Otago Exercise Program (OEP): A Golden Technique on Health Status and Risk of Falls among Older Adults with Chronic Diseases

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Abstract

Background: Fall is a worldwide health problem, leading cause of disability, resulted from declining physical function among elderly people. Otago exercise is a strength and balance program designed to prevent falls and enhance health status among the elderly. **Aim:** to appraise the effect Otago Exercise Program (OEP) on health status and risk of fall among older adults with chronic disease. **Design:** A quasi-experimental research design was utilized. **Setting:** The study was conducted at outpatient clinics at Aswan University Hospital. **Sampling**: A purposive sample of 48 elderly patients was recruited in this study**. Tools of data collection:** Three tools were used. Tool I: A structured interview questionnaire sheet includes two parts; part 1.socio-demographic characteristics e.g. age, sex, education level, part (2): clinical data include history of medical diseases, mobility, activities of daily living and falling. Tool II: The short from 12 health survey (SF-12) to measure health status. Tool III: Timed Up and Go Test (TUGT) to measure risk of fall. **Results**: There was a statistically significant difference in both health status and risk of fall total scores among studied subjects pre and post OEP.Concerning predictors of health status, it was found that, OEP, arthritis and medication number were statistically significant predictors of health status (ß= 0.624, p= 0.028), (ß= -2.935, p= 0.014) & (ß= -4.453, p=. 0.005) respectively. Meanwhile, fall predictors were OEP (ß=-1.067, p= 0.011), age(ß=0.246, p= 0.042),medication number (ß= 6.763, p= 0.005)and frequencies of fall in the past year (ß= 2.585, p= 0.010). **Conclusion:** The study concluded that application of OEP is appropriate way of improving health status and decreasing of risk of falls among older adults with chronic disease. **Recommendation:** This study recommended implementing OEP as part of routine primary care service provided for older adults.

Keywords: Fall, Health status, Older adults, Otago Exercise Program, Nursing.

Introduction

Ageing, in fact, is a progressive physiological process that is characterized by degeneration of organ systems and tissues with consequent loss of functional reserve of those systems ***(Madehkhaksar et al., 2018).*** The Older adult population aged 60 years and above globally increased from 901 million in 2015 to 2.1 billion in 2050 due to advances in medical science and improvements in standards of living ***(Beard et al., 2016 & Seah et al., 2019).***

The increased older adult population is a hallmark risk factor for several health conditions and can provide positive and negative impacts. The positive impact arises if the elderly are healthy, active, and productive. The older adult population can experience burden given their health problems that result in increased health care costs, increased disability, lack of social support, and non-conducive environment, this contribute to a high economic burden on the healthcare system and society ***(Moncada & Mire, 2017).*** The morbidity in the older adults reached to 24.8% in 2013, increased to 25.05% in 2014, and continually rose to 28. 62% in 2015 ***(Wijers et al., 2018).***

Approximately 92% of older adults have at least one chronic disease and 60% have at least two chronic diseases. Chronic diseases and decline in health status may be risk factors for falls in the older adults. Several chronic diseases that affect the older adult, such as hypertension, diabetes mellitus, and osteoarthritis, are important risk factors for falls ***(Ploeg et al., 2017; Hou et al., 2018 & Fong, 2019).***

Fall is a worldwide health problem among older adults due to age-related changes in the body and are the leading cause of injury in this age group ***(Criter & Honaker, 2017).*** Approximately one-third of older adults over age 65 experience a fall; this percentage rises with age to affect more than 50% of elderly over age 80 and older fall annually ***(Williams et al., 2015 & Srinivas et al., 2020).***

Falls are really a serious public health problem among older adult with chronic disease can lead to trauma, pain, impaired function, loss of confidence in carrying out everyday activities, loss of independence and autonomy, and even death ***(Park& Shin, 2019).*** The most common risk factors for falling are leg muscle weakness, difficulty walking, polypharmacy (too much or the wrong type of medications), cognitive impairment, vision impairment, and challenges within the environment ***(Gamage et al., 2019).*** Fall usually a neglected public health problem in many societies, particularly in low and middle-income countries, and when they occur, falls can be costly, in both healthcare treatment and in resulting, lingering pain. Healthcare costs can be reduced if falls are reduced ***(Cheng & Chang, 2017)***.

