Effect of Therapeutic Exercises Intervention on the Functional Status for Patients with Ankylosing Spondylitis

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Abstract
Background: Regular exercises are of importance in the successful long-term management of Ankylosing Spondylitis. **The study aimed** to evaluate the effect of a specific exercise program on spinal and joints stiffness for patients with Ankylosing Spondylitis. **Subjects and Method: Design:** Quasi experimental research design**. Setting:** Rheumatology and rehabilitation department in Tanta University Hospital. **Subjects:** Sampling of 60 adult patients who are suffering from ankylosing spondylitis. They were divided randomly into two equal groups; each group consisted of (30) patients as following: **Group (1): Study group,** it was consisted of (30) patients and they are exposed to the therapeutic exercise. **Group (2): Control group,** it was consisted of (30) patients and they are exposed to the routine hospital care. **Tools: tool (1):** Structured Interview Schedule, **tool (2):** Bath Ankylosing Spondylitis Functional Index, **tool (3):** Bath Ankylosing Spondylitis Disease Activity Index and **tool (4):** Numeric Pain Rating Scale (NPRS**). Results:** the results revealed that there were statistically improvement in patients knowledge before and after two months with mean± SD (19.60 ± 3.37) and (59.40 ± 2.55) respectively. Also, there were statistically significant improvement concerning to bath Ankylosing Spondylitis Functional Index before and after two month with mean (80.93 ± 2.35 and 13.63 ± 1.40) respectively, there were statistically significant improvement concerning to bath Ankylosing Spondylitis Disease Activity Index before and after two months (8.15 ± 0.30 ,1.34 ± 0.20) respectively .Concerning to Numeric Pain Rating Scale there were statistically significant improvement before and after two months in study group. **Conclusion:** The specific exercise program has a valuable effect on patients with Ankylosing Spondylitis on their physical function, and stiffness (mobility of the axial skeleton). **Recommendations:** Applying the specific exercise program on the patients with Ankylosing Spondylitis at different rehabilitation units to decrease the spinal and joint stiffness.
Keywords: Ankylosing Spondylitis, Exercise Program.

Introduction: Spondylus arthropathy (Spa) refers to a heterogeneous group of rheumatic diseases [1,2] that present common clinical and genetic features, which are classified as peripheral or axial (Spa) based on the parts of the body are predominantly affected. Ankylosing spondylitis is a chronic inflammatory disorder which mainly involves the following parts: spine joints, sacroiliac joints and soft tissues, such as tendons and ligaments [2,3].

Ankylosing Spondylitis is not just limited to the spine; the peripheral joints can be affected, and organs such as the eyes, heart, and lungs can be involved [4]. Patients can also complain of systemic symptoms such as fatigue or weight loss. Chronic pain and immobility can lead to patients experiencing depression and anxiety [5-,7].

Exercise is considered a fundamental tool for the management of ankylosing spondylitis patients that improve and control of signs and symptoms of this challenging disease [8]. The goals of exercise of AS are to reduce symptoms, maintain spinal flexibility and normal posture, reduce functional limitations, maintain work ability, and decrease disease complications [9]. Exercises for patients with AS are usually include combination of muscle strengthening, range of motion, flexibility and cardiorespiratory exercises [10,11]. Rehabilitation in ankylosing spondylitis is a lifelong process it is a complex procedure of (re)training a disabled person after illness and injury for the highest possible physical, mental, social and professional benefit according to its capabilities [12,13]. Early and proper rehabilitation procedures reduce the number of completely disabled patients with AS from 25% to only 1%. Rehabilitation reduces the incidence of complications, needs for medications, hospitalization and leads to improved quality of life (QoL) in patients with AS [14]. The main role of nurses is to perform a comprehensive disease management to control disease activity, reduce symptoms and improve patient-preferred outcomes [15]. Nurses should identify, assess and address psychosocial issues to minimize the chance of patients' anxiety and depression [16,17]. Nurses should promote self-management skills in order that patients achieve a greater sense of control, self-efficacy and empowerment [18,19]. Management of the patient with AS should aim to maximize the individual's long-term health-related quality of life by controlling symptoms and inflammation, preventing progressive structural damage, ensuring and maintaining the patient's activities and functions in daily life, and participation in social life [20].

Significance of the study:

Ankylosing Spondylitis (AS) is disabling disease affects people [21]. produces a clear limitation of mobility and functional capacity in the patients who develop this disease [22].

