

## ASSOCIATION BETWEEN RISK OF FALL AND PHYSICAL ACTIVITY AMONG THE ELDERLY POPULATION OF POLICE COLONY, PESHAWAR

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### ABSTRACT

**Introduction:** Fall is considered as one of the major debilitating health problems in elder population. It can lead to functional decline, social interactions and can have serious consequences like fractures, soft tissue injuries or even death. Physically inactive persons or persons with stroke, gait instability, incontinence, muscle weakness and depression are at higher risk of experiencing a fall. This study was design to determine the relationship between risk of fall and physical activity in the elder population of police colony, Peshawar.

**Material & Methods:** This was a cross sectional study conducted on elderly people. Data was collected from 111 people in the Police Colony of Peshawar via non-probability convenience sampling technique. Patients were screened for eligibility criteria. Both male and females of age 60 and above were included in the study. Baseline characteristics were obtained from all the participants. Risk of fall was determined by using "Fall Risk Questionnaire" and the level of physical activity was determined using "Physical Activity Scale for the Elder" (PASE). Data was analysed using SPSS.

**Results:** A total of 99 people were 60 to 75 years old while 12 patients were 80 to 95 years old. The male to female ratio was 59: 52 respectively. This study revealed that 67.6% elder were having low physical activity status and had a potential risk of fall 79.3%. As the level of activity increased the risk of fall reduced significantly(p=0.01).

**Conclusion:** There is strong relation between risk of fall and physical activity. Increased physical activity reduces risk of fall.

**Key Words:** elderly, physical Activity, physical activity score for the elder, risk of fall

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### INTRODUCTION

Fall is a major health problem in elderly population. Thirty percent of community dwelling individuals above the age of 65 years, experience at least one fall once a year.<sup>1</sup> Prevalence of fall is highly variable around the globe specifically in South Asia. India reported prevalence of fall to be 6%. In China it is comparatively less around 3.1%. The highest episodes of fall were reported by Singapore as 17.2 % per year.<sup>2</sup> In Pakistan, a retrospective study revealed that around 45-46% elderly reported history of fall and 59% of the cases of fall resulted in lower limb fracture.<sup>3,4</sup> Other fatal conditions like intra-cranial bleeding and contusions have been associated with fall.<sup>5</sup>

There are several factors which can contribute to fall in elderly namely sarcopenia, multiple chronic diseases like arthritis, diabetes, polypharmacy and impaired sensation.<sup>6</sup> Other disease conditions like orthostatic hypotension, carotid sinus syndrome and cardiac arrhythmias can cause syncope that can increase the risk of fall.<sup>7</sup> External factors in the environment like walking surface, presence of rails, terrains and surrounding lights (timings of day) were also reported to affect the rate of fall among elderly.<sup>3,8</sup>

It is reported that 31% of the population living worldwide are not physically active.<sup>9</sup> An eight-year cohort study proposed that physical activity was associated with high functional status and longevity in young people. In

elderly, physical activity can delay progressive functional loss and improve cardiovascular health.<sup>10</sup> Metabolic abnormalities like hyperglycaemia, dyslipidaemia, hyper-insulinemia and abdominal obesity are proved to be the consequences of physical inactivity.<sup>11</sup> Physical inactivity can lead to an increased risk of developing chronic diseases.<sup>12</sup> Loss of muscle mass and strength is also associated with reduced level of physical activity.<sup>13</sup> Similarly, deficient physical performance of lower limb and balance disorders can play a major role in the causation of falls. Contrary to increased levels of physical activity, a good effect on muscle strength and reducing sarcopenia, thus reducing falls but it can increase the exposure of a person to environmental hazards that can lead to fall.<sup>14</sup> Literature shows evidence with conflicting findings where a number of studies show positive effects of physical activity on decreasing risk of fall.<sup>15</sup> This study aims at providing an insight into the association between fall and physical activity and other possible risk factors of fall.