Falls are considered preventable event, one and only way to prevent falls is through training. In 2010, the Centers for Disease Control and Prevention (CDC) published the second edition of the Compendium of Effective Fall Prevention Interventions. Only two were proven to be effective for preventing falls in people over 65 living in the community: the first was OEP and the second was the Falls Management Exercise program. The OEP was developed as a progressive exercise program that could be delivered in an older person's home taught by physiotherapists and/or trained nurses who provided them with strength, balance and endurance exercises ***(Albornos-Muñoz, 2018).*** It consists of a set of leg muscle strengthening and balance retraining exercises progressing in difficulty, and a walking plan ***(Fusco, 2019).*** Otago training is one of the trainings proven to reduce falls by 35% ***(Abdulrazaq et al., 2018).*** OEP is considered for implementation in older adults with chronic disease because it has demonstrated to be one of the most beneficial programs to prevent fall sand pain resulting from muscle weakness and improve general health status but such programs cannot significantly

increase the mental health status ***(Shubert et al., 2018; Bjerk et al., 2019 & Fusco, 2019).***

So, nurses carry a burden of improving health and reducing falls among older adults with chronic diseases attending any health care setting or even at home through regular home visits. This can be done through educating, training and encouraging older adult to apply Otago Exercise Program (OEP) ***(Dadgari et al., 2016)***

Significance of the study:

Chronic disease is important risk factors for falls; approximately 30% of adults aged 65 and older fall each year. Falls are considered the second leading cause of unintentional injury deaths. More than 37 million falls require medical attention, and over 17 million disability-adjusted life years are lost as a result of falls every year. The treatment of these injuries is costly and has a negative impact on health-care resources. The World Health Organization has declared that if the appropriate preventive actions are not implemented, the burden of fall injuries would increase by 100% by the year 2030. Evidently, more efforts in research and prevention are needed to reduce the burden of falls on global health and economic resources ***(Albornos-Muñoz et al., 2018 & Alghnam et al., 2020).***

Otago training is helpful, and one of the most powerful interventions where the original randomized controlled trials reported improvements in functional outcomes and a 35% reduction in falls for frail, high-risk older adults ***(Shubert et al., 2018).*** In Egypt, there are little researches about Otago Exercise Program. Therefore, this study aimed to determine the effect of Otago Exercise Program on health status and risk of falls among older adults with chronic diseases.

Aim of the study

The aim of this study was to appraise the effect Otago Exercise Program (OEP) on health status and risk of fall among older adults with chronic disease.

Research hypothesis:

H (1). OEP will improve health status among older adults with chronic disease.

H (2). OEP will reduce the risk of fall among older adults with chronic disease.

Materials and methods

Research Design: A quasi-experimental research design (one group pre-test post-test) was utilized to achieve the aim of the current study.

Research Setting: This study was conducted at 5 outpatient clinics affiliated to Aswan University hospital as it had the higher patient flow rate such clinics were (Rheumatology, Diabetics, Cardiovascular, Orthopedic and Internal Medicine) with regular patient flow.

Study Sample: A purposive sample of 48 older adults with chronic disease and attending the above mentioned setting, the researchers selected the patients who met the following inclusion and exclusion criteria.

Inclusion criteria

- Aged 60 years and above from both sexes.

- Having a risk of fall (TUG ≥14 seconds)
- Prior experience of a chronic disease.
- Able to walk at least 10 meters long
- Accept to participate (provide informed consent)
- Moreover, they had a family member (to maintain homogeneity) as a caregiver (aged 18 - 50) who had health literacy. Health literacy was tested by reading an instructional booklet and explaining the content to the participants and care givers.

Exclusion criteria:

- Older adults with communication problems (vision or hearing impairment)
- Experience of postural hypotension
- Elderly Having previous hip replacement surgery or previous history of lower extremities fracture in the last 12 months.
- Elderly with any acute or chronic diseases limiting physical activity and any health conditions discouraging participation for any reason by physician.

Sample size:

Based on data from literature ***Kiik et al., (2020)***, considering level of significance of 5%, and power of study of 80%, the sample size can be calculated using the following formula:

$n = [(Z\alpha/2 + Z\beta)^2 \times \{2(SD)^2\}]/ (\text{mean difference})^2$ where SD = standard deviation, $Z\alpha/2$: This depends on level of significance, for 5% this is 1.96.

$Z\beta$: This depends on power, for 80% this is 0.84

Therefore, $n= [(1.96 + 0.84)^2 \times \{2(2.96)2\}]/ (1.7)2=47.6$

Based on the above formula, the sample size required per group is 48.

Study Tools:

Three tools were used to collect the study databy the researchers as the following:

Tool I: A structured- interview questionnaire: Which was developed by the researchers after extensive literature review and it was written in simple Arabic language. It includes the following two parts:

Part (1): Socio-demographic data of older adult's patients with chronic disease: It was composed of items such as sex, age, residence, marital status, level of education, income living condition, and occupation.

Part (2): Clinical data include: History of medical diseases, level of mobility**,** activities of daily living and falling such as fear of fall, frequencies of falls in last year, place of fall, causes of falling, and complications after fall.

