



## THE EFFECT OF ELECTROMAGNETIC FIELD USE AND NUTRITIONAL THERAPY ON REDUCING KNEE JOINT INFLAMMATION IN OBESE PATIENTS

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### **Abstract.**

Sports medicine has made significant strides in the past ten years in resolving problems associated with the treatment and rehabilitation of musculoskeletal injuries. Rehabilitative exercises are also important, as they help speed up the restoration of muscle and joint function. This is particularly important if the patient recognizes the need to perform them in a coordinated manner under the direct supervision of a trainer, treating physician, and sports injury specialist. Numerous studies indicate that obesity is not simply a matter of excess weight and slow movement, but rather a health problem. Excessive obesity has detrimental effects on the health and efficiency of the heart, arteries, liver, gallbladder, kidneys, pancreas, and skin. It also leads to arthritis in general, and to inflammation of the ankle, knee, and lumbar vertebrae—the joints that bear the entire body weight of overweight and obese individuals. The joints most susceptible to this are the knee, hip, ankle, and lower back. This occurs as a direct result of the damage caused to the joints and vertebrae by excess weight. A recent American study from Harvard University showed that excessive obesity can put a person at early risk for arthritis and osteoporosis. Until recently, scientists believed that being overweight helped protect bones and prevent fractures. However, this study, conducted by researchers at Harvard University, revealed that adults who carry excess fat in their blood and organs are more susceptible to osteoporosis and, consequently, fractures. (150:65)

Obesity is not a local or regional problem. More than 30% of Egyptians suffer from obesity, with women accounting for the lion's share of the incidence. Obesity also causes at least 3 million deaths annually. It is a global problem, and no one is immune from this widespread health problem among the world's populations, whether in developing or developed countries. The problem now affects men, women, children, and adults, due to deficiencies in health education and nutritional awareness, in addition to other environmental factors and a lack of interest in exercising and physical activity. This problem has become epidemic in nature and requires rehabilitation (53:7).

Rehabilitative exercises are considered one of the most effective methods for rehabilitating injuries to the musculoskeletal system (musculoskeletal) in general, and injuries resulting from excess weight and obesity in particular, through rehabilitation programs developed according to scientific principles. (9:21)

The relationship between nutrition and arthritis. Arthritis is not a single disease, but rather a group of diseases that affect the joints, the most common of which are osteoarthritis and rheumatoid arthritis. Most people may not realize that nutrition can improve the way they feel. A diet for arthritis patients should be based on the food pyramid, which encourages everyone to eat more vegetables, grains, legumes, and fruits, and to consume less fat and sweets. A nutritionally balanced diet provides a variety of foods and leads to



moderate intake. It is important for patients to avoid foods that worsen inflammation, including saturated fats, fried foods, red meat, and simple refined carbohydrates, and to reduce sweets and salty foods. (19:53)

Combining rehabilitation exercises with electromagnetic therapy and therapeutic nutrition doubles their positive impact on restoring the health and fitness of the affected individual by reducing obesity in general and morbid obesity in particular, and by reducing complications affecting the body's vital organs in general and the joints in particular, most notably the knee joint, which is directly and indirectly affected by weight gain. Weight loss reduces the burden on the ankle, knee, and lower back joints, which bear the entire body weight. Weight loss also improves symptoms associated with arthritis, if present. Studies have shown that a two-point (2) reduction in the body mass index (BMI) is associated with a fifty percent (50%) reduction in the risk of developing arthritis. Rehabilitation exercises are a means of activating the musculoskeletal system of the affected individual by reducing inflammation associated with limited and difficult joint movement, while maintaining the functional efficiency of the rest of the body. Hence, the researcher noted that it is possible to conduct a study between a kinetic rehabilitation program using electromagnetic fields and a therapeutic nutrition program for knee arthritis, as there is a direct relationship between them in individuals suffering from morbid obesity (66:55) (61:35). Significance of the research: Through the researcher's review and reading of recent research and studies, he noted that obesity research will become a focus of global interest in the coming years, given the significant impact of this relationship. The importance of electromagnetic fields on many biological functions and their association with most diseases has led to a need to understand the use of electromagnetic fields and therapeutic nutrition in knee arthritis in morbidly obese patients, as a guide for researchers and scholars in this field.