### MATERIAL AND METHODS

This was a cross-sectional study conducted on the elder population of the Police Colony of Peshawar, Khyber Pakhtunkhwa, Pakistan. The study was approved by review committee of Khyber Medical University. Permission was taken from the head of Police Colony.

The total population of Police Colony was 2000 residents. At the time of study, 155 persons out of 2000 were identified having age 60 and above. Rao-soft sample size calculator was used with the 95% confidence interval and the estimated sample size was 111. Participants were included in the study having age 60 and above. Both male and female elderly were recruited in the study. Patients who were able to walk independently were included. Older adults with physical disability, substance abuse, recent head or lower limb injury one month ago, neurological deficit were excluded from the study. Participants who refused to participate in the study were excluded from the study. The timeline for the study is shown in the figure 1. After applying inclusion and exclusion criteria, 111 participants were included in the study. Consent was taken from each participant and details of the study were explained before the commencement of study.

Demographic details were obtained from all the participants. To measure the magnitude of physical activity among elderly, "Physical Activity Scale for the Elder" (PASE) Questionnaire was used. PASE questionnaire consists of sections addressing (1) Leisure time activities (2) Domestic / House chores and (3) Occupational activities. PASE quantifies physical activity of the last week in terms of frequency and intensity. The participants were then categorized into low, moderate or high level activities according to the questionnaire where lowest possible score was 0 and maximum was 793.

Risk of fall was assessed by using subjective questionnaire "Fall Risk Assessment". This questionnaire covers 5 major domains (1) Comorbidities: Diabetes, hypertension, cardiovascular disease, incontinence, dizziness, depression, impaired feet sensation and (2) Use of walking aids, (3) Sleeping pills, (4) Event of fall, (5) Fear of fall. Every question in each domain is score 1 = yes and 0=No. If the total score of questionnaires is 4 or above, the person is considered having a high risk of fall. At the end of the study, data was analyzed using SPSS statistical (version 25). Pearson's chi square test of association was applied on all variables to discover if there was any relationship between the categorical variables. The test manifested if there was statistically significant association between any two variables for example correlation among frequency of fall and physical activity or physical activity to risk of fall in this study.

## RESULTS

Descriptive statistics was applied for demographic details of the patients. Ninety-nine patients were 60 to 75 years old while 12 patients were 80 to 95 years old. Male to Female ratio was 59: 52. Participants were divided on the basis of body mass index (BMI) as follows, normal BMI (n=43), Overweight (n=41), Class-I Obesity (n=14), Class-II Obesity (n=2) and Class-III Obesity (n=11). Though able to walk independently 26 (23.4%) were using walking cane. Sleeping pills were used by 20 (18.0%), 39(35.1%) reported history of fall while 39 (35.1%) complained of having fear of fall (see table-1). Participants were asked about any history of diabetes, hypertension, heart diseases, dizziness, incontinence and impaired sensation of feet. Among all, 75 (67.6%) were diabetic, 63(56.8%) were hypertensive, 23(20.7%) had cardiovascular diseases. A total of 35 (31.5%) reported

dizziness on getting out of bed /chair into standing while 33 (29.7%) participants were incontinent. A total of 34 (30.6%) complained of self-reported depression. There were 18 (16.2%) participants who reported impaired feet sensations like numbness, tingling, heaviness (see table 2). Low physical activity was observed in 75 (67.6%), moderate physical activity in 20 (18.0%) and high physical activity was observed in 16 (14.4%) (see table-3 and Figure 3). Thirty nine out of 111 participants reported history of fall. The event of fall was more common in female than in males, however, there was no significant difference between the two genders statistically. Chi square test was applied to compare frequency of fall between male and female (see table 4). Risk of fall was found in 58 (52.25%) out of 111 participants. Chi square test was used to compare level of physical activity and risk of fall. The risk of fall was highest in participants with low physical activity. While low risk of fall was seen in participants with moderate to high physical activity. There was significant difference among the three levels of physical activity regarding potential risk of fall ( $p=0.01$ ). A correlation  $r= (- 0.283)$  was also found between the physical activity and risk of fall. The negative sign indicates an inverse relation (see table 5).