Tool II: The Short Form 12 health survey (SF-12): Was used to measure the health status of the older adult (mental and physical) health status, the tool consists of 12 question can measure the health status, including {Physical Component Summary (PCS)

Physical Functioning (PF), Role-Physical (RP)

Bodily Pain (BP) and General Health (GH)} and {Mental Component Summary (MCS) Vitality (VT)

Social Functioning (SF), Role-Emotional (RE)

Mental Health (MH)} set by ***Cherner et al., (2018).*** SF-12 scales and summary measures are scored so that a higher score indicates a better health state ***(Shumway-Cook et al., 2000; Bohannon, 2006 & Kristensen et al., 2007).***

Tool III: Timed Up and Go Test (TUGT): used to measure the risk of fallingby observation sheet of Timed Up and Go Test (TUGT). TUGT is a very common valid, reliable tool to assess mobility, balance, and walking ability in community dwelling adults ***(Steffen et al., 2002).***

Respondents who perform TUGT procedure begin by sitting on a chair. When the examiner says "start," then the respondent stands up from a chair, walks to the marked line (within 3 m of the seat), turns and walks back to the previous chair after arriving at the line, and sits down as before. The start and stopped when the elderly sits back.

According to the Arabic version of the scale, Score less than 20 seconds indicates independence in basic transfers, while scores higher than 30 in indicate dependence during transfers, difficulties in entering and exiting a shower or tub, and in outdoor ambulation**.** A score higher than 13.5 is the cut off that indicates risk of falls in community dwelling adults.So, Scores ≥ 14 indicate high risk of falls, whereas scores < 14 denote a low risk of falling ***(Elboim-Gabyzon et al., 2015).***

Method:

1.An official approval was issued from the Faculty of Nursing, Aswan University and forwarded to director of Aswan University Hospital andthe director of outpatient clinics to obtain the permission to attend the clinics to carry out the study after explanation of the purpose of the study.

2.Older adults were informed that their participation is voluntary and they have the right to be withdrawn from the study with a full respect.

3.The findings would be presented as group data with no personal participant's information remained.

4.Tool I and developed by the researchers based on systematic review of relevant literature then; tool II, III were translated by the researchers into Arabic language. The Arabic version of all these tools was tested for content validity by five (5) experts in the related field (Geriatric Nursing and Community Health Nursing). The necessary modifications and omissions of some details were done and then set the final fieldwork schedule.

5.The reliability of tool II (SF-12) was 0.893while reliability of tool III (TUGT) was 0.912were tested on 10 of older adults with chronic disease in order to measure the internal consistency of these tools by using Cornbrash's alpha test.

6.A pilot study was conducted to assess the applicability of the tools, the feasibility of the study and to estimate the time needed for data

collection. It was conducted on five participants according to the selection criteria.

Fieldwork:

1. This study was carried out through three sequential phases: interviewing & assessment phase, program conduction phase, planning & implementation phase and evaluation phase. The study cover period of three month from the beginning of October 2019 till the end of December 2019.

2. **Interviewing & Assessment Phase:** Older adults with chronic disease who fulfilled the inclusion criteria were interviewed individually by the researchers in the waiting area of the clinics using tools from I to III in order to obtain the baseline data, assessment of health status & to measure older adults' risk of falling (per-test). The interview took around 30-45 minutes, this according to the interviewers' level of understanding and comfort.This-phase covered over a period of one month (September 2019).

3. The telephone numbers of all participants were taken in order to arrange for program's sessions.

4. In this phase, the researchers interviewed each older patient and explained the aim of the study, tools components, benefits of the program for collecting baseline data concerning their demographic, history of mobility, activities of daily living, falling of older, measure the health status of the older adult and the risk of falling. This phase was conducted in outpatient clinic at Aswan University Hospital.Recruit older patients according to inclusion criteria then discuss the way of future communication with those patients.

5. The short from 12 health survey (SF-12) was used to measure the health status of the elderly.

6. The risk of falling was measured using the observation sheet of Timed Up and Go Test (TUGT).The time needed for completing the questionnaire was ranged from 15 - 20 minutes for each older adult's patient using tool (II and III).

Program conduction phase:

1- The proposed program conducted on group bases of 4 groups (A, B, C &D), each group included 12 older adults with chronic disease.

2- The OEP was conducted three times a week (Sunday&Tuesday for the first two groups A& B) and (Monday &Wednesday for the second two groups C &D) at hospital and one session followed up by the researcher by telephone at home. Each session was conducted for 40 min including warm-up and cooling-down. The total number of sessions was 36 sessions.

3- Before the conduction of the program session, the researchers prepared the environment to be calm and comfortable for each member in the groups, have adequate lighting in a private waiting roomat outpatient clinic in the hospital.

