

Apitherapy and Muscle Damage

¹RAMAZAN CEYLAN*, ²YASAR ERDOGAN

¹Department of Physical and Sports Education, School of Physical Education and Sports, Bayburt University, Bayburt, Turkey.

²Department of Veterinary Medicine Demirozu Vocational School, Bayburt University, Bayburt, Turkey

Corresponding Author: rceylan@bayburt.edu.tr Cell: 0505 589 9335

ABSTRACT

Aim: This study aims to compare the effects of dolgit cream, an anti-inflammatory drug in the NSAID group, is frequently used in treating injuries after sports activities, and natural honey, used due to its anti-inflammatory effect, on muscle damage.

Methods: Twenty-one amateur male athletes voluntarily participated in this study (Age: 21±3). The participants were divided into three groups as honey treatment group (n=7), drug treatment group (n=7), and control group (n=7). In the gym, one-session of intense interval training consisting of movements (unusual push-ups, diamond push-ups, dips) in which the athletes participating in the study were not used was applied. Blood samples were taken consecutively for five days, one time before and four times after the training program. Blood samples were analyzed biochemically, and activation of Creatine Kinase (CK), Lactate Dehydrogenase (LDH) enzymes were determined. Besides, the participants' pain levels (Visual Analogue Scale) were monitored for four days after the training. SPSS 22.0 package program was used for data analysis. The suitability of the data for normal distribution was analyzed with the Shapiro-Wilk test, and it was determined that the data were not distributed normally. Kruskal-Wallis test was applied to determine the acute effect of the treatment protocols carried out in the treatment of muscle damage after the training

Results: According to the result, no statistically significant difference was found between the treatment groups and the control group in the activation of CK, LDH in the blood serum ($p>.05$). According to the pain scale follow-up results, it was observed that the pain scores of the participants in the group who received honey treatment were lower and statistically significant in the 1st after the training ($p<.05$)

Conclusion: As a result, the external application of natural honey in sports injuries may support modern medical treatment practices

Keywords:: Natural Honey Therapy, Interval Training, Creatine Kinase, Lactate Dehydrogenase, Muscle Damage

INTRODUCTION

Honey is a sweet substance that occurs as a result of collecting nectar secreted from flowers or other living parts of plants by honey bees, changing and storing its components¹⁵. Honey has long been considered as a nutrient used for people's health. Honey is the only ingredient mentioned in all mythological texts. In various classical Greek texts such as Homer's epic of the Iliad and Odyssey, the Deipnosophist of the Athenians, and the philosophical texts of Plato, Aristo, Democritus, and others it is mentioned how important honey is to people. Hippocrates stated that the nutritional value and pharmaceutical properties of honey are not accidental. In ancient Greece, it is known that honey is used for medical purposes as well as being used as a nutrient. There are records that the medical formulas of ancient Greeks were based on honey. Since the past, honey has been used in many cultures to treat many diseases due to its medicinal properties^{5,7} today, it is used in medicine as Apitherapy. Apitherapy is a medicinal use of honey, beeswax, pollen, propolis, royal jelly, and bee venom. Honey and honey products, such as pollen, have the effects of anti-bleeding, antibacterial, lowering symptoms of high altitude disease, while royal jelly has positive effects on cell renewal, production, and metabolism. Also, antiallergic, antioxidative, antibacterial, and antiviral effects are known. Propolis is used as an anti-inflammatory, hypotensive, immunostimulant, bacteriostatic, and bactericidal agent. It is known that bee venom is traditionally used to treat back pain, skin diseases, and rheumatism by injection into the body⁷ Treatment methods with apitherapy have developed

rapidly in the world in recent years. In our country, apitherapy centers have not been established yet, and scientific studies on this issue have not reached a remarkable level.^{3,4,15}