Participants were also investigated for having a fear of fall and it was then compared with activity level. A large number of participants with low and moderate physical activity complained of frequent fear of fall 39.9% and 40% respectively. Contrary, among participants with high physical activity level, very less number (12.5%) showed fear of fall. However, no statistical difference was found among low, moderate and high physical activity group ( $p=0.11$ ) (see table 6).

It was observed that risk of fall was associated with increasing age ( $p=0.01$ ). Participants having a cardiovascular disease were found to be associated with fall ( $p=0.01$ ). Presence of hypertension ( $p=0.04$ ), dizziness ( $p=0.001$ ) and depression ( $p=0.001$ ) also showed an association with risk of fall. Urinary incontinent patients and those who use walking aids and sleeping pills were proved to be associated with fall ( $p=0.02$ ), ( $p=0.01$ ) and ( $p=0.01$ ) respectively. On other hand gender, BMI, diabetes and abnormal feet sensation were not statistically associated to increase risk of fall ( $p=0.08$ ), ( $p=0.15$ ), ( $p=0.06$ ) and ( $p=0.07$ ) respectively (see table 7 and figure 4).

## DISCUSSION

This study revealed that risk of fall is inversely proportion to the level of physical activity where a high physical activity status ensures decreased risk of falling. Increased risk of fall was found to be associated with health ailments like cardiovascular disease (history of Myocardial infarctions / Angina / Heart Failure), hypertension, depression, dizziness as well as the use of assistive device and medications for sleep. Increasing age was itself a major risk factor for fall.

In this study, PASE was used to measure the status of physical activity as it is easy to score, brief, reliable and an authentic tool for senior population of age 65 years and above.<sup>16</sup> The risk of fall was measured by using a simple fall risk assessment questionnaire. It is a time efficient yet better than the existing assessment tools to evaluate certain risk factors that can cause or have caused falls in the elderly population of our community.<sup>17</sup>

In this current research, a significant association was seen among risk of fall and the physical activity ( $p=0.012$ ), however, no significant relationship was evaluated between frequency of fall with physical activity ( $p=0.218$ ) or fear of fall with physical activity ( $p=0.116$ ). According to a follow up study conducted in the US (United States of America), a strong relationship was found between the risk of fall and physical inactivity where low fitness level caused a great rate of fall among elderly population.<sup>18</sup> The result was also supported by a cohort study conducted on elderly population in Sweden. Those who were active physically had least risk of fall ( $p < 0.001$ ) compared to those who were sitting more ( $p < 0.05$ ) than the non-fallers.<sup>19</sup> In a prospective study conducted in Southern Germany, there was no relationship observed between occurrence of fall and the average daily physical activity.<sup>14</sup> Similar results were found in a research conducted on community dwelling older population in Malaysia ( $p=0.843$ ).<sup>20</sup>

According to this study, men were found to be at a lower risk of fall than women due to their higher status of physical activity. A study conducted on older adult men in the US contradicts this result; it showed that men in higher quartile range of physical activity had a higher risk of fall.<sup>21</sup> However, the same study implies that men with higher grip strength and greater leg power had a lower risk of fall. This contradiction of results can be due to the differences between the regions and cultures of both countries.

