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# Assessing the impact of camel milk as an anti-arthritic agent in Rattus norvegicus caused by formaldehyde

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**Abstract:**

Camel milk long been in use in the medicine Arabian as an anti-arthritic agent. The musculoskeletal system's most prevalent autoimmune illness, rheumatoid arthritis, is linked to significant morbidity and a reduced quality of life Due to inflammatory responses, aberrant joint development and demolition have a connection to the pathophysiology of rheumatoid arthritis (RA). This study examined the effects of camel milk on joint inflammation in Rattus norvegicus using a formaldehyde-induced arthritis model. During this search, specified points were reached to assess the radiography and arthritis scores. Thirty rats from total were equally divided into five groups. The animals treated with diclofenac and camel milk from tenth day to the 24th day showed a significant lowering in the degrees of arthritis. It was displayed that the treatments led to the emergence of percentages of inhibition of arthritis and the degrees of inhibition ratio and the percentage inhibition edema in left foot in (G3 / G4) was a degree of 2, while (G5) was a degree of 3. We conclude that treatment of camel milk in the oral dose of (1 ml / day) have the ability to delay and improve joint deformities and injuries Rattus norvegicus arthritis induced by formaldehyde.

**Key words:** Camel milk, Arthritis, Formaldehyde, FIA, Diclofenac, MK

## Introduction

Rheumatoid arthritis (RA) is a long-term inflammatory autoimmune condition that damages cartilage and other body tissues, patients with RA experience joint swelling, synovial tissue inflammation, and other symptoms, this will result in a significant disability and a decrease in quality of life, around 1% of people worldwide are affected by RA (1 ; 2). Rheumatoid arthritis is a inveterate illness which results in inflammation in the synovium, primarily and produces demolition and deformation of the joints and the cause of RA is still unknown, but it is recognized to be influenced by environmental and genetic factors (3). The spread of RA is three to one in women, with adults being the peak age for patients (4; 5). The ability of RA to spread to new joints is one of the key characteristics that set it apart from other forms of inflammatory arthritis (6). Aspirin, ibuprofen and diclofenac which exhibit non-selective COX inhibition, are some of the most frequently prescribed NSAIDs to relieve short-term fever, pain, inflammation , steroidal agents and immunosuppressants are typically used as RA treatments (7 ; 8). But, their toxicity and side effects necessitate the development of substitute, more effective normal product based medications (5).

Consequently, there is dramatically increasing interest in herbal medicines between individual who suffer from RA (9).

(CM) is a superior source of nutrients a good balance, and it also demonstrates a variety of biological processes that affect digestion and responses to nutrients consumed and the growth and evolution of particular organs, and disease impedance (10). The presence of peptides and protein in milk is the primary cause of these biological activities (11). (MK) It differs from other ruminant milk in that it is high in minerals as sodium, potassium, iron, copper, of insulin. It is also low in cholesterol, sugar, and protein (12). Many studies on the genotoxic effects of chemicals, this encouraged scientists to conduct research into the characteristics of camel milk (13; 14).

Formaldehyde (HCHO) is a typical ecological poisons present in tobacco smoke, paint, dress, diesel fuel, gas and therapeutic and modern items (15). Formaldehyde incites joint pain (FIA) constant aggravation with articular changes like those seen in rheumatoid joint inflammation (16). Consequently, this examination was intended to concentrate on the impacts of camel milk on joint aggravation in male Rattus norvegicus with formaldehyde. A non-steroidal conditions in order to reduce irritation and as a pain reliever (17).

**Materials & Methods**

**Animals:**

Thirty male rats, weighing between 200 and 275 grams and aged between proper temperature, humidity, location, and food, and all rats had unrestricted access to food and water.

**Camel milk:**

Daily samples of camel milk were collected, stored in bottles and cool boxes, and fed to the rats orally.

**Experimental design:**

Five groups of six rats each, randomly assigned, were handled as follows:

| Groups | Induction FIA 1 ml/ day | Treatment | Treatment time /day |
|---|---|---|---|
| **(G1) Normal control** | **from day 0 until day 10** | **No treatment** | ------ |
| **(G2) Negative control** | **No induction** | **No treatment (distilled water)** | ------- |
| **(G3) Positive contro** | **from day 0 until day 10** | **Diclofenac (10 mg / kg / day)** | **(10 - 24)** |
| **(G4) Concurrent treatment** | | **Camel milk (0.5 ml/ day)** | |
| **(G4) Concurrent treatment** | | **Camel milk 1 ml/ day)** | |

**Induction of FIA:**

On the first and third days of the test, rats received an injection of 0.1 ml of paw thickness was then measured using a vernier caliper, before and days after induction of inflammation (18 ;19).

