CARDIOPULMONARY FUNCTIONS AMONG YOUNG SMOKERS

ABSTRACT

Background: The effects of cigarette smoking on health is well established. It is a component cause of development of myocardial infarction, stroke, lung cancer, and chronic obstructive pulmonary disease (COPD).

Objectives: The aim of this study was to compare the cardiopulmonary functions of smoking and non-smoking male students in Majmaah University, KSA.

Materials and Methods: Sixty subjects with age range 19-24 years were participate in this study. Evaluate pulmonary functions using Spirometry. Heart rate, respiratory rate and rate of perceived exertion measured for each subject before and after 6-minute walk test.

Results: There is significant difference with p < 0.05 between smoking students and non-smoking students in their FVC, FEV₁, MVV, HR, RR and PRE, which confirm that the smoking students are more susceptible for cardiopulmonary diseases.

Conclusion: This study confirm that cardiopulmonary functions were affected in smoking group in comparison to the non-smoking group.

Keywords: Smoking, cardiopulmonary functions, pulmonary function assessment, Six-minute walk test, Modified Borg scale.
INTRODUCTION
Smoking is a bad habit that increased in Middle East region and considered as one of the most important risk factors for respected cardiovascular/pulmonary morbidity and mortality. It has detrimental effects on both the structure and function of the lung. It is the single most important risk factor for the development of chronic obstructive pulmonary disease. Cigarette smoking is a common cause of the development of myocardial infarction, stroke, lung cancer, and chronic obstructive pulmonary disease (COPD).

Pulmonary function tests (PFTs) have improved from methods for applying pathophysiological studies to clinical tools for the diagnosis, management, and follow-up of cardiopulmonary diseases because they used to provide objective information about the status of an individual's cardiopulmonary system. The VO2 max components, heart rate (HR) and systolic blood pressure (SBP), are important indicators of cardiovascular health and fitness. Lower HR at rest and during exercise is associated with improved physical fitness. Higher values of HR and SBP at rest, as well as their increased variability and response during exercise, are important risk factors and prognostic indicators of cardiovascular disease mortality. Smokers usually exhibit elevated HR and reduced exercise capacity and, thus, lower overall cardiovascular fitness.

Forced Vital Capacity (FVC) is one of the most used tests to assess over all ability to move the air in and out ling. FVC is maximal volume of air exhaled with maximally forced effort after a maximal deep inspiration) and equal approximately 5 liters for adult male. FVC obtained chiefly by strength of respiratory muscles, the airway size and resistance, elasticity of the chest wall and lung parenchyma.

Forced expiratory volume in the first second is (FEV1) is account for the greatest part of the expiratory volume from a Spirometry maneuver and reflects mechanical properties of the large and medium sized airways. In normal flow-volume loop, the FEV1 predicted value is about 75% to 85% of the FVC. This parameter reduced in obstructive and restrictive disorders. In obstructive diseases, FEV1 reduced disproportionally to the FVC, reducing the FEV1/FVC ratio below the lower limit of normal and indicates airflow limitation. In restrictive disorders, the FEV1/FVC, and total lung capacity reduced, The FEV1/FVC ratio is normal or even elevated. Severe respiratory impairment occur when FEV1 is becoming less than 40% of predicted.

Maximum Voluntary Ventilation (MVV) is the maximum air, which can be expired in a minute with maximum fast and deep breathing. Normally equals 80 to 160 L/min for males and 60 to 120 L/min for females. It is affect by presence of lung disease. The patient instructed to breathe as hard and fast as possible for 12 seconds. The results extrapolated to 60 seconds and reported in liters per minute. A low MVV can occur in obstructive disease and used to confirm restrictive pattern of breathing.

METHODS AND MATERIALS
Subject
Thirty male university students with history of smoking and thirty none smoker students aged 19-24 years with similar socioeconomic background randomly sampled from the Majmaah University, Majmaah. Kingdom of Saudi Arabia to conduct this cross-sectional study. Group I (smoking) consists of 30 male students with duration of smoking not less than two years and Group II (Non Smoking) consists of 30 non-smoker male students. This study was conducted in the Cardiopulmonary Lab of the Physical Therapy and Health Rehabilitation Department of The College of Applied Medical Science, Majmaah University. Each subject filled up an informed consent form and a questionnaire to record his personal demographic data. All subjects fulfilling selection criteria informed consent for participating in the research

Inclusion criteria
1. Only Cigarette Smoking.
2. All subjects will be ambulant without assistance.
3. Age range from 19 to 24 years old.
4. Participant's average duration of smoking ranges between 2-5 years.
5. Average body mass index from 20 to 30.

**Exclusion criteria**
1. Any history of allergic or respiratory diseases
2. Severe cardiac diseases
3. Thoracic deformity (scoliosis, kyphosis, hyperlordosis) which can effect on pulmonary function .
4. Severe peripheral arterial disease (intermittent claudication.)
5. Severe neurological deficits (eg. Due multiple sclerosis, epilepsy, stroke)
7. Passive Smoking

**Pulmonary function assessment**
Spirometry assessments undertaken in accordance with standards described by the American Thoracic Society. Standard procedure requires FVC and FEV₁ to be measured from a series of at least three forced expiratory curves consequently, this study required participants to perform three correct maneuvers. Participants completed the Spirometry assessment seated, using a portable spirometer (MIR Spiro bank USB Spirometer, Rome, Italy), with a nose clip attached. Pulmonary function variables included FVC, FEV₁, and MVV. Results expressed as percentages of the predicted value to allow comparison of results across participants. At the end of the test, a detailed report was printed.

Spirometer was used to measure the rate at which the lung volume changes during forced breathing maneuvers. Three clinically useful measurements are obtained from a properly performed Spirometry test. The FVC, FEV₁ and MVV. These measurements compared with average values "predicted" for a subject based on sex, age, height, and race.