Physical exercise has been shown to improve activity, symptoms, functional capacity, cardiorespiratory function and quality of life, and it prevent the development of deformities [23].

The Aim of the study is to

To evaluate the effect of therapeutic exercises intervention on the functional status for patients with ankylosing spondylitis.

Research Hypothesis:

- Ankylosing spondylitis Patients exhibit improvement in their functional status post implementation of therapeutic exercises.

Subjects and Method

Research design:

A quasi- experimental research design which had been used.

Setting:

The study was conducted at the Physical Medicine and Rehabilitation Department of Tanta University Hospital.

Subjects

A convenience sampling of 60 adult patients who were offering from ankylosing spondylitis in the above previously mentioned settings. The sample size was calculated based on the Epidemiological Information Program, based on the total of Ankylosing spondylitis patients per year according to review of Tanta Main University Hospital statistical records. They were divided randomly into two equal groups; each group consisted of (30) patients as following:

Group (1): Study group, it was consisted of (30) patients and they are exposed to the therapeutic exercise that was designed and implemented by the researcher.

Group (2): Control group, it was consisted of (30) patients and they are exposed to the routine hospital care.

Tools of the study:

Four tools were used which include the following:

Tool (I): Structured Interview Schedule:

It was developed by the researcher after reviewing of the related literature [24]. It comprises of three parts:

Part (I): Socio- demographic data of the patients: which included patient's code,

age, sex, marital status, level of education, occupation, residence and smoking habits.

Part (II): patients' clinical data [25,26]: which included height, weight, body mass index, past medical history, time of diagnosis, duration of symptoms, presence of morning stiffness methods of treatment, duration of disease, previous surgery, and medication and vital signs.

Part (III): Patients Knowledge Assessment Sheet [27-29]:

- It was developed by the researcher after reviewing of the related literatures [39-42] to gather patients' knowledge regarding ankylosing spondylitis disease which included, (33) question regarding: definition, causes, risk factors, signs and symptoms, complication, diagnostic procedure, treatment, physical therapy, general information about the exercises, its benefits and types and how to carry out this exercises in the home, preparation of the patients before exercises, position, lifestyle changes.

Scoring system of knowledge:

Three level of scoring for the questions were as the following:

Correct and complete answer score (2)

Correct and incomplete answer score (1)

Don't' know or incorrect answer (0)

The total scoring system of patients knowledge was (66) and classified as the following:

-Good → > 75% of the total score

-Fair → ≥ 60% - 75% of the total score

- Poor → < 60% of the total score

Tool (II): Bath Ankylosing Spondylitis Functional Index (BASFI) [30,31]:

The Bath Ankylosing Spondylitis Functional Index (BASFI) used to assess functional limitation in patients with Ankylosing Spondylitis. The BASFI is a set of 10 questions focused on the person's

ability to perform specific functional tasks, the first 8 questions consider activities related to functional anatomy, such as putting on socks with or without help and climbing steps with or without using a handrail, the final two questions assess the patients' ability to cope with everyday life. **Scoring system:** It is measured by using a visual analogue scale on a horizontal 10 cm line (ranging from 0 being easy and 10 being impossible).

Tool (III): Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) [32-34]. This tool was designed for measuring disease activity in Ankylosing Spondylitis, consists of 10 cm horizontal visual analog scales, used to answer 6 questions pertaining to the 5 major symptoms of AS such as fatigue, spinal pain, joint pain/swelling, areas of localized tenderness, morning stiffness. **Scoring system:** The final BASDAI score has a range of 0 to 10(where 0 being no problem and 10 being very severe problem). Higher scores show poor disease activity. A BASDAI score >4 is internationally accepted to indicate active disease.

Tool (IV): The Numeric Pain Rating Scale (NPRS) [35-37].

The Numeric Pain Rating Scale is a segmented numeric version of the visual analog scale in which a respondent selects a whole number (0–10 integers) that best reflects the intensity of pain.

Method:

1-Administrative process:

a- Official permission from the Faculty of Nursing was delivered to the appropriate authorities

b- Permission to conduct the study was obtained from the directors of: the Physical Medicine and Rehabilitation Department at Tanta University Hospital.