**Arthritis score assessment:**

Every day from day 0 until day 10 using a Caliper vernier, the incidence and severity of arthritis were assessed (18;19). The thickness of the left foot of the animals that have been treated with formaldehyde is calculated using a Verneir caliper with a unit of mm, by measuring it before

the treatment day, zero day and on the tenth day of the experiment. In determining the index of arthritis the method is followed (20) and according to the following equation:

$$\text{Arthritis index} = \frac{\text{Thethickness of the foot a day (0) - thickness foot per day (10)}}{\text{thickness foot per day (0)}} \times 100$$

On the tenth and twenty-fourth days of the experiment, the thickness of the left foot is measured in order to calculate the inhibition of arthritis in the treated animals and follows the method of (21) and according to the following equation:

$$\text{Arthritis index} = \frac{\text{Thethickness of the foot a day (10) - thickness foot per day (24)}}{\text{thickness foot per day (10)}} \times 100$$

Results are reported in the form of degrees of inhibition ratio, and the percentage inhibition edema in left foot between 15 and 20% of the effective inhibition is + 1, and if the inhibition ratio of between 20 and 50% the efficiency of inhibition is + 2, If the inhibition ratio of more than 50% of the effective inhibition + 3 (6;11).

**Radiology score assessment:**

Rats were chloroform-anesthetized on day 10 in the last day of the taken into consideration: Score 0 is normal, meaning there is no bone damage or tissue swelling. Score 1 is tissue swelling and edema, score 2 is joint erosion, score 3 is bone erosion and the development of osteophytes , follows the method of (22).

**Statistical analysis:**

expressed as mean SEM at ($p<0.05$).

**Results:**

(Table 1): All arthritic rats showed a continuous increase in arthritis scores, after injection of formaldehyde solution, the rats developed arthritis starting from day 1 onwards.

Incidence of arthritis increased ($p < 0.05$) in negative control mice (G2) compared to normal mice (G1) as a result of the inflammation induces by the formaldehyde solution.

The groups treated with camel milk and (diclofenac) from the tenth day to the 24$^{th}$ day showed a significant decrease in the degrees of arthritis. It was shown that the treatments led to the emergence of percentages of inhibition of arthritis and the degrees of inhibition ratio and the percentage inhibition edema in left foot in (G3 / G4) was a degree of 2, while (G5) was a degree of 3.

**table 1: The effect of formaldehyde-induced arthritis and the effect of treatments in male rats**

| Groups | Mean ± SEM increase in the left foot thickness (mm) during days induction of formaldehyde from day 0 to day 10 | | Arthritis index % | Mean ± SEM decrease in the left foot thickness (mm) during days Treatment oral from day 11 to the day 24 | Arthritis inhibition % | degrees of inhibition ratio |
|---|---|---|---|---|---|---|
| | 0 | 10 | | 24 | | |
| | 3.00 ±.05 | 3.38 ±.09 | 12.66 % | 3.13 ±.04 | — | — |

| | | | | | | |
|---|---|---|---|---|---|---|
| **1** | | | | | | |
| **2** | **3.20 ±.08** | **5.76 ±.46** | **80 %** | **6.10±.49** | **—** | **—** |
| **3** | **3.50 ±.21** | **5.30 ±.48** | **51.43 %** | **3.10±.04** | **41.51 %** | **2** |
| **4** | **3.03 ±.15** | **5.90 ±.04** | **94.72 %** | **3.20±.46** | **45.76 %** | **2** |
| **5** | **3.20 ±.08** | **5.65 ±.08** | **76.56 %** | **2.73±.05** | **51.68 %** | **3** |

Radiographic images of the joints of the subject revealed severe joint erosion, bone erosion, and osteophyte formation in the joints of the (G2) negative control rats in comparison with the joints of (G1) normal control rats.