4- The researchers distributed the designed manual booklet on each participant in order to clarify the desired knowledge and skills. This booklet contains the illustrative colored pictures.

The planning and implementation phase:

5- The researchers presented Otago Exercise Program to older adult patients by using some illustrating pictures, brochure, video films, and demonstration and re-demonstration to teach older adult patient about this exercise and how to do it.

Otago Exercise Program includes the following steps respectively *(Liston et al., 2014 & Skelton et al., 2018).*

No.	Practice	Description
1	Warming-up	▪ Sit on a chair, take deep breath through the nose and raise both arms to the top of the stretch. ▪ Release thearmsandexhale. ▪ Repeat thisexercise ten times.
2	Front Knee Strengthening	▪ Sit on a chair with a backrest. ▪ Slightly lift the leg and then lower it; repeat this step 10 times. ▪ Perform the same exercise on the other leg.
3	Back Knee Strengthening	▪ Stand up facing a chair ▪ Hold the seat back and lift the leg backwards while the knees are bent.
4	Side Hip Strengthening	▪ Stand up holding the chair. ▪ Expand the leg to the side then return to its original position.
5	Calf Raises	▪ Stand up holding the chair. ▪ Strengthen the rests on the calf. ▪ Tiptoe and lower the heel hold. ▪ Repeat the exercise ten times.
6	Toe Raises	▪ Stand up holding the chair. ▪ Slowly raise the toes and then lower them. ▪ Repeat the step ten times.
7	Sit to Stand	▪ Sit down on a chair. ▪ Stand up with unaided hand. ▪ Repeat this stepten times.
8	Heel Waking	▪ Stand on heels. ▪ Walkten steps on heels. ▪ Repeat the exercise ten times.
9	Toe Walking	▪ Walk forward using the toes. ▪ Walkten steps on toes. ▪ Repeat the exercise ten times
10	One Leg Standing	▪ Stand on one leg with the other foot placed in the mid-calf. ▪ Hold for ten seconds, if possible. ▪ Repeat the exercise five times on each leg.
11	Side Ways Walking	▪ Stand with feet pressed together with the knees slightly bent ▪ Spread the legs to the side slowly and with control, and slide one foot first to one side ▪ Move the other leg that has moved closer to the foot ▪ Perform ten steps each while shifting to one side.
12	Cooling-down	▪ Sit on a chair and take a deep breath through the nose with both arms raised to the top of the stretch. ▪ Release the arms and exhale. ▪ Repeat the exercise ten times.

The evaluation phase:

This phase emphasized on estimating the effect of applying OEP on health status and risk of fall among older adults with chronic disease, through a comparison between pre & post- test.

Ethical considerations:

- Informed witness consent was obtained from each
- Participant after explanation of the study purpose.
- Confidentiality of the collected data was maintained.
- Privacy, anonymity, and the right to withdraw at any time were assured.

Statistical Analysis:

The collected data were scored, tabulated and analyzed by the use of Statistical Package for Social Sciences version 22, (SPSS Inc., and Chicago, IL). The collected data were presented in tables and graphs using the actual numbers and percentages. Appropriate statistical tests were used to analyze the data as, chi-square test (X2), independent sample t-test. Mann–Whitney test was used to determine differences in the risk of falling, physical status of health. The level of significance was set at $p < 0.05$ and highly significance at $p < 0.001$.

Results

Table 1: Portrays that 52.1 % of the studied subjects aged between 60 -65 years with a mean age 66.2 ±5.6, years old, more than half (58.3 %)of studied subjects were males. Also, less than half of them (45.8%) came from rural areas and 56.3% of them were married. More than one third of them (35.4) have basic educational level and 52.1% of them reported that their monthly income was sufficient of essential need. In addition, nearly one third of them (31.3%) lived alone and 45.8% still working.

Figure (1): Illustrates that hypertension is the most frequent diseases among studied elderly subjects and followed by Diabetes mellitus, then arthritis (60.4%, 47.9%, and 27.8%) respectively

Table 2: Illustrates that 60.4% of studied subjects mobile without assistance device, one quarter of them (25%) mildly dependent on other, while 37.5% were moderately dependent on others and 37.5% were independent. All of them (100%) feared from fall. Nearly two thirds of them (66.7%) fallen at least once during the previous year (10.4% fallen more than 3 times + 56.3% fallen 1-2 times).

Concerning place of fall, more than one third of them (37.5%) fallen at home, while majority of them fell outdoors (40.6% in the street& 21.9% in workplace). Causes of fall were slipping, loss of balance, feeling faint (68.8%, 15.5% & 9.4%) respectively. Regarding complications of fall, majority of studied subjects (90.6%) suffered from wound as a result of falling, slightly less than half (46.9%) suffered from Bruises and 28.1% had foot sprain.

