Effectiveness of ginger extract plus therapeutic exercises on ankle sprain

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Abstract: This study was carried out on 16 football players affected with ankle sprain. Ginger extract was tested together with therapeutic exercises. Treatment was administered on patients, divided into experimental and control groups (8 each). Blood samples were withdrawn from both groups before and after therapeutic exercises alone or plus ginger extract (4g daily). Data on pain was recorded, Nitric oxide and cortisol were estimated using Elisa technique. Also determination of Max. Pressure on sole surface, heel strike, time of fulcrum, circumference of ankle, range of motion in contraction and relaxation and time of healing. Results indicated significant changes between experimental and control groups for the sake of experimental one in all parameters. In conclusion ; therapeutic exercises plus ginger extract might enhance healing processes of ankle sprain and it is recommended to use ginger extract in recommended doses and therapeutic exercises for a better response and speed of healing of ankle sprain.
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1- Introduction

The Foot is the principal base of human body and obtain its equilibrium, its soundness is considered a key stone of clever movement. Any injury in the foot can weaken balance and physical performance. The sensory nerve ending and ligaments of muscles, nourish the nervous system with information for equilibrium stability.

(El Rakaway, 1990)

Ankle Joint is a hinge uniaxial joint, its movement in contraction, relaxation, adduction, abduction and rotation. The normal range of movement is dorsi flexion around 20 degree, and for planter flexion 45-55 degree (Thompson and Floid, 1998).

Injuries of the ankle joint are different and are spraided between athletes and non athletes and they are of the most predominant among the different sport activities (Watson, 1999) Vicenzina et al, (2002) stated that the more predominant injuries of athletes is distortion of ankle sprain and represent 60% of injuries in sport field. 85% of ankle sprain injuries are due to distortion of inferior foot.

Gran and Newton (1988) showed that injury of the ligament of ankle joint can induce pain swelling, limitation of the range of motion and disturbance in balance of the ankle joint as well as general body balance, such symptoms are exaggerated according to the severity of the injury, further more many of sprain ankle patients are subjected to recurrent ankle sprain due to such disturbed balance.

In addition, injury of ankle joint due to distortion, may affect neuromuscular structures, Rozzi et al (1999) concluded that if such injuries are not treated, chronic instability could affect physical performance and the injury may be recurrent.

Hintermann (1999) confirmed that in some ankle sprain injuries, the ligaments might not return to the normal state, which affect negatively the joint stability, which lead to recurrent distortion with pain and edema in the same place.

Watson (1999) also confirmed that 40% of the curred ankle joint distortion might's be recurrent, leading to a true problem to the athlete.

Therapeutic exercises best known as one of efficient complex methods in treatment of different injuries as it helps healing of injured tissues and get rid of swellings and prevent bleeding and restoration of joints in the least time Steven (2002).

The anti-inflammatory properties of ginger have been known and valued for centuries. During the past 25 years, many laboratories have provided scientific support for the longheld belief that ginger contains constituents with antiinflammatory properties. The original discovery of ginger's inhibitory effects on prostaglandin biosynthesis in the early 1970s has been repeatedly confirmed. This discovery identified ginger as an herbal medicinal product that shares pharmacological properties with non-steroidal anti-inflammatory drugs. Ginger suppresses prostaglandin synthesis through inhibition of cyclooxygenase-1 and cyclooxygenase-2. An important extension of this early work was the observation that ginger also suppresses leukotriene biosynthesis by inhibiting 5-lipoxygenase. This pharmacological property distinguishes ginger from nonsteroidal anti-inflammatory drugs. This discovery preceded the observation that dual inhibitors of cyclooxygenease

and 5-lipoxygenase may have a better therapeutic profile and have fewer side effects than nonsteroidal anti-inflammatory drugs. The characterization of the pharmacological properties of ginger entered a new phase with the discovery that a ginger extract (EV.EXT.77) derived from Zingiber officinale (family Zingiberaceae) and Alpina galanga (family Zingiberaceae) inhibits the induction of several genes involved in the inflammatory response. These include genes encoding cytokines, chemokines, and the inducible enzyme cyclooxygenase-2. (GrZanna et al., 2005).

The aim of this study is to evaluate the efficiency of rehabilitation exercises and ginger extract for healing ankle sprain at restoration of the joints to their function in the least possible time.

Hypothesis:

1- There are a positive effect of the therapeutic exercises program for all variables studied.
2- There are a positive effect of the therapeutic exercises program plus ginger extract for all variables studied.
3- There are difference between the two groups for the sake of the second group (experimentalone).