Figure 1

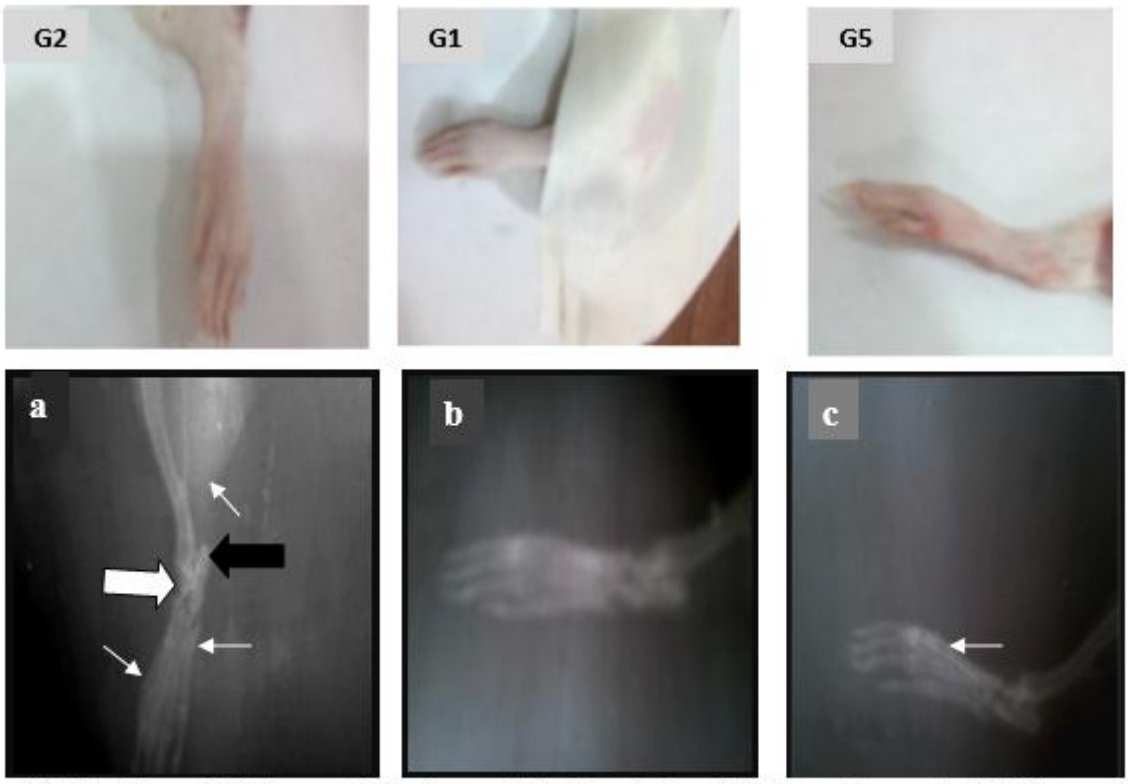


**Figure (1): Radiographic images from formaldehyde solution (G2) negative control (a) appear tissue swelling (small arrows), bone erosion (black arrows) and osteophyte formation (thick white arrow). (G1) normal control (b) showing a normal ankle joint. (G5) given 1 ml / day / oral of camel milk (c) appear a mild tissue swelling (small arrow).**



Discussion

One of the most widely used acute models for evaluating anti-arthritic potential is formaldehyde-induced arthritis, the release of histamine, serotonin, and prostaglandin-like substances at the injection site, which act by activating local pain receptors and nerve endings to create hypersensitivity in the area of injury, results in the formation of edema in the rat foot after formaldehyde (2%) injection (23 ; 24).

Macrophages initiate the pathogenic chain of events that results in the pathogenesis of RA, in the tissue of the synovium, activated macrophages participate in the inflammatory cells' activation, cell communication, over expression of MHC class II molecules, and cytokine production (25). In this study, compared to the control group, arthritis ratings in FIA rats were significantly higher, the

alteration of plasma protein caused fluid to accumulate in the synovium and the production of prostaglandins, pro-inflammatory

increase as a result of the rat's paw's joints and bones being harmed (26; 27; 28).

According to this study, rats with arthritis who received diclofenac had lower arthritis scores than those who received water. Diclofenac is a medicine that works quickly to reduce the symptoms of FIA, it does this by stopping the production of certain substances that cause inflammation in the body, this helps

This research found that drinking camel milk in of 0.5 and 1 ml each day can help to reduce swelling, redness, and stiffness in the joints. The way a certain enzyme, called cyclooxygenase-2, works is affected. This leads to a decrease in the production of a substance called prostaglandins, this happens because another substance called TNF- and IL-1 is produced less and is stopped from working, this happens because camel milk contains linoleic acid, which can delay the body's inflammatory response and reduce the number of symptoms caused by joint inflammation, thus, these adjustments will result in lower arthritis ratings, According to (29). These studies also found that camel milk has antioxidants that help protect against oxidative stress caused by FlA in rats,

also has high levels of magnesium and other important minerals, these vitamins help protect against damage to our body's tissues and have been proven to be good at stopping damage caused by toxins (30).

Radiographs show the harm that happens in patients with RA, X-rays showed that rats treated with water had their joints become narrower, eroded, and had damage to the bones and growth of new bone, this caused a big decrease in how much the joints moved in c0mparison to the rats in the c0ntrol group, The pr0duction of cytokines like TNF-α and IL-1β will increase and this will aid the spread of inflammation in FIA, either locally or throughout the body, these results are consistent with the findings of the researchers (31; 32; 33).

The X-ray results for the rats with joint inflammation (FIA) that were given diclofenac were much lower than the rats with joint inflammation that were given water, the steroid drug decreased the amount of certain chemicals in the process of bone breakdown caused by rheumatoid arthritis in rats, these results are consistent with the findings of the researcher (34). This leads to a slow lowering in the wearing away of the joints and narrowing of the space between them in RA disease, at the same time, taking a small amount of camel milk supplement (0. 5 ml per day by mouth or 1 ml per day by mouth) were found to effectively stop and decrease damage to joints and the growth of bony outgrowths, there is a big drop in the radiology scores when compared to the FIA rats who were given plain water. This radiological effect matches the discoveries in a study that was shared by (35).

**Conclusions**

We can say that people with arthritis can safely drink camel milk. However, we still need to do more research and conduct more studies before we can come to a final decision.

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