## **Research Objectives:**

Rehabilitation exercises to restore functional capacity of the knee joint using electromagnetic fields and a standardized nutritional program were used to reduce knee arthritis in morbidly obese patients by:

1. Identify the use of a scientifically standardized electromagnetic field therapeutic nutrition program to reduce inflammation and effusion in the knee joint and reduce weight in patients.
2. Identify the effect of a therapeutic nutrition program on motor rehabilitation exercises to reduce inflammation and effusion in the knee joint.

## **Research Hypotheses:**

1. There are statistically significant differences between the pre- and post-measurements in favor of the post-measurement in the research variables under study (body composition variables) for the experimental group, which underwent the motor rehabilitation program, the therapeutic nutrition program, and the proposed electromagnetic field.
- 2- There are statistically significant differences between the pre- and post-measurements, in favor of the post-measurement, in the variables under study: muscle strength of the knee joint muscle group, and pain sensation.

## **Research Terms**

**Obesity:** An abnormal increase in the percentage of fat cells stored within the body under the skin, above the normal limit (9:53).

**Therapeutic Nutrition:** The use of food as a means of preventing and treating certain diseases (25:53).

**Electromagnetic Field:** A high-frequency electrical current that passes through the body's tissues. These waves have the ability to penetrate deep into the body's tissues. The heat creates local heating and reduces the degree of pain by increasing the stretching and flexibility of muscle fibers, which stimulates blood circulation to the affected area.



Data Collection Tools: The researcher reviewed scientific studies and research (Arab and foreign) conducted in the field of injuries and rehabilitation to achieve the program's objective, the program's duration, the criteria for transitioning between program stages, and the exercises used in the rehabilitation of those with knee arthritis. This was also used to determine the most important and best measurements used in the research.

#### Measurements and Tools Used in the Research:

- A. Height measurement.
- B. Weight measurement.
- C. Waist circumference measurement.
- D. Knee and thigh circumference measurement.
- E. Range of motion measurement of the affected and healthy knee joint in flexion and extension positions.
- F. Muscle strength measurement of the flexors and extensors of the affected and healthy knee joint.
- A. Ice packs.
- B. Rubber resistance bands.
- C. Sand weights of varying resistances ranging from 0.5 kg to 3 kg.
- D. Oscillation plates (balance).
- E. Plates and cones.
- F. Gradient-height barriers.

#### Research equipment:

- A. A respirometer to measure height.
- B. A medical scale to measure weight.
- C. A goniometer to measure range of motion.
- D. A Biodex isokinetic dynamometer to measure muscle strength.
- E. A stationary bike.
- G. An orbitrac bike.
- I. An electronic stopwatch.

Electromagnetic field device: for fitness and rehabilitation systems.

#### Research Implementation Procedures:

- A. Preparing an expert opinion survey form on the proposed rehabilitation program.
- B. A letter addressed to the Director of the New Baqubah Health Center regarding facilitating the researcher's task in conducting the research measurements.

#### Research Measurements:

First: Height Measurement: Each sample member stands on the device barefoot, with their feet together, their body straight and looking forward. The reading parallel to the highest point of the patient's head is recorded in centimeters. This reading represents the individual in the sample. (71:14)

Second: Weight Measurement: A sample member stands with both feet on the medical scale, looking forward. The reading is recorded in kilograms. (71:14)

Third: Range of Motion Measurement: - Extension Position: A. Each sample member (tested) lies supine, with the upper thigh area exposed to the person conducting the measurement so that they can see and feel the greater trochanter of the femur, with the knee joint positioned in an extension position to the point of pain.

B- The person taking the measurement sits kneeling or on a chair close to the person being measured, with the goniometer at eye level so that the person can position the goniometer correctly and then read the number.

2- Flexion Position: A- From the same initial position as above (lying on the back), the person taking the measurement uses one hand to move the person's thigh to approximately 90° of flexion in the hip joint, while holding the femur in place to prevent any excessive flexion. The person taking the measurement also uses the



other hand to flex the knee joint to the point of pain. B. The person performing the measurement sits kneeling or on a bench near the tester, placing the goniometer at eye level. This allows the tester to position the goniometer correctly and then read the number. (229:42-230)

Muscle strength of the flexors and extensors of the knee joint is measured using a Biodex isokinetic dynamometer. Data is first entered, such as weight and height, identification of the affected limb, and the speed at which the measurement will be performed (60°/s). The following is then performed:

A. The patient sits on the bench with the knee bent at a 90° angle, with the torso and thigh area of the knee to be measured secured by the seat belts.