Muscle damage and delayed muscle pain are often defined as the disruption in the muscle contractile structure, especially in Z-bands and myofibrils, with the muscle's extension during the movements and exercises that are applied with an unusual intensity and force, which usually require eccentric muscle contractions. It is the condition encountered with pain and tenderness in the muscles when it is moved or examined manually^{6,13}. The type of sport, intensity, duration, the severity of the sport, the physical structure of the athlete, the level of training and the existence of harmful habits of age, as well as climate, current weather conditions, the quality of ground and sports equipment, the type of organization of the sports event, etc. can be effective in the formation and rehabilitation of muscle damage in several environmental factors¹. Activation of muscle damage enzymes begins to increase three to four hours after exercise and reaches the top level after 24-48 hours. After reaching the summit, recovery usually takes place within 72 hours. The reference range is (CK: 0-171 U / L), (LDH 0-248U / L) in a healthy individual. The resulting muscle damage can cause poor physical performance. In addition to some interventions such as nutrition, electrical and manual treatments, pharmacological supports, cryotherapy, and active exercise to minimize the adverse effects resulting from muscle damage, supportive diets are also considered essential to speed up and facilitate muscle repair and regeneration

after training. Protein and combined carbohydrate consumption, antioxidant, and/or anti-inflammatory foods rich in certain intervals are the options that generate positive results in the healing process. Thus, faster rehabilitation of the resulting muscle damage enables athletes to return to exercise programs in a shorter time; and obtain more efficiency from training and performance improvements

In traditional medicine, it is known that honey is used in the treatment of many diseases due to its therapeutic properties. When examining which diseases are treated with honey, it is observed that honey is used for many diseases, also for its anti-inflammatory effect. This use alone is in the form of oral intake. In addition, we witness that honey massage and honey dressing are traditionally used to treat broken, dislocated, sprained, and soft tissue injuries in Anatolia. In modern medicine, anti-inflammatory drugs are used to treat sports injuries, muscle strain, muscle damage, and soft tissue injuries. These drugs cause an increase in the body's toxic substances, and affect the kidneys and liver adversely ^{5,6,10,12,16}

This study aims to determine whether natural honey, known to be effective in treating many diseases when used orally, has anti-inflammatory effects when used externally based on scientific data. Moreover, to compare the effects of natural honey with Dolgit, an anti-inflammatory drug in the NSAID group, written in the prescriptions of patients for the treatment of muscle injury and delayed muscle pain by orthopedics and sports physicians in the treatment of many injuries caused by the skeletal system.

MATERIAL & METHODS

This study is a longitudinally designed study consisting of 3 parallel training groups. Twenty-one recreational active men were randomly divided into three groups. One session of training on a similar day and hour was applied to all three groups of the honey-treated group (BG; n=7), drug-treated group (IG; n=7), and control group (CON; n=7). 0.5 ml of blood samples were taken 24 hours before the training, 4, 24, 48, and 96 hours after the training. Also, participants' post-workout pain levels were monitored with the VAS (Visual Analog Score) pain scale. Biochemical analyzes were done by taking blood samples before and after the training. The pain and sensitivity conditions that may occur after the participants' training were monitored on the days when blood samples were taken with the VAS pain scale, and pain scores were recorded.

Participants: Twenty-one amateur active men (age 21±3) voluntarily participated in this study. All necessary permissions were obtained from the ethics committee of Bayburt University under the Helsinki declaration. None of the participants had any cardiovascular health problems or health problems to prevent exercise. The participants were informed about the training program and the experimental design of the study, and an approval form was signed.

Training Program: All participants received a one-session intensive interval training program in the gym, which

includes movements that the participants are not accustomed to and have not attempted before^{6,14} The applied training program (10 min warm-up 25 min intensive interval training, 5 min stretching) was about 40 min. The participants performed 20x3 sets of regular push-ups, 20x3 sets of diamond push-ups, and 20x3 sets of dips. The training program applied aimed to cause damage to the muscles of the participants. A trained researcher followed the training session.