Table 3: Demonstrates that there was a statistically significant improvement in both Physical and mental health status after implementation of Otago exercise ($P<0.001$). Also there was a statistically significant improvement in total health status score after exercise ($P<0.001$).

Table 4: Illustrates that there was 75% of studied subjects had high risk of fall. Also there was a statistically significant improvement in TUGT score after implementation of Otago exercise (P<0.001), as 25% of subjects compared to 70.8% of them perform the test in less than 20 second after implementing the exercise with mean score 22.4 ±5.8 seconds before, compared to 17.7 ±4.3 seconds after implementing the exercise.

Table 5 : Demonstrates that there was a highly statistically significant relationship between risk of fall and physical component of health status, as studied subjects with TUG test score ≤20 seconds had significantly higher PCS score than subjects with TUG test score ≤30 seconds (11.8 ±2.1 vs 9.3 ±2.1 respectively, p<0.001). Also, there was a statistically significant relationship between risk of fall and mental health status, as mental health status was significantly higher in studied subjects with TUG test score ≤20 seconds as compared to subjects with TUG test score ≤30 seconds (18.2 ±2.2 vs 16.4 ±2.1 respectively) (p=0.003).

Regarding total health status , there was a highly statistically significant relationship between risk of fall and total health status, the total SF-12 score in the studied subjects with TUG test score ≤20 seconds was 28.0 ±3.3 compared to 17.7 ±2.7 in studied subjects with total TUG test score ≤30 seconds. This difference was significant (p<0.001).

Table 6: Clarifies that Otago exercise is the only statistically significant positive predictor for health status of studied subjects (ß= 0.624, p= 0.028).On the other hand both arthritis and medication number were statistically significant negative predictors of health status (ß= -2.935, p= 0.014) & (ß= -4.453, p=. 0.005) respectively.

In addition, this table also shows that age, level of education, presence of hypertension, diabetes and frequencies of fall in the past year were negative predictors of health status but not statistically significant. While, income, living conditions and level of mobility were positive predictors of health status of studied subjects which is not statistically significant.

Table 7: Reveals that Otago exercise is the only statistically significant negative predictor of fall among studied subjects (ß=-1.067, p= 0.011), while age (ß=0.246, p= 0.042), medication number (ß= 6.763, p= 0.005), and frequencies of fall in the past year (ß= 2.585, p= 0.010), were statistically significant positive predictors.

In addition, this table also shows that, presence of hypertension, diabetes, arthritis and level of mobility were negative predictors of health status but not statistically significant. While, income, and living conditions were positive predictors of health status of studied subjects which is not statistically significant.

Table 1: Sociodemographic Characteristics of Older Adults with Chronic Diseases (n=48).

Items	N	%
Age (in years)		
60 – <66	25	52.1
66 – <70	16	33.3
≥70	7	14.6
Mean ±SD	66.2 ±5.6	
Sex		
Male	28	58.3
Female	20	41.7
Residence		
Rural	22	45.8
Urban	26	54.2
Marital status		
Widow	16	33.3
Married	27	56.3
Divorced	5	10.4
Educational level		
Illiterate	14	29.2
Basic	17	35.4
Secondary	11	22.9
Higher	6	12.5
Income		
Insufficient	15	31.3
Sufficient of essential need	25	52.1
Sufficient and save	8	16.7
Livingcondition		
Family (Wife/ husbands)	27	56.3
Siblings	6	12.5
Alone	15	31.3
Occupation		
Working	22	45.8
Not Working	26	54.2