2- Materials and techniques of testing

The researcher used the experimental method for its suitability to the research objective by using two groups the first therapeutic exercises plus placebo and the second therapeutic exercises plus ginger extract (4g) daily for 25 days sample of the study: 16 soccer players affected with ankle sprain of the second degree. They were diagnosed by a specialist and the injuries of the two ankles were dismissed. All of them were assigned to rehabilitation at El Agoza Army rehabilitation center.

Table (1): Statistical analysis of the two groups of physical characteristics

Variables	N = 8 Placebo group	N=8 Ginger group	Sign.
Age (yrs)	20.3 ± 2.5	20.9 ± 2.3	0.81
Height (cm)	170.4 ± 3.3	171.2 ± 1.6	0.62
Weight (kg)	68.1 ± 4.2	69.2 ± 3.2	0.54

Non significant differences between two groups $P < 0.05$.

Instrument used:

1- Foot Maxx for biomechanical of the injured ankle.
2- Geniometer from the range of motion in contraction and relaxation.
3- Measurement of the circumference of the injured joint.
4- Using visual pain score.
5- Elisa for cortisol and Nitric oxide.

The following variables were tested:

- Max. pressure on sole surface of foot.
- Heel strike.
- Time of fulcrum.
- Circumference of the joint.
- Range of motion in contraction and relaxation.
- Cortisol and nitric oxide and pain score.

The therapeutic rehabilitation program was designed after the suggestion of specialist of physical therapy and bone specialist, leading to the view:

- Therapeutic exercises will be exerted in 3 phases 2 weeks each.
- Time table for the execution of the program (6) weeks, 4 time a week, this will be 24 exercises unit.

The players were in negative rest in the first stage of program and positive rest during the second stage and third stage.

- Ginger extract (4g) after Wigler et al (2003) was choosen for exhibiting the following characteristics:
  - Good analgesic action.
  - Fast resorption of edema and hematomas.
  - Enhancement of microcirculation with promotion of the natural healing process.
  - A minimum of side effects.
- Cortisol and nitric oxide (nitrite) were estimated using Elisa technique in specialized Lab.
- Foot Maxx instrument.

It is a plate form constructed for analyses of the forces of the foot. One of the benefit of the instrument is to registered of the distribution of body pressure upon foot, in the phases of leaning and its time. The instrument translate the electric waves from the instrument to a curve which divide the plantar of the foot to identical squares, with colours, due to pressure of the foot on the instrument surface, each colour represent a pressure cost known as paskal.

Statistical analysis

Non- parametric tests were used due to small numbers of the groups. The differences between the control and experimental group were compared by the Mann-Whitney U-test. Statistical significance was set at $P < 0.05$.

3- Results

Table (1) revealed that the therapeutic exercises and therapeutic exercises plus ginger extract (4g) everyday until healing process. The results indicated non significant data in their baseline physical characteristics.

Table (2,3) shows the biochemical variables, Nitric oxide and cortisol before and after both treatments. After healing these was non significant change in case of nitric oxide and cortisol concentrations in case of therapeutic exercises only. While in case of therapeutic exercises plus ginger which acts as antiniflamatory agent cortisol increased, nitric oxide decreased significantly. As for Max. pressure on sole surface of foot, Heel strike, time of fulcrum, circumference of foot, range of motion in relaxation and contraction (Table 4,5) The results were in the favor of therapeutic exercises plus gingers, which is a proof of the positive effects for improving the normal function of the ankle joint.

3- Discussion

Injuries to joint and muscle are common. The injuries are characterised by a) Destruction phase and haematoma formation degeneration and inflammatory response b) The repair phase include phagocytosis of the damaged tissue and regeneration (Menerey et al, 2000).

The results of this study show that the immunomodulator ginger can present raised serum cortisol and decreased nitric oxide after therapeutic exercises and ginger administration (Table 2). This result was is accordance with that of (Cordova et al 2004). William (1994) suggested that acute inflammatory processes may be the underlying mechanism of joint damage. Grzanna et al (2004) stated that inflammation appears to play an important role in the pathogenesis of joint and muscular damage induced by injuries, and ginger possess an anti-inflammatory action leading to decreasing nitric oxide biological acitivities, which was first widely appreciated when it was identified as the endothelial derived relaxing factor responsible for the potent vasodilating properties of stimulated endothelia leading to edema and inflammation (Ignarro, 1987). Nitric oxide metabolite, nitrite, has been used in measurement of Nitric oxide in biological fluid (Marietta, 1988). Nitric oxide activation mediate a range of biological functions such as synaptic plasticity, inflammation, angiogenesis (Hood and Granger, 1998), Phan et al (2005). The elevated in cortisol concentration due to the effect of therapeutic exercises plusginger administration could be due to the ginger neuroendocrine action, leading to increased cortisol concentration which inhibit the inflammatory response to tissue injury also cortisol suppress manifestations of allergic disease (Barret et al, 2010).