2-Ethical and legal considerations:

a-Approval of ethical committee from the Faculty of Nursing was obtained.

b- An informed consent was taken from every participant patients after complete explanation about the aim of the study.

c- Complete confidentiality and privacy was considered regarding data collection and results. A code number was used rather than names.

d-The patients was informed the right to withdraw from the study at any time and without any reason.

3-Tools development:

All tools of the study were developed by the researcher to collect the data after extensive review of literature [24-37]. And used to collect data except tool (II): Bath Ankylosing Spondylitis Functional Index (BASFI) was developed by [30,31], tool (III): Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) [32-34] and tool (IV): The Numeric Pain Rating Scale (NPRS) [35-37].

4-Tools of data collection:

It was translated into Arabic language because the study subjects had different levels of education.

5- Validity of Tools:

All tools of the study were tested for content validity and clarity of questionnaire by a panel of (5) expertise in the field of Medical Surgical Nursing, physiotherapy physicians, it was calculated and found to be = (98%).

6- Reliability:

The reliability for the study tools was calculated by Cronbach's alpha test [18], it was:0.987for tool (I), 0.976for tool (II) and 0.949 for tool (III). The suitable statistical tests were used for testing questionnaire reliability.

7-A pilot study:

It was conducted before the study on 3 patients to test the clarity, feasibility and the applicability of the tools to detect any obstacles during the period of data collection. The needed modification was done by the researcher before study

8-Data collection:

The collection of the data for the present study was 6 months started from first of November 2020 to the end of March in 2021.

9-The present study was conducted through four main phases:

(Assessment, planning, implementation, and evaluation), and it was continued for each until the end of the study.

Statistical analysis of the data:

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0**. (**Armonk, NY: IBM Corp**)**. Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significances of the obtained results was judged at the 5% level.

Results

 Table (1): Shows that comparison between the two studied groups according to sociodemographic data of the patient. Concerning to age, the table showed that about (36.7%) from the studied and control group were in the age of (31≥ 40) years old. **Regarding to gender and marital status,** the table revealed that more than half (63.3%and 56.7%) from the studied group were female and married respectively while nearly half (53.3%, 43.3%, 43.3%) of the control group were male, single and

married respectively. **According to level of education and occupation,** the table present that (83.3%, 40.0%) from studied group were secondary education and manual work respectively while (90%, 30%) from control group were secondary education and not work respectively. **Concerning to residence and smoking**, the table showed that (56.7%, 73.3%) from study group were urban and no smoker respectively, while (50%, 50%, 56.7%) from the control group were urban, rural and no smoker.

Table (2): Comparison between the two studied groups according to Total mean scores of patient's knowledge assessment sheet. This table showed that there was statistically significant difference between studied &control group regarding total mean **scores** of patient's knowledge assessment sheet from pre to post one and two months at $p \leq 0.05$.

Table (3): Comparison between the two studied groups according to total scores of bath ankylosing spondylitis functional index. Regarding to functional anatomy: this table showed that there was highly improvement among studied group with mean $\pm$ SD (81.13±2.49), to mean $\pm$ SD (13.83 $\pm$ 1.73) compared to control group with mean $\pm$ SD (81.79 ±2.38) to (6.23 $\pm$ 0.63) and p value (p<0.0001*).

Regarding to patients ability to cope with everyday life activity: this table revealed that there was highly improvement among studied group with mean $\pm$ SD (80.17±5.17), to mean $\pm$ SD (12.83 $\pm$ 2.84) compared to control group where with mean $\pm$ SD (81.50 ±5.11) to (63.17 $\pm$ 4.82) and p value (p<0.0001*).

According to bath ankylosing spondylitis functional index, this table revealed that there was highly

improvement among studied group with mean ± SD (80.93±2.35), to mean ± SD (13.63 ± 1.40) compared to control group where there was slight change from with mean ± SD (81.73 ±2.07) to (61.87 ± 2.33) and p value (p<0.0001*).

Table (4) Comparison between the two studied groups according to total scores of bath ankylosing spondylitis disease activity index (BASDAI), this table showed that there were highly improvement among studied with mean ± SD (8.15±0.30) , to mean ± SD (1.34 ± 0.20) compared to control group where there was slight change from pre exposure to routine care with mean ± SD (8.16 ±0.36) to post two months of routine care (5.86±0.33) and p value (p<0.0001*).