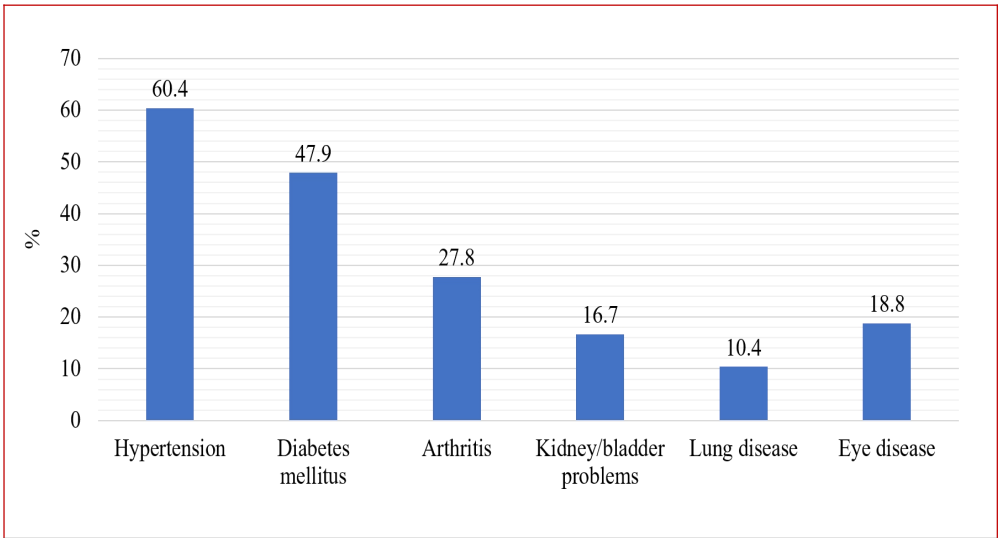

Figure 1. Distribution of chronic diseases in the older adults

Table 2: Frequency Distribution of Clinical Data of Older Adults with Chronic Diseases (N=48).

Items	N	%
Level of mobility		
Without assistance device	29	60.4
With assistance device	19	39.6
Assistance with ADLs		
Independent	18	37.5
Mild dependent	12	25.0
Moderate dependent	18	37.5
Fear of fall		
No	0	0.0
Yes	48	100.0
Frequencies of falls in last year		
No	16	33.3
1-2	27	56.3
3 or more	5	10.4
Place of fall (n=32)		
Home	12	37.5
Work-place/office Passage	7	21.9
Street/alley ways	13	40.6
Causes of fall (n=32)		
Slipped	22	68.8
Lost your balance	5	15.5
Feel of faint/dizzy	3	9.4
Unknown	2	6.3
Complication after fall (n=32)		
Wound	29	90.6
Foot sprain	9	28.1
Bruises	15	46.9

Table 3: Comparison of the Scores of Components of the SF12 Pre Versus After OEP In Older Adults With Chronic Diseases (N=48).

Items	Pre-OEP Mean ±SD	Post-OEP Mean ±SD	Student's t test t	p
Physical health (PCS)	10.4 ±2.1	13.3 ±2.0	7.059	<0.001
Mental health (MCS)	17.4 ±2.1	19.9 ±2.0	6.133	<0.001
Total score	27.7 ±2.9	33.2 ±3.1	8.816	<0.001

Table 4: Comparison of the Distribution of the TUGT Responses Pre versus After OEP in Older Adults with Chronic Diseases (n=48).

Items	Pre-OEP		Post-OEP		Chi square test	
	n	%	n	%	X^2	p
TUG test						
≤20 seconds	12	25.0	34	70.8		
≤30 seconds	36	75.0	14	29.2	20.202	<0.001
TUG test (seconds)						
Range	10 – 30		11 – 26			
Mean ±SD	22.4 ±5.8		17.7 ±4.3		4.510	<0.001

Table 5. : Relationship between SF-2 Scores and Risk of Fall TUG Test in Elderly with Chronic Diseases (N=48).

Items	TUG test score ≤20 seconds Mean ±SD	≤30 seconds Mean ±SD	t test t	p
Physical health (PCS)	11.8 ±2.1	9.3 ±2.1	3.571	<0.001
Mental health (MCS)	18.2 ±2.2	16.4 ±2.1	3.107	0.003
Total health status score	28.0 ±3.3	17.7 ±2.7	10.823	<0.001

Table 6: Logistic Regression Analysis For Factors That Predict Health Status In Elderly Subjects (N=48).

Model	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	42.994	5.542		7.758	<0.001
Age	-0.044	0.628	-0.011	-0.070	0.945
Sex	-1.080	1.122	-0.183	-0.962	0.344
Residence	-1.991	1.031	-0.341	-1.931	0.063
Marital status	0.161	0.843	0.034	0.191	0.850
Level of education	-0.419	0.383	-0.143	-1.094	0.283
Income	0.414	0.630	0.096	0.657	0.514
Living condition	0.589	0.465	0.183	1.267	0.215
Occupation	-0.576	0.939	-0.099	-0.613	0.544
Hypertension	-1.468	0.849	-0.247	-1.729	0.090
Diabetes mellitus	-0.768	1.078	-0.132	-0.713	0.482
Arthritis	-2.935	1.120	-0.376	-2.621	0.014
Kidney and bladder problems	-0.892	1.195	-0.114	-0.746	0.461
Lung disease	-0.367	1.402	-0.039	-0.262	0.794
Medication number	-4.453	1.464	-0.423	-3.041	0.005
Level of mobility	0.152	0.865	0.026	0.176	0.862
Otego	0.624	0.274	0.318	2.272	0.028
Frequencies of falls per last year	-0.046	0.720	-0.010	-0.064	0.950

Table 7: Logistic Regression Analysis For Factors That Predict TUG Test (Falling) (N=48).