Table (2): Concentration of contisol and nitric oxide before and after placebo(1) and ginger extract(2)

Variables	Group (1)		Group (2)	
	Before	After	Before	After
Cortisol (µg/dl)	22.1 ± 3.6	23.4 ± 4.2	23.8 ± 4.2	29.1 ± 2.7*
Nitric oxide µ mol /L	37.2 ± 4.8	38.9 ± 5.4	39.5 ± 2.7	35.3 ± 3.1*

Significant differences between each group before and after therapeutic exercises (placebo(1)) and therpeutic exercises plus gingers(2) $P < 0.05$

Table (3): concentration of cortisol and nitric oxide after Treatment of groups (1) (2)

Variables	Group (1)	Group (2)
Cortisol µg/dl	23.4 ± 4.2	29.1 ± 2.7*
Nitric oxide µmol/L	38.9 ± 5.4	35.3 ± 31*

$P < 0.05$

Table (4): The different variables before and after therapeutic exercises and exercises plus ginger (group 1, 2)

Variables	Group (1)		Group (2)	
	Before	After	Before	After
Max. pressureon sole surface of foot	6.12 ± 0.4	6.67 ± 0.7	6.3 ± 0.5	8.1 ± 0.6*
Heel strike	37.2 ± 2.1	38.2 ± 3.4	37.4±	39.9 ± 4.1*
Time of fulcrum	1.31 ± 0.02	1.42 ± 0.04	1.34 ± 0.03	1.85 ± 0.03*
Circumference of foot	13.9 ± 2.3	13.6 ± 1.2	14.1 ± 3.3	11.4 ± 1.4*
Range of motion in relaxation	7.4 ± 1.5	8.0 ± 1.3	7.5 ± 1.6	9.8 ± 1.5*
Range of motion in contraction	24.1 ± 1.7	25.9 ± 1.6	23.9 ± 1.8	29.6 ± 1.1*

Sig at $P < 0.05$

Table (5): The different variables after the therapeutic exercises group (1) and therapeutic excrcises plus ginger group (2)

Variables	Group (1)	Group (2)
Max pressure on sole surface of foot	6.67 ± 0.7	8.1 ± 0.6*
Heel strike	38.2 ± 3.4	39.9 ± 4.1*
Time of fulcrum	1.42 ± 0.04	1.85 ± 0.03*
Circumference of foot	13.6 ± 1.2	11.4 ± 1.4*
Range of motion in relax	8.0 ± 1.3	9.8 ± 1.5*
Range of motion in contrac	28.90 ± 1.6	29.6 ± 1.1*
Healing time (days)	24.3 ± 2.1	22.1 ± 1.2*

Sig. at $P < 0.05$

Table (4,5) showed that there are a positive effect of the therapeutic exercises for improving the normal function of the ankle joint and a better result when using ginger extract with the therpeutic exercises in max pressure on sole surface, heel strike, time of fulcrum, circumference of foot, range of motion in contraction and relaxation. This was obvious in decreasing circumference of foot and improving the normal function of the foot to reach normal level after the getting rid of the inflammation and edema of the foot.

The results of this experiment are in accordance with that of Vicenzino et al (2002) and Lofnenberg et al (2001). They added that exercise rehabilitation programs might lead to increased in muscle force working on the injured joint and increase range of motion and help in prevention of recurrency of injury in the future.

The result agreed also with Verhagen et al (2004) and Kern and Kelsey (1999) and Hinterman (1999) and Gran and Newton (1988), They indicated that therapeutic exercises improve motion of joint to different direction.

Also to evaluate the efficacy and safety of ginger extract in patients with osteoarthritis (Altman and Marcussen 2001) reach the conclusion that a purified ginger extract had a statistically significant effect on reducing symptoms of osteoarthritis of the knee, there was a safety profile and recorded an anti-inflammatory action (Phan et al, 2005) Kim et al (2005). Also Gran and Newton (1988) and Hertel (2000) denoted an improvement in joint mobility after using electrotherapy with therapeutic exercises.

The therapy assessed successfully in score recorded for pain for group (1) for high pain of 90% to moderate pain 45% at the end of treatment, while in case of groups (2) pain score began from 90% reach a low pain score of 25% at the end of rehabilitation exercise plus ginger. This was in accordance with the results of Mohamed Abd el Rehim (2012).

The decreased pain score recorded might be due to the anti inflammatory action and decreased edema due the administration of ginger, leading to suppressing the pain sensation, also healing time decreased due to the action of the ginger extract because it fulfills all the requirements leading to anti exudative action and regenerative effect. Almekinders (1999).

Conclusion

In ankle joint injury therapeutic exercises plus ginger might enhance healing processes and maintain joint function.

Recommendation

It is recommended to use ginger extract with therapeutic exercises for a better response and speed of healing of ankle sprains.

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