Table (5): Comparison between the studied groups according to level of rheumatic pain, it was found a significant difference before and after exposure to therapeutic exercise among study and control group (P<0.001*)

Table (6): Concerning to a correlation between knowledge overall and bath ankylosing spondylitis disease activity index and the (NPRS) in two study group in period before exposure to therapeutic exercise, the table revealed that there was no statistically significant difference found between all items before exposure to therapeutic exercise.

 Table (7): In addition to correlation between overall knowledge, overall (BAsFI) and bath ankylosing spondylitis disease activity index and the (NPRS) in study group after a period of 2 month of exposure to therapeutic exercise: the table revealed that there was positive correlation between bath ankylosing spondylitis disease activity index post two month where r=0.378*, P< (0.040*).

Table (1): Comparison between the two studied groups according to socio-demographic data of the patient

Socio-demographic data of the patient	Study (n = 30)		Control (n = 30)		Test of sig.	P
	No.	%	No.	%		
Age (years)						
21 ≥ 30 years	4	13.3	5	16.7	χ^2=1.351	^{MC}p= 0.754
31 ≥ 40 years	11	36.7	11	36.7		
41 ≥ 50 years	9	30.0	11	36.7		
≥ 50 years	6	20.0	3	10.0		
Mean ± SD.	40.23 ± 10.19		38.67 ± 8.80		t=0.638	0.526
Sex						
Male	11	36.7	16	53.3	χ^2=1.684	0.194
Female	19	63.3	14	46.7		
Marital status						
Single	11	36.7	13	43.3	χ^2=1.530	^{MC}p= 0.706
Married	17	56.7	13	43.3		
Divorced	1	3.3	2	6.7		
Widow	1	3.3	2	6.7		
Level of education						
Illiterate	0	0.0	0	0.0	χ^2=1.207	^{MC}p= 0.702
Read &write	1	3.3	0	0.0		
Secondary education	25	83.3	27	90.0		
University education	4	13.3	3	10.0		
Occupation						
Employee	5	16.7	6	20.0	χ^2=4.629	0.201
Machinery work	10	33.3	8	26.7		
Manual work	12	40.0	7	23.3		
Not work	3	10.0	9	30.0		
Residence						
Urban area	17	56.7	15	50.0	χ^2=0.268	0.605
Rural area	13	43.3	15	50.0		
Smoking habits						
Smoker	8	26.7	13	43.3	χ^2=1.832	0.176
No smoker	22	73.3	17	56.7		
If patient is smoker mention number of package (day)						
1	7	87.5	13	100.0	χ^2=1.706	^{FE}p= 0.381
2	1	12.5	0	0.0		

Table (2):   Comparison between the two studied groups according to total scores of patient's knowledge assessment sheet

Part (III): patient's knowledge assessment sheet	Study (n = 30)			Control (n = 30)			U (p1)	U (p2)	U (p3)
	Before exercise program	After month of exercise program	After 2 months of exercise program	Before routine care	After month of routine care	After 2 months of routine care			
	Mean ± SD.	Mean ± SD.	Mean ± SD.	Mean ± SD.	Mean ± SD.	Mean ± SD.			
A-knowledge about ankylosing spondylitis									
Mean ± SD	5.47 ± 1.61	18.77 ± 1.14	18.17 ± 1.29	5.30 ± 1.80	6.07 ± 1.74	5.97 ± 1.75	401.0 (0.460)	0.0* (<0.001*)	0.0* (<0.001*)
Fr (p0)	50.108* (<0.001*)			16.125* (<0.001*)					
B-knowledge about management and healthy life style of ankylosing spondylitis 1-knowledge about management									
Mean ± SD	7.93 ± 1.89	24.97 ± 1.07	23.43 ± 1.57	7.27 ± 1.87	8.53 ± 1.61	8.10 ± 2.11	371.0 (0.237)	0.0* (<0.001*)	0.0* (<0.001*)
Fr (p0)	55.357* (<0.001*)			21.700* (<0.001*)					
2- knowledge about healthy life style (0 – 20)									
Mean ± SD	6.20 ± 1.69	19.23 ± 0.82	17.80 ± 1.63	5.57 ± 2.61	6.40 ± 2.62	5.87 ± 2.57	387.50 (0.350)	0.0* (<0.001*)	0.0* (<0.001*)
Fr (p0)	53.745* (<0.001*)			19.200* (<0.001*)					
Overall B-knowledge about management and healthy life style of ankylosing spondylitis (0 – 46)									
Mean ± SD	14.13 ± 2.50	44.20 ± 1.13	41.23 ± 2.50	12.83 ± 3.20	14.93 ± 3.31	13.97 ± 3.17	365.50 (0.208)	0.0* (<0.001*)	0.0* (<0.001*)
Fr (p0)	56.838* (<0.001*)			32.521* (<0.001*)					
Overall patient's knowledge									
Mean ± SD	19.60 ± 3.37	62.97 ± 1.43	59.40 ± 2.55	18.13 ± 3.59	21.0 ± 3.79	19.93 ± 3.52	356.0 (0.162)	0.0* (<0.001*)	0.0* (<0.001*)
Fr (p0)	55.882* (<0.001*)			36.505* (<0.001*)					