B. The patient performs a measurement where they extend and flex their leg with the force they can produce (within the limits of pain) from a 90° angle to a 0.0° angle once. C- The injured person repeats the previous exercise (with the force she can produce within the limits of pain) (5) consecutive times, where the device records the force torque exerted during extension (the force of the anterior thigh muscles that extend the knee joint) and the force torque exerted during flexion (the force of the posterior thigh muscles that flex the knee joint).

D- Measurements are made for both the healthy and injured legs.

E- The results are printed in a special report. (264:132)

Exploratory Study: The researcher conducted a survey study during the period from 4/10/2024 AD to 5/10/2024 AD on a sample of (5) patients with knee arthritis from outside the main research sample.

Study objectives:

- A. To ensure the safety and efficiency of the devices and tools used for measurement.
- B. To learn how to measure muscle strength using a Biodex isokinetic dynamometer.
- C. To determine the suitability of the proposed rehabilitation program for the sample members.
- D. To identify the criteria for transitioning between the different program stages.
- E. To identify the difficulties and problems that may occur during the various measurements, as well as during the program's implementation, and to develop appropriate solutions.

This study resulted in the following:

- A. To ensure the safety and efficiency of the devices and tools used for measurement.
- B. To know how to measure the various research variables using the specific measuring devices.
- C. To determine the suitability of the proposed rehabilitation program for the sample members.
- D. To identify the determinants of transitioning between the different program stages.
- E. To identify the difficulties and problems that may occur during the various measurements, as well as during the program's implementation, and to develop appropriate solutions for them.

Proposed Rehabilitation Program:

After reviewing numerous Arab and foreign studies in the field of injuries and rehabilitation related to the study topic, the researcher designed an expert opinion survey form regarding the proposed rehabilitation



exercise program and presented it to experts and specialists in the field of injuries and rehabilitation, as well as orthopedic surgeons, physical medicine doctors, and rheumatologists. The total duration of the program was determined to be (12) weeks. The overall objectives of the rehabilitation program were established, along with the objectives of each stage separately, and the criteria for transitioning from one stage to the next, as follows:

## General Objectives of the Rehabilitation Program:

- A. Reducing pain, swelling, and inflammation.
- B. Early weight-bearing of the feet.
- C. Preventing the occurrence of atrophy and muscle weakness resulting from knee arthritis.
- D. Achieving the full range of motion of the affected joint, or as close to it as possible in a healthy joint.
- E. Restoring the strength of the anterior and posterior muscles in particular, and the muscles operating on the knee joint in general.
- F. Improving the functional status of injured individuals.
- H- Return to full daily and physical activity.

## Phase One: Objectives of the Acute Phase:

- A- Reducing inflammation and swelling resulting from weight bearing and knee arthritis resulting from knee joint effusion.
- B- Beginning to restore range of motion (ROM).
- C- Beginning to reestablish quadriceps femoris muscle activity.
- D- Preventing muscle atrophy.

## Criteria for moving to the Second Phase (Internal Phase):

- A- Decrease in pain and swelling (using a measuring tape).
- B- Noticeable improvement in range of motion.
- C- Visual muscle strength when the quadriceps femoris muscle contracts.

## Phase Three: Objectives of the Advanced Activity Phase:

- A- Enhancing muscle strength and endurance and bringing muscle strength to or as close to normal as possible in a healthy joint.
- B- Returning to full daily and physical activity.

## Foundations for constructing the proposed rehabilitation program:

- A- Ensure that the rehabilitation exercises are consistent with the overall goal of the program.
- b- Ensure that rehabilitation exercises are consistent with available resources, both financial and human.



- c- Progressively design the rehabilitation exercises from easy to difficult, and from simple to complex.
- d- Ensure excitement and enthusiasm are maintained by diversifying the use of tools.
- f- Implement the program individually, depending on the condition of each injured person and the timing of the injury.