**Six-minute walk test (6MWT)**

The 6MWT performed using the methodology specified by the American Thoracic Society (ATS-2002). The patients instructed that the objective was to walk as far as possible during 6 minutes. The 6MWT performed in a flat, long, covered corridor, which was 30 meters long, meter-by-meter marked. Heart rate, oxygen saturation and modified Borg scale assessing subjectively the degree of dyspnea graded from 0 to 10, were collected at the beginning and at the end of the 6MWT. When the test was finished, the distance covered was calculated.

**Modified Borg scale**
This modified 12-point scale consists (0, 0.5, 1–10) corresponds with increasing shortness of breath. It starts at number 0 where your breathing is causing you no difficulty at all and progresses through to number 10 where your breathing difficulty is maximal. Patients were asked to mark the most appropriate description or number of their shortness of breath at rest and after 6 Minute walk test.

**Statistical analysis**
Data was collected and tabulated, SPSS 21 software was used to describe the demographic, baseline and post line value using means and SDs for all variables and Significant changes within group were analyzed with Paired t Test. An overall significance level accepted at p-value < 0.05.

**RESULTS**
The data concerning the students’ Age, Weight, Height, Body mass index (BMI), and duration of smoking collected at the start of the study. The hemodynamic variables including heart rate (HR), respiratory rate (RR) and rate of perceived exertion (RPE), and data related to pulmonary function tests; forced vital capacity
Table (1): Descriptive Statistics of participants BMI.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>GROUP</th>
<th>X</th>
<th>SD</th>
<th>DF</th>
<th>T-value</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>SOMK</td>
<td>1.7736</td>
<td>.04765</td>
<td>27</td>
<td>.963</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>NON SOMK</td>
<td>1.7567</td>
<td>.04685</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>SOMK</td>
<td>80.43</td>
<td>10.92</td>
<td>27</td>
<td>.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NON SOMK</td>
<td>79.47</td>
<td>7.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>SOMK</td>
<td>25.4571</td>
<td>3.01298</td>
<td>27</td>
<td>.800</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NON SOMK</td>
<td>26.2667</td>
<td>2.42477</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WC</td>
<td>SOMK</td>
<td>85.9286</td>
<td>7.47781</td>
<td>27</td>
<td>1.811</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NON SOMK</td>
<td>81.6667</td>
<td>5.03795</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHR</td>
<td>SOMK</td>
<td>.8457</td>
<td>.05273</td>
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<td>.164</td>
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<tr>
<td></td>
<td>NON SOMK</td>
<td>.8487</td>
<td>.04406</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

X=Mean, SD=Standard deviation, MD=Mean difference, Sig. =Significant, BMI=body mass index, WC=waist circumference, WHR=waist-hip ratio, # = Non –Significant

I. Patients’ demographic data
As noticed from table (1), the mean value of subject’s age for group I was (22.3±1.3), with maximum value of 24 years old and minimum value of 19 years old and the mean value of subjects’ age for group II was (22.73±1.9), with maximum value of 24 years old and minimum value of 19 years old. The mean duration for smoking was (3.6 ± 1.2 years), with maximum value of 5 years and minimum values of two years.

II. Hemodynamic variables

Heart Rate (HR):-
Group I: The mean value of HR measured before six-minute test was (74±3 bpm). The maximum value was (79 bpm), and the minimum value was (70bpm), while after test the mean value of HR was (108±8 bpm). The maximum value was (128bpm), and the minimum value was (99 bpm).

The mean values of HR revealed that there is a significant (P<0.05) changes in HR after test. The reported ratio of changes in HR was 11.86 % at the end of treatment as observed in table (2) and fig (1).

Group II: the mean value of HR measured before six-minute test was (89±3bpm). The maximum value was (75 bpm), and the minimum value was (69 bpm), while after test the mean value of HR was (89±3 bpm). The maximum value was (95 bpm), and the minimum value was (84 bpm). The mean values of HR revealed that there is a significant (P<0.05) changes in HR after test. The reported ratio of changes in HR was 11.86 % at the end of treatment as observed in table (2) and fig (1).

Respiratory Rate (RR):-
Group I: the mean value of RR measured before six-minute walk test was (17.74±2.74bpm). The maximum value was (20bpm), and minimum
value was (13 bpm), while after test the mean value of RR, was (14.65±1.13 bpm). The of RR revealed that there is a significant (P<0.05) decreased in RR than before treatment, as observed in table (2) and fig (1).

Group II: the mean value of RR measured before six minute walk test was (17.74±2.74 bpm). The maximum value was (16 bpm), and minimum value was (13 bpm), while after test the mean maximum value was (30 bpm), and minimum value was (24 bpm). The mean values value of RR, was (22.65±2 bpm). The maximum value was (25 bpm), and minimum value was (19 bpm). The mean values of RR revealed that there is a significant (P<0.05) decreased in RR than before treatment. As observed in table (2) and fig (1).