Table (3):   **Comparison between the two studied groups according to total scores of Bath ankylosing spondylitis functional index (BASFI)**

Bath ankylosing spondylitis functional index (BASFI)	Study (n = 30)			Control (n = 30)			U (p1)	U (p2)	U (p3)
	Before of exercise program	After month of exercise program	After 2 months of exercise program	Before routine care	After monthof routine care	After 2 months of routine care			
Functional anatomy									
Mean±SD	81.13 ± 2.49	30.88 ± 2.65	13.83 ± 1.73	81.79 ± 2.38	60.38 ± 3.76	61.54 ± 2.61	383.50 (0.318)	0.0* (<0.001*)	0.0* (<0.001*)
Fr (p0)	60.0* (<0.001*)			47.113* (<0.001*)					
Patients' ability to cope with everyday life									
Mean±SD	80.17 ± 5.17	32.0 ± 5.81	12.83 ± 2.84	81.50 ± 5.11	61.0 ± 4.43	63.17 ± 4.82	384.0 (0.310)	0.0* (<0.001*)	0.0* (<0.001*)
Fr (p0)	60.0* (<0.001*)			50.255* (<0.001*)					
Bath ankylosing spondylitis functional index (BASFI) Mean±SD	80.93 ± 2.35	31.10 ± 2.63	13.63 ± 1.40	81.73 ± 2.07	60.50 ± 3.37	61.87 ± 2.33	376.0 (0.270)	0.0* (<0.001*)	0.0* (<0.001*)
Fr (p0)	60.0* (<0.001*)			48.276* (<0.001*)					

Table (4):   **Comparison between the two studied groups according to scores of Tool (III): Bath ankylosing spondylitis disease activity index (BASDAI)**

Bath ankylosing spondylitis disease activity index	Study (n = 30)			Control (n = 30)			U (p₁)	U (p₂)	U (p₃)
	Before	After month	After 2 months	Before	After month	After 2 months			
	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.			
Overall BASDAI									
Mean score ±SD	8.15 ± 0.30	3.36 ± 0.25	1.34 ± 0.20	8.16 ± 0.36	5.85 ± 0.31	5.86 ± 0.33	445.50 (0.946)	0.0^* ($<0.001^*$)	0.0^* ($<0.001^*$)
Fr (p₀)	60.0^* ($<0.001^*$)			48.214^* ($<0.001^*$)					

Table (5):   **Comparison between the two studied groups according to level of the numeric pain rating scale (NPRS)**

The numeric pain rating scale (NPRS)	Study (n =30)						Control (n =30)						χ^2 ($^{MC}p_1$)	χ^2 (p_2)	χ^2 (p_3)
	Before		After month		After 2 months		Before		After month		After 2 months				
	No	%	No	%	No	%	No	%	No	%	No	%			
No pain (0)	0	0.0	0	0.0	0	0.0	1	3.3	0	0.0	0	0.0	2.960 (0.242)	16.596^* ($<0.001^*$)	60.0^* ($<0.001^*$)
Mild pain (1:3)	0	0.0	13	43.3	30	100.0	1	3.3	0	0.0	0	0.0			
Moderate pain (4:6)	0	0.0	17	56.7	0	0.0	0	0.0	30	100.0	30	100.0			
Sever pain (7-9)	30	100.0	0	0.0	0	0.0	27	90.0	0	0.0	0	0.0			
Worst pain (10)	0	0.0	0	0.0	0	0.0	1	3.3	0	0.0	0	0.0			
Fr (p₀)	55.869^* ($<0.001^*$)						37.527^* ($<0.001^*$)								

Table (6):   Correlation between overall knowledge, overall (BASFI) and bath ankylosing spondylitis disease activity index: The (NPRS) in study group in before