Requirements to be followed when implementing the program:

- A. A good warm-up before the treatment session.
- B. Perform stretching and flexibility exercises for all muscles and joints of the body in general after the warm-up.
- C. A thorough explanation of each exercise and attention to applying the correct rules of performance during each exercise.
- D. Train the muscles of the opposing (healthy) limb during the rest periods.
- E. Perform the program exercises used to the point of pain to prevent complications.
- F. Do not continue performing range-of-motion exercises if you feel pain or fatigue.
- G. Consult a specialist physician if any complications occur that prevent progress in the program.
- H. Ensure flexibility during the program implementation and its ability to be modified without compromising the scientific foundations of the program.
- J. Use ice packs for 20-30 minutes before, during, and after completing the rehabilitation session.
- K. Use massage for the muscles working on the affected and healthy knee joints in the event of muscle fatigue or stress.

Table (2)

A sample training unit from the proposed motor rehabilitation program

| no | Element | Training unit No. (.....) within the activities of the proposed program                                                                    |                                    |
|----|---------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
|    |         | Total duration of implementation<br>(one and a half months)                                                                                | Training unit time (50-60 minutes) |
| 1  | Warm-up | (Standing, open): Bend your arms on your shoulders, rotating your shoulders forward and then backward                                      | .1                                 |
|    |         | (Standing): Bend your neck forward and backward, then bend your head to the sides alternately                                              | .2                                 |
|    |         | Standing, arms to the sides. Bend your forearms upward, touching your elbows together in front of you so that your fingers are bent upward | .3                                 |
|    |         | (Standing, open): Arms to the side of your body. Swing your arms forward and backward                                                      | .4                                 |
|    |         | (Standing) Extend your injured leg forward while contracting your quadriceps, then return to the starting position                         | .5                                 |



|   |            |                                                                                                                                                                                                                                    |
|---|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | Basic      | Abductor exercises .1                                                                                                                                                                                                              |
|   |            | Adductor exercises .2                                                                                                                                                                                                              |
|   |            | Leg press exercises with both feet together .3                                                                                                                                                                                     |
|   |            | Leg press exercises with the injured foot only .4                                                                                                                                                                                  |
|   |            | Multi-hip extension exercises .5                                                                                                                                                                                                   |
| 3 | Final Part | (Lying down. Arms by your side) With your eyes closed, take a deep breath in .1<br>.through your nose, then exhale with a deep sigh, and repeat                                                                                    |
|   |            | (Sit on a chair and place your hands behind your head) Straighten your back while .2<br>.tensing it, then inhale through your nose and relax it, then exhale                                                                       |
|   |            | (Lying down. Arms by your side) Inhale through your nose to raise your shoulders .3<br>up towards your ears and hold the position for a count of (1-5), then relax your<br>.shoulders while exhaling and exhaling with a deep sigh |

Table (3) Sample of a diet program (1600) calories

| Meal            | Contents                                                                                                                                                                                             |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Daily Breakfast | (Before breakfast) A cup of water + half a lemon + a cup of water + a small spoon of honey<br>(3 dates or a banana)                                                                                  |
| Lunch Day 1:    | 3 tablespoons of oatmeal + a cup of yogurt                                                                                                                                                           |
| Day 2:          | Tuna with onions, a plate of salad (2 cucumbers + 1 carrot + a bunch of parsley + a bunch of lettuce + 2 green peppers + a spoon of turmeric + cumin) + a loaf of sunflower oil                      |
| Day 3:          | Diet moussaka (1/2 kg eggplant + 100 g minced meat + 2 tomatoes + parsley) + a plate of salad (2 cucumbers + 2 green peppers + 5 cabbage leaves) + half a loaf of whole wheat bread or sunflower oil |
| Day 4:          | Tuna with onions + a salad (2 cucumbers + carrots + a bunch of parsley + a bunch of lettuce + 2 green peppers + a spoon of turmeric + cumin) + half a loaf of sunflower oil                          |
| Day 5:          | A quarter chicken + an oven-baked potato + 7 tablespoons of vegetables                                                                                                                               |
| Day 6:          | Half a kilo of grilled fish + a plate of salad (2 cucumbers + 1 green pepper + 1 tomato + a spoon of Turmeric + cumin) + 4 tablespoons turmeric rice                                                 |
| Day 7:          | 1/4 chicken + 1 boiled and mashed potato (mashed) in the oven + 8 tablespoons vegetables                                                                                                             |