**Table (2):** Descriptive Statistics of Heart Rate and Respiratory Rate before and after test.

<table>
<thead>
<tr>
<th>Variables</th>
<th>GROUP</th>
<th>X</th>
<th>SD</th>
<th>df</th>
<th>T-value</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR_{rest}</td>
<td>SOMK</td>
<td>74.1429</td>
<td>2.76954</td>
<td>27</td>
<td>3.159</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>NON SOMK</td>
<td>71.5333</td>
<td>1.55226</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR_{after}</td>
<td>SOMK</td>
<td>108.6429</td>
<td>7.88969</td>
<td>27</td>
<td>9.105</td>
<td>*</td>
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<tr>
<td></td>
<td>NON SOMK</td>
<td>88.9333</td>
<td>2.76371</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RR_{rest}</td>
<td>SOMK</td>
<td>15.6429</td>
<td>1.94569</td>
<td>27</td>
<td>2.315</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>NON SOMK</td>
<td>14.3333</td>
<td>.97590</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RR_{after}</td>
<td>SOMK</td>
<td>26.5714</td>
<td>1.86936</td>
<td>27</td>
<td>6.252</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>NON SOMK</td>
<td>22.4000</td>
<td>1.72378</td>
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</tr>
<tr>
<td>RPE</td>
<td>SOMK</td>
<td>.6429</td>
<td>.53452</td>
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<td>1.760</td>
<td>*</td>
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<tr>
<td></td>
<td>NON SOMK</td>
<td>.3333</td>
<td>.40825</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

X=Mean, SD=Standard deviation HR= heart rate, RR= respiratory rate, RPE= rate of perceived exertion, * = Significant, # = Non –Significant

**FIGURE (1):** results of participant’ demographic data, hemodynamic variables and
Pulmonary function test of the participants in the study.

III. Results of pulmonary function test

Forced Vital Capacity (FVC):

Group I: the mean values of FVC (percentage predicated) was (78.14±5.4), with maximum value of 88 and minimum value of 69, while in Group II: it was (101.33±8.7), with maximum and minimum value of 118 and 78 respectively. The mean values of FVC (percentage predicated) revealed that there is a significant (P<0.05) increased in FVC for group II than group I. as observed in the table (3), and fig (1).

### Table (3): Descriptive Statistics of FVC for both groups group

<table>
<thead>
<tr>
<th>Variables</th>
<th>FVC (%) Smoking</th>
<th>FVC (%) Non-smoking</th>
</tr>
</thead>
<tbody>
<tr>
<td>X±SD</td>
<td>78.14±5.4</td>
<td>101.33±8.7</td>
</tr>
<tr>
<td>Maximum</td>
<td>88</td>
<td>118</td>
</tr>
<tr>
<td>Minimum</td>
<td>69</td>
<td>87</td>
</tr>
<tr>
<td>MD</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>T-value</td>
<td>-8.542</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Significance</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

X=Mean, SD=Standard deviation, MD=Mean difference, FVC=Forced vital capacity, P-value =Probability level, * =Significant.

Forced expiratory volume in first second (FEV\(_1\)):

Group I: (smoking group) the mean values of FEV\(_1\) (percentage predicated) was (77.14±3.48), with maximum and minimum value of 82 and 69, while group II was (101.33±8.7), (% predicated), with reported maximum value of 96 and minimum value of 88 respectively. The mean values of FEV\(_1\) (% predicated) revealed that there is significance (P<0.05) increase in FEV\(_1\) in group II than group I. as observed in the table (4), and fig (1).

### Table (4): Descriptive Statistics of FEV\(_1\) in group I and group II

<table>
<thead>
<tr>
<th>Variables</th>
<th>FEV(_1) (%) predicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>77.14±3.48</td>
</tr>
<tr>
<td>Non-smoking</td>
<td>90.4±6.55</td>
</tr>
<tr>
<td>X±SD</td>
<td>82</td>
</tr>
<tr>
<td>Maximum</td>
<td>96</td>
</tr>
<tr>
<td>Minimum</td>
<td>88</td>
</tr>
<tr>
<td>MD</td>
<td>27</td>
</tr>
<tr>
<td>T-value</td>
<td>6.73</td>
</tr>
<tr>
<td>P-value</td>
<td>0.00</td>
</tr>
<tr>
<td>Significance</td>
<td>*</td>
</tr>
</tbody>
</table>

X=Mean, SD=Standard deviation, MD=Mean difference, FEV\(_1\)= forced expiratory volume at first second, P-value =Probability level, * =Significant.

Maximum voluntary ventilation (MVV):-

Group I (smoking group) the mean values of MVV (percentage predicated) was (78.14±5.4), with maximum and minimum value of 81 and 43, while in group II (non-smoking group) it was (101.33±8.7), (% predicated), with reported maximum value of 126 and minimum value of 82 respectively. The mean values of MVV (% predicated) revealed that there is significance (P<0.05) increase in MVV in group II than group I. as observed in the table (5), and fig (1).
Table (5): Descriptive Statistics of MVV in group I and group II

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>GROUP</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>df</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVC</td>
<td>SOMK</td>
<td>78.1429</td>
<td>5.40452</td>
<td>27</td>
<td>-8.542</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>NON SOMK</td>
<td>101.3333</td>
<td>8.70687</td>
<td></td>
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</tr>
<tr>
<td>FEV\textsubscript{1}</td>
<td>SOMK</td>
<td>77.1429</td>
<td>3.48308</td>
<td>27</td>
<td>-6.727</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>NON SOMK</td>
<td>90.4000</td>
<td>6.55526</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MVV</td>
<td>SOMK</td>
<td>74.5714</td>
<td>9.67721</td>
<td>27</td>
<td>-6.385</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>NON SOMK</td>
<td>100.6000</td>
<td>12.04634</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

FVC=Forced vital capacity, FEV\textsubscript{1}= forced expiratory volume at first second, MVV= maximum voluntary ventilation, *= Significant

DISCUSSION
This study designed to evaluate the cardiopulmonary functions among smoking and non-smoking male university students in KSA. By testing the ventilation function (FVC, FEV\textsubscript{1} and MVV), exercise capacity (HR, RR and RPE) this through comparing (smoking group) values with that of the (non-smoking group) values. Smoking is one of the most common cause of obstructive lung diseases. Cigarette smoking induced subclinical early inflammatory changes occur in the large airways as well as to the periphery of the bronchial tree at the small to middle airways\textsuperscript{17}