Model	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
Age	0.246	0.117	0.295	2.092	0.042
Sex	-2.955	2.212	-0.316	-1.336	0.189
Marital status	-1.575	1.346	-0.212	-1.170	0.249
Level of education	0.742	0.776	0.160	0.955	0.345
Income	0.224	1.030	0.033	0.217	0.829
Living condition	0.223	0.849	0.044	0.263	0.794
Occupation	1.049	1.865	0.113	0.562	0.577
Hypertension	-1.376	1.566	-0.146	-0.879	0.385
Diabetes mellitus	-1.300	1.482	-0.141	-0.877	0.385
Arthritis	-1.505	1.846	-0.122	-0.815	0.420
Kidney and bladder problems	0.967	1.946	0.078	0.497	0.622
Lung disease	2.836	2.150	0.188	1.319	0.195
Medication number	6.763	2.269	0.405	2.981	0.005
Level of mobility	-1.036	1.513	-0.110	-0.685	0.497
Frequencies of falls per last year	2.585	0.963	0.348	2.685	0.010
Otego	-1.067	0.403	-0.343	-2.645	0.011

Discussion

Older adults comprise a part of the community who require more attention and special care than the rest of society. Falls are a serious health problem that elderly people inevitably face. Falls are a serious consequence of declining physical function in elderly population. Also falls and fall-related injuries are a leading cause of morbidity and mortality, representing a serious public health problem. Otago exercise is strength and balance training program which may help in preventing falls and enhance health status among the elderly ***(Alshammari et al., 2018).***

The aim of this study was to appraise the effect Otago Exercise Program (OEP) on health status and risk of fall among older adults with chronic disease.

This study illustrated that the mean age of studied subjects was 66.2 ±5.6 years, less than one quarter (22.9%) of them had secondary education. This was in accordance with ***Hazrati and colleagues (2019)*** in Iran who found that the mean age of the subjects was 68.9 years and 39% of them had secondary education.

This study clarified that the most prevalent chronic diseases among studied sample were hypertension, Diabetes and arthritis (60.4%, 47.9% & 27.8%) respectively. This may be explained by the reduction in physiological and physical functions associated with aging. The results are consistent with the study of ***Darjani et al., (2013)*** in Iran who found that the most common comorbidities of elderly subjects were hypertension (87%) and diabetes mellitus (18%).On contrary, ***El-Hamd et al., (2020)*** in Egypt found that the most prevalent chronic disease among elderly population was diabetes mellitus (33.41%) followed by hypertension (7.92%). This difference may be due to differences in setting and sample structure.

This study showed that all (100%) studied subjects reported fear of fall. This may be due to their previous experience of fall and its consequences, as all those who experienced fall suffered from wound, bruises foot or sprain (90.6%,46.9% and 28.1%) respectively. Accordingly, ***Shubert et al., (2017)*** in United States found that the majority of subjects (87%) reporting fear of falling.

The present study found that two thirds of studied subjects (66.7%) experienced falling at least once in the previous year. This may be due to the fact that ageing is associated with a progressive decline in several physiological functions, and therefore has consequences in terms of overall functioning, including functional abilities which may cause slipping, loss of balance, feeling faint (68.8%, 15.5%&9.4%) respectively. These findings are consistent with ***Bickerstaff et al., (2010)*** in Amsterdam who found that 73.8% of subjects reported at least one fall in the last year. On the other hand, ***Pirrie et al., (2020)*** in Canada found that only 34.5% of studied sample experienced fall in the previous year. Contradicting with these findings 2006 Behavioral Risk Factor Surveillance System (BRFSS) reported that only 16% of individuals in the United States and 18% of Californians aged ≥65 years reported falling at least once in the previous year ***(Stevens et al., 2008).***

Concerning the place of fall, this study clarified that more than one third of studied subjects (37.5%) fell at home, while the majority of them fell outside

(40.6% in the street &21.9% in workplace). Possible reasons may be that most studied subjects belonged young old and middle old age group (52.1% &33.3%) respectively who tend to be more mobile. In the same line, ***Berg's et al., (1997)*** study findings showed more falls occurred outside home. On contrary, ***Chacko et al., (2017)*** in India found that almost equal number of falls occurred inside and outside home. Also, ***Pitchai et al., (2019)*** in India found that 65.43% of falls occurred indoors and 34.57% from outdoors. This difference may be due to difference in culture and sample structure.

In the present study, Otago training significantly improved health status of studied subjects as total health status mean score increased from 27.7 ±2.9 before intervention to 33.2 ±3.1 after intervention ($p<0.001$). This improvement may be due to the commitment of subjects and researchers with the exercise program plan and the enough time given to subjects to practice the exercise and continuous remote (home) follow up during the period of program done by telephones. This finding agreed with the findings of ***Wati and colleagues (2018),*** which showed that the exercise program improved health status of elderly in Indonesia.