Table (4) The first stage of the proposed motor rehabilitation program

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| Notes                                                     | Tools                  | Training load formation |                                                     |                         |            | Resistance        | Suggested Rehabilitation Program                                                                                           | Element                  | m  | Exercise Type                                                                                         |
|-----------------------------------------------------------|------------------------|-------------------------|-----------------------------------------------------|-------------------------|------------|-------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------|----|-------------------------------------------------------------------------------------------------------|
|                                                           |                        | Gro pes                 |                                                     |                         | Intensi ty |                   |                                                                                                                            |                          |    |                                                                                                       |
| Intensit y for 7-10 seconds, with in the limits of pain . | Qualifie d Assistan ce | 3                       | Intensi ty: 7-10 seconds, within the range of pain. | Qual ifier Assi stan ce | 5-7s       | Self-suppo rtin g | (Lying on the uninjured side) Raise the injured leg fully straight and high to the side and remain steady.                 | Motor muscl e streng th  | 21 | Static contraction exercises for the anterior, posterior, abductor, and adductor muscles of the thigh |
|                                                           | Medicin e Ball         | 3                       | 15s                                                 | Med icine Ball          | 5-7s       | Self-suppo rtin g | (Lying) On the uninjured side, place a rubber ball between the knees. Press the injured leg onto the ball.                 | Static muscl e streng th | 22 |                                                                                                       |
|                                                           | مساعدة المؤهل          | 3                       | 15s                                                 | Qual ifier Assi stan ce | 5-7s       | Med icine ball    | (Sit for a long time) Place the injured leg on top of the uninjured leg. Slowly raise the uninjured leg and remain steady. | Motor muscl e streng th  | 23 |                                                                                                       |
|                                                           | balance board          | 3                       | 15s                                                 | 8-6                     | 7-5s       | Self Balance      | (Sitting on a chair) Place the feet on a balance                                                                           | Static balanc e          | 24 |                                                                                                       |



|  |  |  |  |  |  |  |                                                                              |  |  |  |
|--|--|--|--|--|--|--|------------------------------------------------------------------------------|--|--|--|
|  |  |  |  |  |  |  | board.<br>Gently press<br>the front of<br>the board<br>with your<br>insteps. |  |  |  |
|--|--|--|--|--|--|--|------------------------------------------------------------------------------|--|--|--|

**Pre-measurements:** Pre-measurements were conducted for the primary research sample, consisting of (30) patients, in different clinics for each patient on one side. After the infection period had ended, and after consulting the treating physician, the patients were allowed to undergo the measurement procedures to prevent any complications.

**Primary Research Experience:** The proposed rehabilitation program was implemented for the research sample from May 1, 2024, to November 20, 2024, individually for each patient on one side, for a period of (16) weeks.

- A. All measurements were conducted for all sample members in a single manner.
- B. The same measurements were applied to all sample members.
- C. All measurements were conducted for all sample members in a single order and sequence.

**Post-measurements:** Post-measurements of the research variables were conducted for each patient on one side after the program was completed, in the rehabilitation program clinics.

**Statistical treatments used:**

- A. Arithmetic mean.
- B. Median.
- C. Standard deviation.
- D. Skewness.

Table (5)

Analysis of variance between the five research measurements in the variable of knee and thigh circumference (for the affected foot) in the (therapeutic nutrition) group.

| no | Variable           | Source of Variance   | degree of freedom | sum of squares | mean squares | F value |
|----|--------------------|----------------------|-------------------|----------------|--------------|---------|
| 1  | Knee circumference | Between Measurements | 4.00              | 59.07          | 14.77        | 49.27   |



|   |                                 |                      |       |        |       |        |
|---|---------------------------------|----------------------|-------|--------|-------|--------|
|   | Thigh circumference at 3 inches | Within Measurements  | 45.00 | 13.49  | 0.30  |        |
|   |                                 | Total                | 49.00 | 72.55  |       |        |
| 2 | Variable                        | Between Measurements | 4.00  | 253.46 | 63.36 | 243.76 |
|   |                                 | Within Measurements  | 45.00 | 11.70  | 0.26  |        |
|   |                                 | Total                | 49.00 | 265.15 |       |        |
| 3 | Knee circumference              | Between Measurements | 4.00  | 93.17  | 23.29 | 129.45 |
|   |                                 | Within Measurements  | 45.00 | 8.10   | 0.18  |        |
|   |                                 | Total                | 49.00 | 101.27 |       |        |

The value of the table is 4 and 25 degrees of freedom and a significance level of 0.05 = 2.76.