The epithelial reaction in the small airways with thickening of the bronchial walls occurs independently from similar reactions in the larger airways thereby reducing the bronchial lumen greater than in the large airways.\textsuperscript{18,19} Few studies conduct to show the effects of smoking in Sudayr Region KSA, although there is many studies discussed the effect of smoking effects in other countries. The customs and traditions in Sudayr Region put restriction on smoking in public places so the dangerous of passive smoking is lower than other countries, and give more bad effect of smoking as smoker subjects have to sit in small and closed places hiding from others to smoke. The results of the current study revealed that there was significant (P<0.05) difference in the mean values of forced vital capacity, forced expiratory volume in first second, maximum voluntary ventilation, heart rate and respiratory rate. Our results reported value of forced expiratory volume in first second in this study were in agreement with the finding of Meo et al.,(2014)\textsuperscript{19} who reported mean values of FEV\textsubscript{1}= 3.8±0.12 L in smoking group while in non-smoking group FEV\textsubscript{1}= 4.49±0.073 L with significant difference equal to p value = 0.001. In a study for 57 adult male smokers from South Africa, it found that FVC and FEV\textsubscript{1} decreased in both conventional cigarettes and electrically heated cigarette-smoking system smoking in related to non-smoking subjects.\textsuperscript{20} Another study conducted in Izmir-Turkia The total number of participants was 397. All were males with Mean +SD value of ages was 50+14 years. The results showed that cigarette smoking decreased all PFT parameters except FVC compared with values in non-smokers. Cigarette smoking is the primary risk factor for chronic obstructive pulmonary disease and the Spirometry method used in this study is a standard test for determination of airway obstruction. FEV\textsubscript{1}, FVC and FEV\textsubscript{1}/FVC define airway obstruction.\textsuperscript{21,22,23} Zahran and Baig (1982)\textsuperscript{24} explained the significant decrease in FEV\textsubscript{1}/FVC percentage and MMEF of cigarette and water pipe smokers as a result of partial obstruction of the small airways. Although the mean FVC has been slightly higher in water-pipe smokers than in cigarette smokers, the study sample was not large enough to make precise comments \textsuperscript{24} The thoracic gas volume tended to be the highest while the subjects assigned to smoking conventional cigarettes possibly reflecting trapped air. Since cigarette smoking has been
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reported to induce inflammation. It seems likely that the associated processes such as inflammatory-cell infiltration, goblet- and squamous-cell metaplasia, and swelling of the epithelium along with enhanced production of mucus rich in neutrophils may lead to complete obstruction of small peripheral airways with the ensuing impaired ventilation. Cigarette smoking induced subclinical early inflammatory changes occur not only in the larger airways, but to a considerable extent in the periphery of the bronchial tree (particle deposition in the centers of the acini) and, thus, within the small to midsize airways.

Koubaa et al., (2015) Studies the pulmonary function of a total of 35 sedentary smokers and non-smokers with average age, 44.79±4.5 years; and found that the mean Spirometry values of smokers were lower than of those non-smokers. Also, at least 15% of cigarette smokers reported to develop COPD as reflected mainly by the reduction of the forced expiratory volume (FEV1). Changes of FEV1, predominantly effect on mid-size and larger airways.

CONCLUSION
From these results, we can conclude that cardiopulmonary functions hampered in smoking group when compared to the non-smoking group.

CONFLICTS OF INTEREST
Authors declared that there is No conflicts of interest

REFERENCES


24. Zahran FM and Baig MHA. Long term effects of shisha and cigarette smoking on respiratory system in


27. Abdessalem Koubaa, Moez Triki, Hajer Trabelsi, Liwa Masmoudi, Khaled N. Zeghal1, Zouhair Sahnoun and Ahmed Hakim: Lung function profiles and aerobic capacity of adult
Effect of laser acupuncture in mild benign hypertensive female patients

Mohamed K. Seyam, Ghada M. Shawky

Abstract

Background: Recent studies have found that acupuncture treatments lower blood pressure. Acupuncture is a traditional Chinese medical technique of inserting needles at particular points on the body to balance the opposing forces of yin and yang and the smooth flow of qi. Laser acupoint technique is considered as saving time because it is performed in less time than needles acupuncture.

Purpose: The aim of this study was to study the effect of laser acupuncture on lowering the primary type of hypertension in old female adults.

Materials and Methods: Thirty female mild hypertensive patients with ranged age 50-59 years were enrolled in the study. Systolic and diastolic blood pressure evaluated by Mercury sphygmomanometer. Baseline blood pressure measured for each subject prior to the initiation of the treatment and after enrolled in the treatment program. The anthropometric data including age, duration of hypertension, height, weight and body mass index (BMI) was collected for both experimental and six weeks control groups.

Results: after treating hypertension patients by the laser acupuncture for 6 weeks (twice per week session), both the systolic blood pressure (SBP) and diastolic blood pressure (DBP) decreased significantly (P < .01). The mean SBP in experimental group (Group I) was 155.9 ± 4.33 mm Hg before the treatment and was reduced to 134.1 ± 2.33 mm Hg (P < .001) after treatment. While the mean SBP in control group (Group II) was 156.2 ± 3.88 mm Hg before the treatment and was reduced to 152.9 ± 2.85 mm Hg (P < .002) after treatment. The mean DBP in Group I was 91.5 ± 2.55 mm Hg before treatment and was reduced to 82.6 ± 2.12 mm Hg (P < .001), While the mean DBP in Group II was 91.1 ± 2.85 mm Hg before the treatment and was reduced to 89.2 ± 2.1 mm Hg (P < .002) after treatment.