In this current survey, status of physical activity of the participants was categorized into low, moderate and high. Among the participants, 67.6% had a low physical activity status, 18.0% had moderate and 14.4% had a high physical activity status. No significant difference was present among both genders' involvement in physical activities. According to a study conducted in Australia, no significant differences were found among the physical functionality of male and female but men were found to have a greater sturdiness.<sup>22</sup>

This study showed the fear of fall was elevated in the elder female population than elderly male. Similar results were found in a study conducted in United Arab Emirates where older women were found to have a higher fear of fall as well as fall rate 146 (57%) than their male equivalents 42 (36.8%).<sup>5</sup> The similarity can be due to the similar cultures and regions however, their sample included an unequal number of both genders, females being more 256 (69.2%) than males 114 (30.8%). According to a study in Australia, conducted on women, higher status physical activity was correlated with lower fracture rate although, no substantial relation was observed among risk of fall and physical activity.<sup>23</sup>

There are potentially over 400 different factors thought to be associated with fall among older people that are grossly divided into intrinsic and extrinsic factors and should be taken into account when evaluating the risk.<sup>24</sup> Current study shows a weak relation between BMI and risk of fall among participants ( $p=0.151$ ). This result is opposed by a study carried out to find the relation between obesity and physical activity. According to that study, overweight population had high risk of fall by 31% ( $p=0.0003$ ).<sup>25,26</sup>

The investigations of the current study showed that there was significance correlation between hypertension and fall risk ( $p=0.041$ ). A study conducted in Boston, USA

showed similar results where uncontrolled hypertension caused increased falls within a year irrespective of the associated orthostatic hypotension.<sup>27</sup>

Findings of our trails suggested that participants suffering from cardiovascular diseases had higher risk of fall than non-sufferers ( $p=0.001$ ). A systematic review of 86 studies on association of CVD with falls identified a significant relation the latter two factors.<sup>28,29</sup> cardiovascular associations included low blood pressure, arrhythmias and heart failure.<sup>29</sup>

Current study showed that participants with chronic depression showed an increased risk of fall and occurrence of fall. In a clinical review, elderly population being prescribed with anti-depressants in patients with chronic depression showed an increased risk of fall.<sup>30</sup>

In the present research, participants that felt dizzy when they walk were found to have an increased risk of fall than their non-dizzy parallels ( $p=0.001$ ). In a national cross-sectional survey analysis in the USA, dizziness and balance dysfunction were found to have a strong association with both, occurrence of fall and injuries related to fall.<sup>31</sup>

The investigations of current study showed that participants with the use of walking aids including both cane and a walker showed an increased risk of fall and were found to be worried about falling ( $p=0.001$ ). These findings were contradicted by a study where no association of fear or risk of fall with mobility device usage was reported. However, those using canes were shown to compensate their fear of fall with decreasing daily physical activity rate.<sup>32</sup>

The current study concluded that those participants having trouble with sleeping or using medications for it were associated to risk of fall than normal sleepers ( $p=0.001$ ). According to a previous research the medications used by participants, sleeping tablets had shown association with obesity and fall ( $p < 0.0001$ ).<sup>25</sup>

According to this study, those participants with history of fall had a history of recurrent episodes of incontinence. Similar findings were reported in a study conducted in Egypt where participants with an experience of fall have shown association with urological comorbidities.<sup>33</sup>

Our study showed that the participants in the old age group had an increased fear of fall, risk of fall and low physical activity status. In addition, this group showed a greater frequency of fall than the other groups. Similar results were found with a high prevalence rate and a low physical activity rate among the oldest-age group in a trial carried out on elderly population.<sup>22</sup> Another follow up study conducted in the USA showed similar results with old-older people being at a greater threat of fall compared to the young-older people.<sup>18</sup>

One of the findings of our study was that frequency and fear of fall were higher among women than in men showing a significant relationship between fear and frequency of fall with gender. In a study conducted on older women in Japan, showed similar results. The participants who was afraid of fall also showed a fall history, lower physical activity, lower fitness rate and a higher medication use.<sup>34</sup>

In the current research study, low physical activity is shown to have a weak relationship with frequency of fall. In a cohort study conducted in the US on older men, it

was shown that men with a history of fall scored low on the physical activity scale than non-fallers.<sup>19</sup>

### CONCLUSION

There is a significant association between risk of fall and physical activity in older population.