Before		Study Group				Control Group			
		Overall patient's knowledge	Overall, Tool (II): Bath ankylosing spondylitis functional index (BASFI)	Tool (III): Bath ankylosing spondylitis disease activity index	Tool (IV): The numeric pain rating scale (NPRS)	Overall patient's knowledge	Overall, Tool (II): Bath ankylosing spondylitis functional index (BASFI)	Tool (III): Bath ankylosing spondylitis disease activity index	Tool (IV): The numeric pain rating scale (NPRS)
Overall patient's knowledge	r_s		0.244	0.095	0.009		0.024	-0.160	0.070
	p		0.194	0.617	0.962		0.902	0.398	0.713
Overall, Tool (II): Bath ankylosing spondylitis functional index (BASFI)	r_s			0.082	-0.190			-0.098	0.077
	p			0.667	0.316			0.605	0.685
Tool (III): Bath ankylosing spondylitis disease activity index	r_s				0.114				-0.122
	p				0.550				0.520
Tool (IV): The numeric pain rating scale (NPRS)	r_s								
	p								

Table (7): Correlation between Overall knowledge, overall (BASFI) and Bath

After 2 months		Study Group				Control Group			
		Overall patient's knowledge	Overall, Tool (II): Bath ankylosing spondylitis functional index (BASFI)	Tool (III): Bath ankylosing spondylitis disease activity index	Tool (IV): The numeric pain rating scale (NPRS)	Overall patient's knowledge	Overall, Tool (II): Bath ankylosing spondylitis functional index (BASFI)	Tool (III): Bath ankylosing spondylitis disease activity index	Tool (IV): The numeric pain rating scale (NPRS)
Overall patient's knowledge	r_s		-0.278	0.129	0.180		0.301	-0.030	0.015
	P		0.137	0.496	0.342		0.107	0.875	0.936
Overall Tool (II): Bath ankylosing spondylitis functional index (BASFI)	r_s			0.141	0.134			-0.190	-0.025
	P			0.457	0.479			0.315	0.896
Tool (III): Bath ankylosing spondylitis disease activity index	r_s				0.378*				-0.318
	P				0.040*				0.087
Tool (IV): The numeric pain rating scale (NPRS)	r_s								
	P								

Ankylosing spondylitis disease activity index: The (NPRS) in study group in before
disease activity index: The (NPRS) in study group in before

Discussion

Ankylosing spondylitis, (AS) is a chronic, inflammatory, and progressive rheumatic condition that is characterized by back pain, decreased mobility, and deformity, as well as weakness and poor quality of life**.** Ankylosing spondylitis (AS) mainly affects the spine and sacroiliac joints, causing characteristic inflammatory back pain. If untreated, this may progress to severe damage to the spine, sacroiliac joint, and peripheral joints with functional impairment, reduction of physiological range of motion (ROM), deformity, disability, and compromised psychological status and quality of life [38].

Exercise, in combination with pharmacological treatment, is considered a critical method in the management of ankylosing spondylitis (AS) and has greatly increased the control of signs and symptoms of this challenging disease [39]. Therefore, to evaluate the effect of therapeutic exercises intervention on the functional status for patients with ankylosing spondylitis.

Concerning to socio demographic data of the studied patients, the results of the present study showed that nearly more than one third of studied patients were in the age group (31≥40). This finding was in the same line with **O'Dwyer et al. (2016)** [40] who reported that Ankylosing spondylitis affected the third and fourth decades of patients' age with a mean age (37.80 ± 7.906 years). In contrast to the study finding **Rouse et al. (2019)** [41] who revealed that two-thirds of the study ankylosing spondylitis patients age were more than forty years.

Concerning to sex and marital status, the results of this study showed that nearly two third of the studied patients were female and married. This study was in same line to **Rouse et al., (2019)** [41] who revealed that two-thirds of the study ankylosing spondylitis patients were females. In contrast to this study **Regnaux et al. (2019)** [39] who reported that most from ankylosing spondylitis were male.

 In addition to Moltó et al. (2015) [42] reported that more than three quarter of patient who are diagnosed with AS were nonsmoker. Also, **Tayel et al. (2018)** [43] showed that nearly half of patients who are diagnosed with AS were secondary educated and nearly three quarter of them were nonsmokers, indicating a socioeconomic variation. In contrast to this study **Moltó et al. (2015)** [42] reported that more than half of patients were highly educated. Also, **Westerveld et al. (2019)** [44] reported that more than half of patients who are diagnosed with AS were smokers.