Conclusion: we concluded that low-level laser acupuncture treatment resulted in lower blood pressure by stimulating these points LI 4 LI 11, Sp 6 and P 6

Keywords: laser, acupuncture and hypertension.
INTRODUCTION

Hypertension is considered as main risk factor for coronary artery disease and stroke.\textsuperscript{1} Traditional treatment for hypertension includes sodium restriction, pharmacologic management and lifestyle modifications such as stress management and exercise.\textsuperscript{2} As most of these methods of treatment are generally need permanent lifestyle modifications. Thus, poor patient compliance is common. Also the side effects of antihypertensive medication that include fatigue, electrolyte imbalance, and impotence, which often result in patient intolerance.\textsuperscript{3}

Primary hypertension affects up to one billion individuals worldwide and is attributable each year for more than 7 million deaths and loss of 64 million disability-adjusted life years. Hypertension still a major public health challenge in both developed and developing countries despite all the progress in prevention and management of hypertension.\textsuperscript{4}

LASER is an acronym for ‘light amplification by stimulated emission of radiation’ is a form of electromagnetic radiation. High coherence, monochromaticity and polarization are the basic physical properties of laser.\textsuperscript{5,6} Low-intensity-level laser (LLL) has potency ranging from 1 to 100 mW and has been used for therapeutic purposes without major damage of the tissues.\textsuperscript{7} Its effects are considered to be associated with biostimulation or biomodulation of the synthesis of DNA, RNA and proteins, as well as the release of anti-inflammatory factors.\textsuperscript{8}

Low intensity level laser therapy at low energy has been utilized to treat some diseases due to the biostimulative effect of this electromagnetic radiation.\textsuperscript{9} In laser acupoint treatment, the wavelengths of the laser used are usually between 405 nm and 904 nm, laser acupoint has been used to treat various clinical conditions, such as blood pressure and body weight.\textsuperscript{10}

The acupoint laser technique benefits include that it is not invasive technique and is suitable for patients who have fear of needles. Moreover, it is tolerable for children. In contrast to needles technique there are low risks of local bleeding and infections such as myositis and cellulitis.\textsuperscript{11} Laser acupoint technique is considers as saving time because it is performed in less time than needles acupuncture.\textsuperscript{12}

Acupuncture is a traditional Chinese medical technique of inserting needles at particular points on the body to balance the opposing forces of yin and yang and the smooth flow of qi.\textsuperscript{13} Recent studies have found that acupuncture treatments lower blood pressure.\textsuperscript{14-16} The mechanism of acupuncture that lowers blood pressure is not clear, but it is believed that acupuncture works to alter central nervous system neurotransmitter activities by stimulating acupoints.

Cold laser or soft laser is a laser devices for medical uses were fabricated in particular manner in which both power and energy densities of laser were lowered to the limit of no photo-thermal effects occurred; but the photo-osmotic, photo-ionic and photo-enzymatic effects of LASER were still operative. The modern laser devices are designed with infrared wavelength combined with high-frequency pulses that allow the photons to penetrate deep into tissue without heat effect.\textsuperscript{2}

Few studies have used laser to treat acupuncture point for clinical conditions. By using the database of searching in the website of PubMed on 1 August 2016 found 791 publications with the keyword ‘laser
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acupuncture’ and 25,036 publications with the keyword ‘acupuncture’.
This indicates that it is necessary to increase the investigations of laser acupoint using different experimental models.
Considering the limited number of publications in the PubMed database with investigations in laser acupuncture, and due to the importance of this technique in children and patients with the fear of needles, the aim of this study was to analyze the effect of the exposure to the laser with a wavelength of 560 nm in the acupoint (LI 4, LI 11, Sp 6 and P 6) on lowering the systolic and diastolic blood pressure.
The main aims of the study were to test the effectiveness of laser acupuncture on specific acupuncture points LI 4, LI 11, Sp 6 and P 6 on both systolic and diastolic blood pressure. The hypothesis was that the stimulation of a pattern of acupoints with the laser was effective in reducing blood pressure. This research is designed to study the effects of laser acupuncture on blood pressure by stimulating certain acupuncture points and meridians on nursing staff members in national heart institute.

Research Design and Methods

Subject characteristics:
30-hypertensive female with blood pressure stage I (mild) systolic 140-159 mm Hg and diastolic 90-99 mm Hg was participated in this study. They were randomly selected from the nursing stuff at national heart institute in Cairo. Their ages Ranged from 50-59 years. The study was conducted to investigate the effect of laser acupuncture in hypertension women. We took informed consent form participated women after description of the procedure had been explained and they understood that they might withdraw their consent and discontinue participation in this research at any time without prejudice to me.

The participants were divided randomly into 2 equal groups. Experimental group received laser acupuncture therapy (group I) and Control group received placebo treatment (group II).

Inclusion criteria:
1) All participants age was ranged from 50 to 59 years old.
2) The systolic blood pressure was ranged from 140-159 mm Hg
3) The diastolic blood pressure was ranged from 90-99 mm Hg
4) All participants had primary hypertension.
5) The duration of hypertension not less than five years.
6) They took their dose of anti-hypertensive drugs.
7) They were stable clinically and medically.
8) All participants BMI were ranged from 30 to 34.9.

Exclusion criteria:
1) Patients had systolic blood pressure more than 159 mm hg and
2) Patients had diastolic blood pressure more than 99 mm hg.
3) Patients had metabolic disease.
4) Patients who suffered from mental or psychological disorders.
5) Patients with secondary hypertension.
6) Smoking Patients.
Each subject signed informed consent form before participate in this study.

**Study description**

**Evaluative equipment:**

A) Weight and height scale:

The scale was national made 7031 with max weight 160 kg and max height 2 meters to measure BMI (Body Mass Index) which is the most commonly used indicator of obesity and is determined from height and weight. In this trial (weight in kg) per height in m².