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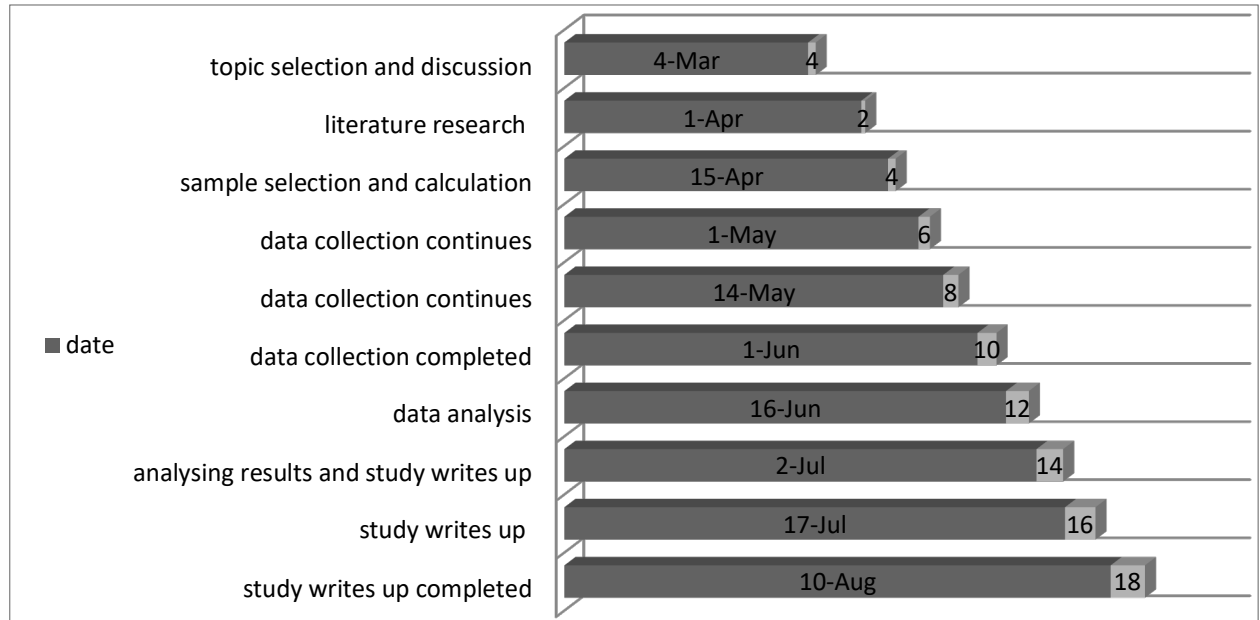