Regarding mental health status, it was significantly improved after exercise program with mean scores (17.4 ±2.1 before to 19.9 ±2.0 after intervention) ($p<0.003$) and this is slightly less than the improvement in physical health status (10.4 ±2.1 before to 13.3 ±2.0 after intervention) ($p<0.001$). This may be due to the fact that mental health takes longer time than physical health status to be changed or improved. On the other hand, ***Bjerk et al., (2019)*** reported that Otago training programs can improve physical health but cause no significant increase in the mental health status of Norwegian older adults. Also, [23] in Indonesia found that Otago training program significantly improved mental health but had no statistically significant effect on physical health of elderly.

This study illustrated that there were three quarters of studied subjects (75%) had a risk for fall. This might be explained by the fact that aging decreases the density of bones and muscles making the elderly more prone to fall. This was confirmed by ***Dadgari et al., (2016)*** who reported that 85% of the sample had risk of fall

The current study demonstrated that Otago training significantly reduced the risk of falling among the studied subjects (22.4 ±5.8 pre intervention) to (17.7 ±4.3post intervention). This may be due to the fact that OEP is a combination of muscle strengthening, balance training, and walking programs for the reduction of falls among elderly. the results are consistent with the study of[23] which showed that the Otago training significantly reduced the risk of falling among the studied elderly from 14.26 seconds to 12.05 seconds ($p= 0.041$). This was in agreement with ***Patel & Pachpute, (2015)*** who found that Otago exercise program is significantly effective in prevention of fall among Indian elder people. Also in Portugal, it was reported that Otago training needs to be conducted regularly and sustained as a training program to prevent falls in the elderly ***(Martins et al., 2018).***

This study clarified that there was a statistically significant relationship between risk of fall and health status, as those with high risk of fall (TUG≤30) get lower SF-12 scores (17.7 ±2.7) than those with lower risk of fall. This may be explained as risk of fall increases with the deterioration in bodily physical functions associated with aging process. In

agreement with the current study, ***Alshammari et al., (2018)*** in Riyadh found that there was a strong relationship between risk of fall and health status.

Logistic regression analysis of this study identified Otago as a statistically significant predictor of health status. This may be explained by the fact that Otago exercise consisted of a range of motion trainings, balance trainings, strength training, game sessions, and deep breathing, which can improve the health status of the elderly.

In the present study, medication number and arthritis were statistically significant negative predictors of health status among studied subjects. This may be explained as presence of arthritis affects elderly mobility and bodily functions; also increases number of medication may cause side effects and affect both physical and mental health. In agreement with these findings, ***Byers, (2008)*** in United States found that number of medication was a predictor of health status among studied women.

Regression analysis of current study revealed that age was a positive predictor of fall. This may be due to the fact that with increasing age, physiological changes occur in the body. As a result, reaction time, reflexes and mobility are affected. The cumulative effect of all these will understandably cause increased incidence of falls. This was confirmed by ***MISRA, (2004)*** who stated that increasing age was significant independent predictors of falls in the elderly in Singapore.

Findings of this study revealed that medication number was a statistically significant positive predictor of fall, as the medication number increased, the risk of fall increased. This may be due to medication interaction or several medication side effects, which might be hindering the normal activities of the body, e.g. postural hypotension in hypertensive subjects.In the same line, ***Smith et al., (2016)*** in United Kingdom found that number of medication taken by the elderly was a statistically significant predictor of fall. Also, ***Hammond& Wilson, (2013)*** in Australia reported that medication intake is an independent predictor of falls in the elderly. On contrary, ***Tromp et al., (2001)*** in Amsterdam found that the use of medication was not related to any falls or recurrent falls. Also, ***MISRA, (2004)*** in Singapore found that number of medications taken by older adult was not significant predictor of fall.

The findings of the present study revealed that previous fall was a statistically significant positive predictor of fall among studied subjects. This may be explained as the current fall may cause injury or sustained impairments, which may cause future falls. Accordingly**,** ***Ismail et al., (2018)*** in Egypt found that previous fall was a statistically significant independent predictor of fall among older adults in geriatric homes.

Conclusion:

Application of Otago exercise program is appropriate way of improving health status and decreasing of risk of falls among older adults with chronic illness.

Recommendations:

- Training nurses in primary care settings to provide Otago exercise program for elderly.
- Implementing Otago exercise program as part of routine primary care service provided for older adults.
- Further research studies should be made to determine the most effective method in implementing Otago Exercise Program into routine primary care settings in Egypt.
- Further examination of predictors of risk of fall and health status among those patients.

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