B) Mercury sphygmomanometer:

It was desk model CE 0123 made in Germany. It was used to measure the systolic and diastolic blood pressure before and after each session and the end of the study.

**Therapeutic equipment’s:**

**Laser**

The parameters of laser equipment:

The laser unit was a small hand held machine ga AS laser, class 3 B laser. It manufactured by gymna. Model combi 2000 made in Brazil.. Selo de garantia atencao. Lasermed 650 nm. Main supply 100-230v. Frequency 50-60 Hz. Power consumption 30 va. Fuses: 1.0-250v. The machine offers two types of laser therapy (continuous and pulsed). Continuous laser therapy is of a common use and many studies had found it effective. In this study 10 mw probe was used and connected, wave length 905 nm wave length and energy density 2J session beam diameter was 4mm.
Procedure:

(A) Evaluation procedures:
1- Measurement of weight and height
   Every patient was asked to get out her shoes and let out the heavy clothes; the readings were taken before the program.
   The BMI was calculated according to the following equation, the body weight (kg) divided by the height (m²) to exclude patient out of class one obesity:
   \[ \text{BMI} = \frac{\text{weight (kg)}}{\text{height (m}^2)} \]
2- The measurement of blood pressure was obtained according to the following steps before and after six weeks of the study: The auscultator method of blood pressure measurement with a properly calibrated and validated instrument was used. The subject was asked to relax and not perform any physical activity before the measurement for 3 minutes; patients was seated quietly in a chair rather than on an examination table, an appropriate-sized cuff encircling at least was used around her left arm from sitting position.
   The sphygmomanometer was placed on table beside the sitter at the level of subject.
   - Blood pressure was evaluated before and after six weeks of treatment. The blood pressure reading was taken twice during date collection, and the average was used for data analysis.
   - Precautions to obtain correct blood pressure reading: the ideal way to measure blood pressure through¹⁷:
     1. Choose the correct cuff size.
     2. Avoid placing the cuff over clothes.
     3. Arm must be at heart level.
     4. Patient should rest quietly for 3-5 minutes before measurement in a quiet room with comfortable temperature.
     5. Avoid talking during measurement.
     6. No caffeine or cigarette smoking at least 1 hour before procedure.
     7. Bladder should be evacuated carefully.
     8. Do not deflate the cuff too quickly (2 mm Hg/beat).
     9. Do not re-inflate the cuff to repeat measurements before it has fully deflated.
    10. Take more than one measurement and have the mean value.
    11. If there is a difference of more than 10 mmHg between two measurements

(B) Therapeutic procedure
   Group I:
   Patients were received laser acupoint sessions twice weekly for 6 weeks, the patients were putted in a comfortable long sitting position. Laser was applied three minutes for each point by two rotation of the points, each rotation for 90 seconds.
   - Patient preparation
     1. The patient was bare skin.
     2. The sites of acupuncture points were cleaned by alcohol.
     3. The points were detected firstly by tape measurement or fingers.
     4. The patients and the therapist were protective glasses.
   - Laser apparatus operation
     1. The apparatus was turned on.
     2. The time adjusted at 90 sec for each point.
     3. Total session time is 12 min.
     4. The power was adjusted automatically.
     5. The head was applied perpendicular at each point then pressed the start button.
Laser – acupuncture points are:

1- (LI 4) Large Intestine 4
Location: It is situated in the web between the forefinger and the thumb on the posterior aspect of the hand and may be located when the forefinger and the thumb are adducted at the highest point of the muscles on the back of the hand.

2- (LI 11) Large Intestine 11
Location: At the outer end of the elbow crease when the elbow is semi flexed.

3- (Sp 6) Spleen 6 Location:
3 cun (It is Chinese inch which equal to width of thumb across the inter phalangeal joint. Two cun equal the width of middle three fingers) directly above the tip of the medial malleolus, on the medial border of the tibia.
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forearm in between the two tendons. To find and use this acupressure point, (1) locate the point by turning your hands over so the palm is facing up then (2) apply downward pressure between the two tendons, massaging and stimulating the area for 4-5 seconds.

Figure (4) Location of pericardium 6 point.

Group (II):

Control group.
Participants will take placebo treatment of LASER with their regular anti-hypertensive medications.

Statistical design and data analysis:
Descriptive statistics and paired t test to compare the changes will take place (pre and post treatment) with treatment group. Compare between the two group by unpaired student t test.
All variables will be expressed as well, standard deviation and the accepted level of statistically significant difference will be at $p$ value less than 0.05.

Results

Thirty hypertension patients participated in this study. They were divided into two groups. Group I (experimental group) consists of fifteen patients and group II (control group) consists of fifteen patients, with duration of hypertension not less than five year, they have been selected from nursing stuff at national heart institute in Cairo. The data concerning the students’ age, duration of hypertension, weight, height, body mass index (BMI) had been collected at the start of the study. The hemodynamic variables including systolic blood pressure and diastolic blood pressure had been measured, before and after acupoint laser treatment. The recorded data from twenty patients who completed the procedure of the study have been collected; statistically analyzed, descriptive statistics and paired t test to compare the changes would take place (pre and post treatment) within each group. Compare between the two groups by unpaired student t test (for comparing post treatment result of both groups). All variables would be expressed as well, standard deviation and the accepted level of statistically significant differences would be value less than 0.05.
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Table (1): Demographic and Clinical characteristics of participants at the start of the study.
X=Mean, SD=Standard deviation, \( t \)= t test, \( p \)= probability value, NS= not significant