Applied Treatment Method: The participants were randomly divided into three different groups. After the one-session training program, honey treatment was used for one group. The other group received medication therapy (NASII), which is often used as first-line drugs for symptomatic relief in inflammatory events, while no treatment was applied to the **Control group**

For those who received honey treatment, natural honey was applied externally (on the skin) three times a day to form a thin layer on the triceps' surface. The drug-treated group was applied dolgit cream to the triceps three times a day, as in the treatment of honey, according to the procedure of use externally. In the control group, no treatment protocol was followed.

Taking Blood Samples and Biochemical Analysis: Blood samples were taken To determine the acute effect of the applied training in terms of muscle damage consecutively for five days, 24 hours before the training session, and four times after 3, 24, 48, 96 hours. Blood samples were analyzed biochemically within 30 minutes of the day of collection (CK, LDH).

Pain Scale (Visual Analog Score): Visual Analogue Scale. It is the table used to convert some values that cannot be measured numerically into numerical values. The visual analog scale is an accurate, reliable, and reproducible method used in the subjective measurement of pain.

Evaluation: The values obtained for patients are averaged.

- 0 points, no pain is evaluated once a day.
- 1-2 points are defined as mild pain and evaluated every 6 hours.
- 3-4 points are defined as a little bit of pain and are evaluated every 4 hours.
- 5-6 points are defined as moderate pain and evaluated every 2 hours.
- 7 and the above points are defined as severe pain and evaluated every hour ^{8,13}

Statistical Analysis: SPSS 22.0 packaged software has been used in the process of data analysis. The suitability of the data for normal distribution was analyzed with the Shapiro-Wilk test, and it was determined that the data were not distributed normally. Blood samples were analyzed biochemically. They were evaluated with the Kruskal-Wallis test to determine the acute effect of the treatment protocols carried out in the treatment of muscle damage after the training.

RESULTS

Table 1: Kruskal Wallis test (CK, LDH) and VAS Evaluation Results

	Test Time	Drug therapy (dolgit cream)	Honey treatment	Control group	Ort-std	P	Significant difference
	from training	group Avg	group Avg	group Avg			
CK (0-171 U/L)	24 hours before	163.00	160.85	161.71	161.85±42.18	.985	
	3 hours later	570.00	900.00	236.57	568.85±875.98	.123	
	24 hours later	3426.71	3732.71	2212.00	3123.809±2818.61	.558	
	48 hours later	9926.14	8347.42	8360.71	8878.095±7653.80	.989	
	96 hours later	11260.85	9404.57	11040.42	10568.619±6069.01	.713	
LDH (0-248 U/L)	24 hours before	183.28	185.71	162.71	177.23±41.73	.546	
	3 hours later	190.42	194.71	172.42	185.85±31.83	.273	
	24 hours later	307.42	323.42	247.42	292.76 ±142.95	.756	
	48 hours later	582.85	511.14	358.14	484.04 ± 349.89	.865	
	96 hours later	401.00	392.00	411.57	401.52± 153.66	.872	
VAS	After training						
	Day 1	4.24	2.41	4.60	3.69 ± 1.75	.027*	a-b*-b-c*
	Day 2	6.02	4.53	5.72	5.42 ± 1.76	.210	
	Day 3	6.70	5.01	5.15	5.62 ± 1.92	.265	
	Day 4	5.16	4.00	4.85	4.67 ± 1.28	.224	

* there is a significant difference between groups p <0.05 a drug treatment group, b honey treatment group, c control group
CK (creatine kinase), LDH (lactate dehydrogenase) VAS (visual analog score)

Biochemical Analysis and VAS Evaluation: From the blood samples taken 24 hours before the one-session training consisting of movements (regular push-ups, diamond push-ups, dips) that the participants in the research were not accustomed to and 3, 4, 24, and 96 hours after the training; activations of enzymes (CK, LDH), which are markers of muscle damage, in blood serum were determined as a result of biochemical analysis. When the pre-training data are analyzed, no significant difference between the groups is observed. In addition, pain scores were recorded every hour by monitoring with VAS. The scores were averaged (Table: 1).