Regarding to comparison between two studied groups about knowledge of ankylosing spondylitis items: the study results revealed that there was statistically significant difference between studied and control group regarding knowledge about ankylosing spondylitis, studied patients. This result was in the same line with **Srikesavan et al. (2019)** [45] who revealed that lack of knowledge may be due to difficulty in attending to regular exercise program, physical limitations, time constraints that improved post implementation of exercise program. about AS is a barrier to exercise and medication adherence.

In contrast to this study Molto et al (2021) [46] **revealed** that there were limited knowledge and practice on self-efficacy and adherence, regarding to management, exercise program and healthy life style among AS patients which needs to design

educational program. Also, **Ji et al. (2019)** [25] found that the intervention delivery methods of many previous studies relied heavily on face-to-face interactions, which can be difficult due to travel restrictions, time constraints due to any number of factors, and costs of missing work of ankylosing spondylitis patients. **Regarding to comparison between the two studied groups according to bath ankylosing spondylitis disease activity index:** The results of the current study illustrated that, there was non-statistically significant improvement before of the program among two studied group.

Amarnani et al. (2020) [26] agreed with the present study results as they stated that, exercise and rehabilitation intervention program have been found to help patients with AS control their disease activity and preserve or improve their spinal function and physical activity. Also, **Gyurcsik et al. (2013)** [27] claimed that a complex physical therapy regimen for AS patients resulted in comfort and spine tension reduction, as well as changes in many subjective and functional criteria when compared to the baseline assessment.

In contrast to this study **Pedersen et al. (2019)** [30] which was conducted to evaluate responsiveness of the Ankylosing Spondylitis disease activity on patients with axial spondylarthritis treated with tumor necrosis factor and inhibitors and found high responsiveness during treatment with TNFα inhibitors in patients with Spa. **Regarding to comparison between the two studied groups according to bath ankylosing spondylitis disease functional index:** The results of the current study illustrated that, there was no statistically

significant difference between two studied groups.

These results are in the same line with **Gyurcsik et al. (2013)** [27] who reported that the exercise program was conducted for AS patients 12weeks, when the patient assessment of disease activity and pain intensity, BASFI significantly improved after the physical therapy program.

In contrast to this study, **Haroon et al. (2015)** [33] showed that NSAIDs are highly efficacious in reducing stiffness and back pain in AS patients and are recommended as first-line treatment for patients in AS. conducted a retrospective study and discovered that NSAIDs treatment was linked to reduced cardiovascular risk and a decrease in inflammation in AS patients. **Regarding to comparison between the two studied groups according to the numeric pain rating scale:** The results of the current study illustrated that, there was non-statistical significant difference between two studied groups

In this respect, **Bestaş et al. (2022)** [36] mentioned the positive effects of therapeutic exercises on the improvement of pain and function of patients with AS. Also, **Zhao et al. (2020)** [37] reported the significant effects of exercises on the pain reduction in patients with AS.

Correlation between overall knowledge, overall (BASFI), overall (BASDAI) and overall (NPRS) in the study group: The finding of the present study revealed that there was no statistically significant correlation between all items before exposure to therapeutic exercise. These results were in the same line with **Khuman (2018)** [47] who found that the physiotherapy interventions had promising short-term as well as long-term relation without deterioration in AS symptoms

with increased patients' mobility and physical ability. Also, **Seiler et al. (2020)** [48] illustrated that the key purpose of exercise therapy is to prevent patients from stiffening up in a flexed posture and to keep or enhance the functional ability. The long-term goal is to keep the posture in good condition.

Conclusion

The study findings concluded that after two months of performing specific exercise program had a great effect on patients with AS as patient's physical functioning has been improved, patient's difficulty of performing the physical functioning has been decreased, and the patient's spinal column mobility (axial status) has been improved (decreased stiffness) after two months from the implementation of the exercise programs.

Recommendations

-Patients should Applying the specific exercise program on the Ankylosing Spondylitis at different rehabilitation units to improve spinal and joint stiffness.

-Patients should be provided with sufficient information about AS definition, treatment, exercise, benefits and how to perform it.

-Patients should inform about the importance of follow up and its schedule to finish the exercise program.

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