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Group</th>
<th>X</th>
<th>SD</th>
<th>( t )</th>
<th>( p )</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>Group I</td>
<td>52.4</td>
<td>2.07</td>
<td>0.10</td>
<td>0.92</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>52.3</td>
<td>2.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (Kilogram)</td>
<td>Group I</td>
<td>90.7</td>
<td>2.00</td>
<td>-0.32</td>
<td>0.76</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>90.9</td>
<td>2.18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (Meter)</td>
<td>Group I</td>
<td>162.9</td>
<td>2.81</td>
<td>-0.20</td>
<td>0.85</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>163.1</td>
<td>2.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Mass Index(BMI) (Kg/m²)</td>
<td>Group I</td>
<td>34.21</td>
<td>1.62</td>
<td>0.03</td>
<td>0.98</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>34.2</td>
<td>1.31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of hypertension</td>
<td>Group I</td>
<td>7.4</td>
<td>1.8</td>
<td>0.09</td>
<td>1.04</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Group II</td>
<td>7.2</td>
<td>1.7</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

l-Patients’ demographic data: group I was (52.4±2.07), with maximum value of 58 years old and minimum value of 50 years old and the mean value of patient’s age for group II was (52.3±2.00), with maximum value of 59 years old and minimum value of 51 years old. The mean duration of hypertension for group I was (7.4 ± 1.8 years), with maximum value of 10 years and minimum values of five years, and the mean duration of hypertension for group II was (7.2 ± 1.7 years), with maximum value of 9 years and minimum values of five years. As noticed from table (1) and figure (5) the mean value of patient’s age for both group

Fig. (5): Anthropometric data of participants at the start of the study
II- Hemodynamic variables:

Systolic Blood Pressure (SBP): The mean value of SBP measured before treatment for group I was (155.90±4.33mmhg) and for group II was (156.20±3.88mmhg). The mean values of SBP revealed that there is a significant (P<0.05) changes in SBP after treatment.

Table (2): The pre and post blood pressure data the mean and stander deviation for both groups I and II

<table>
<thead>
<tr>
<th>Blood pressure data</th>
<th>X</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I Systolic blood pressure (Pre)</td>
<td>155.90</td>
<td>4.33</td>
</tr>
<tr>
<td>Group I diastolic blood pressure (Pre)</td>
<td>91.50</td>
<td>2.55</td>
</tr>
<tr>
<td>Group I Systolic blood pressure (Post)</td>
<td>134.10</td>
<td>2.33</td>
</tr>
<tr>
<td>Group I diastolic blood pressure (Post)</td>
<td>82.60</td>
<td>2.12</td>
</tr>
<tr>
<td>Group II Systolic blood pressure (Pre)</td>
<td>156.20</td>
<td>3.88</td>
</tr>
<tr>
<td>Group II diastolic blood pressure (Pre)</td>
<td>91.10</td>
<td>2.85</td>
</tr>
<tr>
<td>Group II Systolic blood pressure (Post)</td>
<td>152.90</td>
<td>2.85</td>
</tr>
<tr>
<td>Group II diastolic blood pressure (Post)</td>
<td>89.20</td>
<td>2.10</td>
</tr>
</tbody>
</table>

Table (3): The pre and post blood pressure data the $t$ and $p$ values and significance for both groups I and II

<table>
<thead>
<tr>
<th>Paired Samples Test</th>
<th>$t$</th>
<th>$p$</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp Systol Pre - Exp Systol Post</td>
<td>15.975</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Exp Diastol Pre - Exp Diastol Post</td>
<td>12.329</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Con Systol Pre - Con Systol Post</td>
<td>4.423</td>
<td>.002</td>
<td>S</td>
</tr>
<tr>
<td>Con Diastol Pre - Con Diastol Post</td>
<td>3.943</td>
<td>.003</td>
<td>S</td>
</tr>
<tr>
<td>Exp Systol Pre - Con Systol Pre</td>
<td>-.176</td>
<td>.864</td>
<td>NS</td>
</tr>
<tr>
<td>Exp Diastol Pre - Con Diastol Pre</td>
<td>.303</td>
<td>.768</td>
<td>NS</td>
</tr>
<tr>
<td>Exp Systol Post - Con Systol Post</td>
<td>-15.789</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Exp Diastol Post - Con Diastol Post</td>
<td>-9.000</td>
<td>.000</td>
<td>S</td>
</tr>
</tbody>
</table>

Table (4): The pre and post systolic and diastolic blood pressure intra groups I and II

<table>
<thead>
<tr>
<th>GROUP</th>
<th>X</th>
<th>SD</th>
<th>$T$</th>
<th>$p$</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP pre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>155.90</td>
<td>4.33</td>
<td>-1.176</td>
<td>.864</td>
<td>NS</td>
</tr>
<tr>
<td>Group II</td>
<td>156.20</td>
<td>3.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBP post</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>134.10</td>
<td>2.33</td>
<td>-15.789</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Group II</td>
<td>152.90</td>
<td>2.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DBP pre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>91.50</td>
<td>2.55</td>
<td>.303</td>
<td>.768</td>
<td>NS</td>
</tr>
<tr>
<td>Group II</td>
<td>91.10</td>
<td>2.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DBP post</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group I</td>
<td>82.60</td>
<td>2.12</td>
<td>-9.000</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Group II</td>
<td>89.20</td>
<td>2.10</td>
<td></td>
<td></td>
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</tbody>
</table>
Discussion

This study was designed to evaluate the efficacy of laser acupuncture on both systolic and diastolic blood pressure (SBP and DBP), this through comparing (Pre-treatment) values with that of the (Post-Treatment) in both groups (Group I & II) after 6 weeks of laser acupoint stimulation for the points (LI 4, LI 11, Sp 6 and P 6 ) in patients with mild hypertension.

The results of the current study revealed that there was significant (P<0.05) decrease in the mean values of SBP in the experimental group which was changed from (155.90±4.33 mmHg), to (134.10±2.33mmHg) with mean percentage of improvement equal to (13.98 %).