Table (4) shows the significance of the differences between the research measurements (in the variable of knee and thigh circumference (for the affected leg) at a significance level of 0.05). It is clear that there are statistically significant differences between the research measurements, which prompted the researcher to conduct an LSD test to determine the least significant differences between the measurements.

The researcher believes that this tangible progress in the muscle strength of the muscle groups operating on the knee joint of the affected limb may be due to the effect of the rehabilitation program, which includes rehabilitation exercises and electromagnetic fields. It includes various and diverse exercises for static and dynamic muscle strength, which led to an increase in the physiological cross-section of the muscle and an increase in muscle strength.

Table (5)

Analysis of variance between the variables of weight, waist circumference, and BMI in the (therapeutic nutrition) group

| F value | mean squares | sum of squares | degree of freedom | Source of Variance | Variable | μ |
|---------|--------------|----------------|-------------------|--------------------|----------|---|
|---------|--------------|----------------|-------------------|--------------------|----------|---|



|       |         |         |       |                      |                                              |   |
|-------|---------|---------|-------|----------------------|----------------------------------------------|---|
| 24.13 | 1515.83 | 6063.32 | 4.00  | Between Measurements | Weight<br>Waist<br>Circumference             | 1 |
|       | 62.82   | 2827.00 | 45.00 | Within Measurements  |                                              |   |
|       |         | 8890.32 | 49.00 | Total                |                                              |   |
| 35.41 | 1559.65 | 6238.60 | 4.00  | Between Measurements | Variable<br>Weight<br>Waist<br>Circumference | 2 |
|       | 44.04   | 1981.90 | 45.00 | Within Measurements  |                                              |   |
|       |         | 8220.50 | 49.00 | Total                |                                              |   |
| 19.28 | 223.43  | 893.72  | 4.00  | Between Measurements | BMI                                          | 3 |
|       | 11.59   | 521.40  | 45.00 | Within Measurements  |                                              |   |
|       |         | 1415.12 | 49.00 | Total                |                                              |   |

The value of the table is 4 and 25 degrees of freedom, and the significance level is  $0.05 = 2.76$ .

Table (5) shows the significance of the differences between the five research measurements in the variables of weight, waist circumference, and BMI at a significance level of 0.05. It is clear that there are statistically significant differences between the five research measurements, which prompted the researcher to conduct an LSD test to determine the least significant differences between the measurements.

The researcher attributes the improvement in muscle strength and mobility to the high efficiency of the research sample.

This is a result of the improved efficiency and strength of the muscles operating on the knee joint, which helps the joint move with muscle force during movement due to the cohesion of the ligaments and the flexibility of the muscles, which contribute to the efficiency of movement.

Table (6)

Analysis of variance between the variable of muscle strength (for the affected foot) for the (therapeutic nutrition) group



| no | Variable       | Source of Variance   | degree of freedom | sum of squares | mean squares | F value |
|----|----------------|----------------------|-------------------|----------------|--------------|---------|
| 1  | Anterior thigh | Between Measurements | 4.00              | 67889.64       | 16972.41     | 817.56  |
|    |                | Within Measurements  | 45.00             | 934.20         | 20.76        |         |
|    |                | Total                | 49.00             | 68823.84       |              |         |
| 2  | Variable       | Between Measurements | 4.00              | 8480.75        | 2120.19      | 945.51  |
|    |                | Within Measurements  | 45.00             | 100.91         | 2.24         |         |
|    |                | Total                | 49.00             | 8581.66        |              |         |

The value of the table is 4 and 25 degrees of freedom, and the significance level is  $0.05 = 2.76$ .

Table (6) shows the significance of the differences between the five research measurements in the muscle strength variable (for the injured foot) at a significance level of 0.05. It is clear that there were statistically significant differences between the five research measurements, which prompted the researcher to conduct an LSD test to determine the least significant differences between the measurements.

The researcher attributes this result to the motor rehabilitation program, therapeutic nutrition, and electromagnetic fields, given their integration of static and dynamic muscle strength exercises, using self-resistance or the assistance of a partner, in a gradual and varied manner. Furthermore, the use of the latest rehabilitation devices helped maintain normal joint movement.