Creatine Kinase (CK): According to the findings, when the activation of the CK (creatine kinase) enzyme in the participants' blood serum was examined, it was similar before the training and increased in all three groups in the following days. This increase between the groups is not statistically significant (Table 1).

Lactate Dehydrogenase (LDH): Regarding the results of LDH, it was observed that the activation of the enzyme LDH (lactate dehydrogenase) in the participants' blood serum was similar in all three groups before the training and demonstrated a similar increase after the training. It is comprehended that this increase was not statistically significant (P<0.05) (Table 1).

First Author, Second author, et al

DISCUSSION

Honey, as in the past, is used today in people's daily life, as a food source and for the treatment of various diseases. In the 21st century, the use and importance of honey in alternative medicine are increasing day by day.² Although the positive effects of honey on wound healing have been known among the people for centuries, scientific results have emerged recently. Depending on the type of the disease, oral and sometimes external use are encountered. To date, honey has been used for various reasons such as burn wounds, diabetic wounds, decubitus wounds,

traumatic ulcers, Fournier gangrene, malignant ulcers, chemical debridement, and anti-edema, and anti-inflammatory effect⁸ In their research stated that NSAID drugs are frequently used to prevent inflammation with acute and chronic pain and inhibit the synthesis of prostaglandin, and that they have essential effects on glomerular and tubular functions¹⁶. They also mentioned that drugs in this group could lead to critical complications like hyperkalemia, hyponatremia, edema, hypertension, acute kidney injury, acute interstitial nephritis, and analgesic nephropathy. When we examine natural honey in scientific sources in terms of the side effects mentioned above, no information about the human body's adverse side effects has been found.

The study aims to determine whether natural honey, which has been reported in many studies to show an inflammatory affect when taken orally, has the similar impact on CK and LDH release. CK and LDH are muscle damage markers when used externally, and to compare it with a drug in the NSAID (Non-steroidal) group, which is often written as an anti-inflammatory to patients' prescriptions by orthopedists and sports physicians.¹¹

When we look at the findings we obtained, it is comprehended that the activation of CK, LDH enzymes in the blood serum increases day after day. It is seen that this increase is similar in all three groups, but there is no statistically significant difference (Table 1). However, according to the data 96 hours after the training, it is comprehended that the group using natural honey in the treatment has a more mathematical decrease in both CK and LDH activation compared to the drug-using group and the control group. According to this result, it can be said that natural honey can partially contribute to the recovery of muscle damage.

When looking at the VAS assessment, the pain assessment on the 1st day after the training shows that the group treated with honey felt less pain than the drug-using and control group. However, the difference between the

scores obtained is statistically significant (Table 1). Although there is no statistically significant difference between the groups on the other days following the training, the honey group's pain scores are lower than the other two groups (Table 1). The reason for this is that the honey's anti-inflammatory affect and the softening of the tissue on which honey is applied may affect the perception of pain and the placebo effect.

When the literature on the subject of the research is examined, studies related to the oral use of honey are encountered mostly. As in the treatment protocol, we have applied, there is no one-to-one research that matches the effect of external application of natural honey on muscle damage and delayed muscle pain. Our research is unique in this respect. In his research, Ulusoy mentioned about honey as a natural food ingredient responsible for a considerable number of phytobiological activities increasing from the treatment of wounds to upper respiratory tract infections, aging and prevention of cancer due to many biological activities (antioxidant, antiradical, antibacterial, antiviral, anti-inflammatory, antitumoral, etc.) shown by various secondary metabolites, which are approximately 1% in its content. He stated that the use of honey in terms of apitherapy is an alternative, effective, and economical way to treat or prevent many diseases compared to other high-priced products and products with side effects. In another study, stated that honey has therapeutic potential, including wound healing properties and antimicrobial activity^{3,9}

CONCLUSION

When the research results in the literature are examined, it is comprehended that they are typically related to the oral use of honey and that natural honey produces positive results when used in treating diseases. According to the results obtained in this study, honey appears to benefit patients not to feel the adverse effects of muscle damage, even as a placebo effect. It is partly in line with the research results in the literature.

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