While the results of the current study revealed that there was significant (P<0.05) decrease in the mean values of SBP in the control group which was changed from (156.20±3.88mmHg), to (152.90±2.85mmHg) with mean percentage of improvement equal to (2.11 %), however this still lie within hypertension range.

The results of the current study revealed that there were significant (P<0.05) decrease in the mean value of DBP in the control group which was changed from (91.50±2.55mmHg) to (82.60±2.12mmHg), with mean percentage of improvement equal to (9.73 %).

The results of the current study revealed that there were significant (P<0.05) decrease in the mean value of DBP in the experimental group which was changed from (91.10±2.85mmHg) to (89.20±2.10mmHg), with mean percentage of improvement equal to (2.1 %).

The results of our study confirmed with results of Zhang et al., (2008) who found After the 12 laser treatment sessions twice a week for 45 patients with average age of the subjects was 25 ± 5 years old. The youngest subject was 20 years old, and the oldest was 56 years old, both the systolic and diastolic blood pressures decreased significantly. The mean systolic blood pressure was 129.6 ± 14.7 mm Hg before the treatment started and was reduced to 122.9 ± 15.2 mm Hg (P < .001).

These results of our study were supported by the work of Hong et al., who found that the blood pressure decreased significantly after treatment in group A and group B (all P<0.01), and the decrease in systolic blood pressure was more significant in group A (P < 0.05). The total effective rate was 90.5 / (38/42) in group A, which was superior to 71. 4 (30/420) (P < 0.05) in group B and 19.1% (18/34) (P<0. 01) in group C. They concluded that the clinical effect of multi-mode audio frequency pulse photoelectric therapeutic apparatus for treatment of grade I essential hypertension is reliable. Meanwhile, it has the advantages of a non-invasive and simple operation.

Zhang et al., describes the regular use of acupuncture treatments for a patient with hypertension who could not tolerate the side effects of the antihypertensive agents. The patient received 60 acupuncture treatments in the course of 12 weeks, during which time his overall wellbeing improved, his blood pressure reduced and the
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side effects of antihypertensive drugs were removed. Although acupuncture plus the drug appeared to have a substantial synergistic effect that was weakened when the drug was discontinued, acupuncture may still play a role in the management of hypertension, especially for patients who cannot tolerate the side effects of antihypertensive agents.19

Çevik et al., demonstrated significant reduction (p <001) in both systolic (from 163.14 ± 19.33 to 129.49 ± 18.52) and diastolic (from 94.37 ± 19.70 to 79.31 ± 7.87) blood pressures of 24 male and 10 female patients. Ki 3 (Taixi), Liv 3 (Taichong), Sp 9 (Yinlingquan), L.I. 4 (Hegu), Ht 7 (Shenmen), St 36 (Zusanli), Sp 6 (Sanyinjiao), Ki 7 (Fulio), Lu 9 acupuncture points were needled. After being treated with acupuncture for one month in every two days for a total of 15 sessions, they found significant reductions in both systolic and diastolic blood pressure and they concluded that acupuncture should be in the hypertension treatment guidelines and widely used for blood pressure regulation.20

On other hand Brien et al., found that laser acupuncture stimulation does not affect the symptoms of hypertension.21

The work of Macklin, who found that acupuncture laser are unlikely to achieve clinically meaningful reduction in systolic blood pressure or diastolic blood pressure for the average patient with mild to moderate hypertension22.

Conclusion

In conclusion, although further investigations are needed to clarify the mechanism by which the Laser acupuncture acts, it is possible to conclude that the Laser acupuncture treatment lead to reduction of both systolic and diastolic blood pressure.

Conflict of Interest: No conflict of interest

References


5. Litscher G and Opitz G. Technical parameters for laser acupuncture to elicit peripheral and central effects: state of the art and short guidelines based on results from the Medical University of Graz, the German Academy of Acupuncture, and the scientific literature. Evid Based Complement Alternat Med 2012; 697096.


20. Çevik, Cemal; İşeri, Sevgin Özlem. The Effect of Acupuncture on High Blood Pressure of Patients Using
laser acupuncture in mild benign hypertensive


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Letter to Editor

Practice of culturally validated questionnaires in health-care centers in Saudi Arabia

Sir,

It is well known about the importance of psychometric analysis of patient impairments as a part of symptom evaluation. Psychometric evaluation provides the complete and comprehensive data about patient suffering about the stage-wise chronicity of the disease. Generally, practitioners do evaluate based on their physical examination and other investigations and expect the outcomes. Many health centers ignore to evaluate their functional levels of impairments which are considered to be more valuable. Culturally validated questionnaires measure in-depth functional suffering by the patients as well for better outcomes. Questionnaires also measure comprehensive patient outcomes that are helpful for a practitioner to plan segmental interventions periodically to prevent the insidious development of disabilities.

There is a need of documentation of such obtained data using culturally validated questionnaires to improve the quality of life. Saudi Arabia requires the use of culturally validated questionnaires in huge quantity. Enormous questionnaires are being used for research purpose, but at the same time, individual patient outcome documentation needs to be practiced using questionnaires. Cross-cultural validation studies are required in Saudi Arabia in huge quantities. Based on this, numerous disease registries will be maintained to serve the qualitative research to support the meta-analysis, thereby scientific and patient-benefited results would be possible to obtain. If such long questionnaires were implemented successfully, there will be a scope for short forms to be documented for a high level of functional evaluation. These short forms will be utilized in randomized control trials to cut short the time duration of trials and registries with the elderly population.

Finally, there is a high value of such protocols to be incorporated by all the clinicians in their assessment protocols in Saudi Arabia for better result-oriented outcomes for the betterment of the patient.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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