Figure 1: Research timeline via Gantt chart

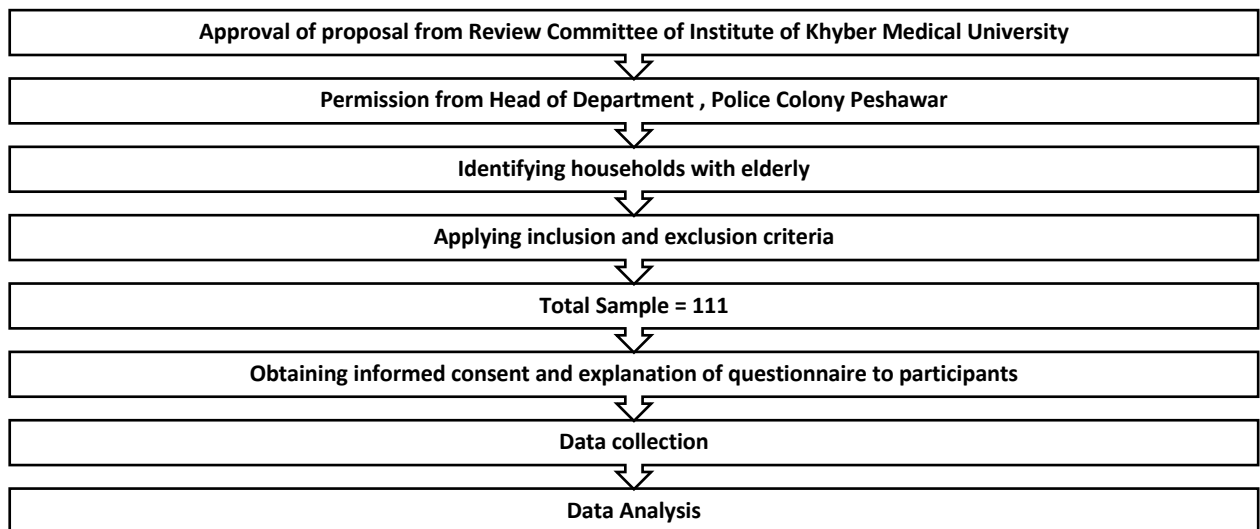


Figure 2: showing schematic presentation of research methodology

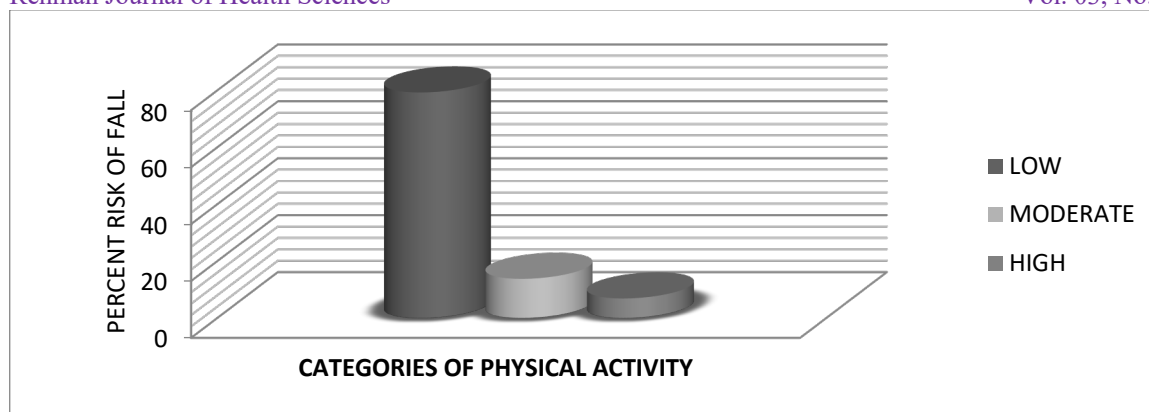


Figure 1 ; Show relation between Risk of fall and Physical activity

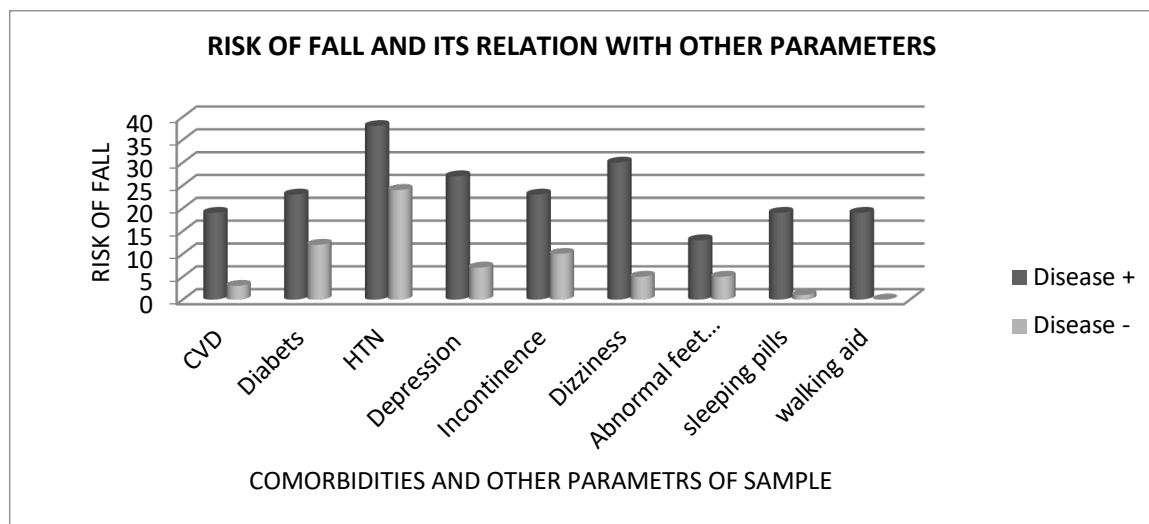


Figure 2; showing risk of fall and its relationship with other

Table 1: Sample characteristics

	FREQUENCY	PERCENTAGE
AGE	60-75 years (n=99)	89.1%
	80-95 years (n=12)	10.8%
Gender	Male (59)	53%
	Female (52)	46.8%
BMI	Normal (43)	37.8%
	Overweight (41)	36.9%
	Class I Obesity (14)	12.6%
	Class II Obesity (2)	1.8%
	Class III Obesity (11)	9.9%
Use of walking aid	26	23.4%
Use of Sleeping pills	20	18.0%
Fear of Fall	39	35.1%

Table 2: Distribution of Comorbidities among Study Participants

Comorbidities	Frequency	Percentage
Diabetic	75	67.6%
Hypertension	63	56.8%
CVD	23	20.7%
Dizziness on standing	35	31.5%
Urine incontinence	33	29.7%
Status of depression	34	30.6%
Abnormal feet sensation	18	16.2%

Table 3: Physical Activity of Participants via PASE Scoring System

PHYSICAL ACTIVITY	Frequency	Percentage
Low physical activity	75	67.6%
Moderate physical activity	20	18.0%
High physical activity	16	14.4%

Table 4: Frequency Of Fall And Gender

Chi-Square Tests	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.024 <sup>a</sup>	1	0.155		
Continuity Correction <sup>b</sup>	1.496	1	0.221		
