strength and increase in the rigidity of the ankle's flexor muscles would cause a limitation in the flexion movement of that articulation, what would imply in a higher possibility to stumble during a march, consequently causing falls. Rozenfeld[17] proposes that the weakness of the ankle's dorsiflexion could be an important factor in the genesis of the falls, since the coordination between such movement and the plantar flexion is critical to recover from balance disturbances. Some investigators also point out the relationship (associated to the muscular strength) of the decline in the ankle, trunk and hip's mobility, with changes occurring in the marching pattern both related to its magnitude, cadency and balance[28,29]. Therefore, there is a strong evidence to the association between the strength and flexibility levels with the individual's marching pattern, and consequently with the possibility to fall.

The muscular strength – essential to a perfect health and physiological function – assumes a special role in elderly persons, due to its relationship with the balance, muscular endurance, locomotion, and ability to perform basic daily tasks (going up and down staircases, to seat and to stand, etc.) and finally, decreasing the risk for falls. Among all types of dynamic strength, it is suggested that the muscular strength is affected in a special way by the aging process[11,18,26]. But such type of strength has an important

role in a situation of imminent fall, once the re-establishment of the balance generally depends on the fast action of the lower limbs' musculature. The weakness of the lower limbs is common in elderly persons, and it has been identified as the second major cause of falls[12,15,27]. Stalenhoef *et al.*[5], in a study proposing the construction of a risk model for falls in elderly persons has mentioned the weakness of muscles and articulations as a risk factor for recurrent falls in individuals above 70 years of age. Brandon *et al.*[11], in his turn, showed that the decreasing in the lower limbs' strength with the aging decreases the functional mobility and increases the propension for falls in the elderly persons.

The balance also presents progressive deterioration with the aging. Among those factors that contribute for this occurrence, it can be mentioned the progressive loss of the neural cells, decreasing in the proprioceptive function of articulations, degenerative processes of the structures in the internal ear (sacculus and utriculus) and the muscular debility[3,10,18]. With this, the ability in controlling the body movements, including the necessary corrective movements whenever the gravity center is displaced by an external strength is reduced. The somatosensory, visual and vestibular systems show changes with the aging process, and may supply a reduced or inadequate feedback to the postural controlling centers. Similarly, the effector muscles may lose their ability to respond in an adequate way to postural disturbances[18]. With this, the right responses to the balance loss start in a slowest way – whenever there is an unbalance, and the elderly persons fail in their response selection, especially the more complex ones that require speed and accuracy.

Dynamic balance problems have been considered as causes of fall in elderly persons: approximately 50% of falls occur during some kind of locomotion (deviating from obstacles, at the beginning or end of the walking movement), whose tasks demand good static and/or dynamic balance[10,12,15]. Disturbances in the balance and in the messages intermediated by sensory organs are also pointed as risk factors[5]. The elderly persons have difficulty in keeping their balance under sensorial conflict conditions (such as when walking close to a flux of speed vehicles)[27]. Due to this reason, it was applied a test whose performance contributes to attain good strength levels (muscular strength) and balance in a functional perspective. In other words, instead of observing these qualities in an isolated way, it was chosen to evaluate how they would interact in the context of a complex task more closely associated to the risk of falls.

Results seemed to indicate an association between the flexibility levels and the prevalence of falls, with a possible exception for the ankle's flexion. On the other hand, there were no big differences as to the amount of falls in individuals classified in the lower and upper third of the agility test. This follows previous published results, indicating a favorable relationship between the strength, the balance and agility levels[7,14].

Among the possible reasons for the result found, it could be mentioned the reduced sampling, insufficient dichotomization of the dependent variable (presence and absence of falls) or the own nature of the test performed, thus combining the strength and balance variables instead of isolating them. Besides, it should be considered that the comparison performed in this study was of descriptive order, with no support of an inferential statistics to confirm the first impression. To overcome such limitations, it seems to us to be fundamental a better clarification of the role of these variables as to the predisposition to falls in the population observed.

CONCLUSIONS

All studies on the relationship between the incidence for falls and the possible risk factors that contribute for a better planning on the interventions as a purpose to keep functional capabilities in elderly persons. The results attained in this study indicate that upon the elaboration a prevention program to avoid falls it should be considered aspects from several spheres. Thus, in the sampling of elderly women observed, it was identified a significant relationship between the prevalence of falls and the presence of sight problems, the use of a high amount of medication (mainly psycho-actives and diuretics) and a reduction in the articular mobility of lower limbs level.

Considering the limitations of this study, some recommendations should be made for future investigations. The use of a higher and more randomized sampling could contribute for a higher potential to generalize the results. Furthermore, working with a better discrimination between elderly persons with or without historic of falls (case-control type study). Other possibility to be taken into account would be to refine the way to quantify some variables observed in this study, a recent changing and the time of consumption may contributed to constitute potential intervenient variables to the results obtained, once they influence the postural stability, in a general way.

Finally, the motor variables themselves can be target for more specific tests – in some cases, functional tests that combine different physical skill for its performance could introduce elements that confound the interpretation of predisposing factors to the prevalence of falls.

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