Table (8)

Analysis of variance between measurements of the range of motion variable (for the injured foot) for the therapeutic nutrition group

| n o | Variable       | degree of freedom    | sum of squares | mean squares | F value | degree of freedom |
|-----|----------------|----------------------|----------------|--------------|---------|-------------------|
| 1   | From extension | Between measurements | 4.00           | 110.68       | 27.67   | 2.62              |



|   |                |                      |       |          |         |        |
|---|----------------|----------------------|-------|----------|---------|--------|
|   | Variable       | Within measurements  | 45.00 | 475.50   | 10.57   |        |
|   |                | Total                | 49.00 | 586.18   |         |        |
| 2 | From extension | Between measurements | 4.00  | 31509.88 | 7877.47 | 877.66 |
|   |                | Within measurements  | 45.00 | 403.90   | 8.98    |        |
|   |                | Total                | 49.00 | 31913.78 |         |        |

The value of the table is 4 and 25 degrees of freedom and a significance level of 0.05 = 2.76.

Table (8) shows the significance of the differences between the four research measurements in the range of motion variable (for the injured foot) at a significance level of 0.05. It is clear that there are statistically significant differences between the five research measurements, which prompted the researcher to conduct an LSD test to show the least significant differences between the measurements.

Table (7)

Analysis of variance between the research measurements (pre-test, inter-test, post-test) in the variable of sensation of pain degree.

| n o | Variable   | Source of variance   | degree of freedom | sum of squares | mean squares | F value |
|-----|------------|----------------------|-------------------|----------------|--------------|---------|
| 1   | Pain level | Between measurements | 4.00              | 296.28         | 74.07        | 129.19  |
|     |            | Within measurements  | 45.00             | 25.80          | 0.57         |         |
|     |            | Total                | 49.00             | 322.08         |              |         |

Total 49.00 322.08

Value of F in the table at 4 and 25 degrees of freedom and a significance level of 0.05 = 2.76

Table (41) shows the significance of the differences between the four research measurements in the variable of sensation of pain level (for the injured foot) at a significance level of (0.05). It is clear that there are statistically significant differences between the five research measurements, which prompted the researcher



to conduct the LSD test (Least Significant Difference) to indicate the least significant differences between the measurements.

## Discussion of the Results

Discussion of the results of the first hypothesis, which states that there are statistically significant differences between the pre-measurement and post-measurement in favor of the post-measurement for the sample members applying the motor rehabilitation program, therapeutic nutrition, and electromagnetic field (the experimental group). The discussion was as follows:

It is clear from Tables No. (4), (5), (6), and (7) that there are statistically significant differences at a significance level of (0.05) in the variables under study for weight, body mass index, and circumferences. Waist, knee circumference, thigh circumference at 3 inches, thigh circumference at (8) inches, muscle strength of the muscles working on the knee joint - the range of motion of the knee joint in the direction of extension and flexion (degree of feeling pain) between the pre-measurement, the dependent measurements and the post-measurement in favor of the post-measurement for the individuals of the group (the third experimental) achieving noticeable positive results, which was subjected to the sports rehabilitation program, therapeutic nutrition and the electromagnetic field

## References:

1. Ayman Mohamed El-Husseini, "Joint Pain, Cartilage Roughness, and Knee Pain," Ibn Sina Library, Cairo, 2004.
2. Ezzat Mohamed Kashf, "Rehabilitation Exercises for Athletes and Heart Patients," 2nd ed., Nahdet Misr Library, Cairo, 2004.
3. Mohamed Qadri Bakri Siham El-Sayed El-Ghamry, "Sports Injuries and Physical Rehabilitation," Kitab Publishing Center, Cairo, 2005.
4. Walid Youssef Hussein Mohamed, "The Effect of a Sports Program and Therapeutic Nutrition on the Efficiency of the Immune System in Obese Patients," Unpublished Master's Thesis, Faculty of Physical Education, Tanta University, 2011
5. Aabdelsamie Mohamed Halawa "Evaluation of arthroscopic double-bundle anterior cruciate ligament reconstruction ,thesis submitted for partial fulfillment of the M.D degree in orthopedic surgery ,faculty of medicine,Banhauniversity ,2008."
6. Caele Kelley "Text book of rheumatology.2005"
7. Clinical Orthopaedics & Related Research "Rehabilitation after hamstring anterior cruciate ligament reconstruction. [April 2002 - volume 397 - issue - pp 370-380](#) Section ii original articles: knee"
8. Dale M. Daniel "Reference ,maintenance &user guide for arthrometermedmetric knee ligament arthrometer models kt-1000and kt2000 ,2005."