Likelihood Ratio	2.026	1	0.155		
Fisher's Exact Test				0.168	0.111
Linear-by-Linear Association	2.006	1	0.157		
N of Valid Cases	110				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.44.

b. Computed only for a 2x2 table

Table 5: Relation between risk of fall and physical activity

PHYSICAL ACTIVITY	RISK OF FALL	
Risk of Fall	58	52.25%
Risk of Fall & Physical Activity level		
	Frequency	Percentage
Low physical activity (n= 75)	46	79.3%
Moderate physical activity (n=20)	8	13.8%
High physical activity (n=16)	4	6.9%
	P= 0.012	r= -0.283

Table 6: Level of physical activity and fear of fall

PHYSICAL ACTIVITY	FEAR OF FALL	
	Frequency	Percentage
Low physical activity (n= 75)	29	39.2%
Moderate physical activity (n=20)	8	40.0%
High physical activity (n=16)	2	12.5%
	P= 0.11	

Table 7: Risk of fall and its association with other parameters

PARAMETRS	RISK OF FALL		
	Frequency	Percentage	
AGE	60-70	28	38.4%
	70-75	20	80.0%
	>75	10 (p= 0.01)	83.3%
GENDER	MALE	26	44.8%
	FEMAL	32 (p=0.08)	61.5%
BMI	NORMAL	19	44.2%
	OBESE	39 (p=0.15)	58.2%
CVD		19 (p=0.01)	86.4%
Diabetes		23 (p=0.06)	65.7%
Hypertension		38 (p=0.04)	61.3%
Depression		27 (p=0.01)	79.4%
Urine incontinence		23(p=0.02)	69.75%
Dizziness upon standing		30 (p=0.01)	85.7%
Abnormal feet sensation		13 (p=0.07)	72.2%
Use of Sleeping pills		19 (p=0.01)	95.0%
Use of cane		19 (p=0.01)	95.0%