EXPERIMENTAL STUDIES OF THE WOUND-HEALING ACTION OF INULA HELENIUM AND INULA BRITANNICA THICK EXTRACTS ON THE CONVENTIONAL INJURY MODEL (PHANTOM) IN RATS

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The search of new medicines among the plant substances possessing a wound-healing effect has become important and one of the priority trends in modern medicine. This article presents the experimental studies of the wound-healing action of Inula Helenium and Inula Britannica thick extracts on the conventional injury model in rats; they contain a complex of biologically active substances mainly polysaccharide with the content ranging from 3.46 to 16.7%. Such characteristics as the area of wound-healing and the rate of healing of the wound surface have been determined in the research. The clinical observations included the visual assessment of the animals’ state: changes in activity, behaviour and appetite. Besides, such an integral index as the body weight was recorded at certain periods of time. To evaluate the effectiveness of treatment we have calculated a daily reduction of the wound area (the area of wound-healing) when applying tests-samples 1 and 2 on the basis of Inula Helenium and Inula Britannica. The samples studied show a marked wound-healing activity, accelerate proliferative processes in the wound and make connective tissues with the soft scar formation. It is accompanied with stimulation of the epithelium regeneration, its functional characteristics restoration. The area of wound healing on the 17-th day of the experiment using the extract of Inula Helenium was 9.8±2.4 mm² and the extract of Inula Britannica – 14.2±1.8 mm². It indicates a more pronounced effect of test-sample 1.

Currently, in order to prevent and treat diseases of various etiology, including ecologically causative agents, medicines based on such biologically active substances as polyphenols and polysaccharides have become common at the pharmaceutical market. Numerous studies have shown that medicines based on polysaccharides possess the immune-enhancing, antibacterial, antioxidant, hypolipidemic, wound-healing effects [3-6, 9-12].

Thick extracts of the plants studied contain a complex of biologically active substances mainly polysaccharide with the content ranging from 3.46 to 16.7%.

In this case the study of the wound-healing activity of the biologically active substances complex of Inula Helenium and Inula Britannica is of current interest.

In accordance with up-to-date concepts, the pathological process course in the wound irrespective of its causes involves three consistent phases: the first one is purulonecrotic, the second one is formation of granulations, the third one is the epithelialization phase, which transfer one into another smoothly and can not be differentiated distinctly [2, 8].

The aim of this work was to investigate experimentally the effect of thick extracts of two Inula types on the wound-healing process.

Materials and Methods

The research was carried out on the Wistar rats males with their initial body weight of 300-350 g. The rats were kept in the vivarium standard conditions at the temperature of 22-24°C and the relative humidity of 30-70% with free access to forage and water.

Standard wounds were reproduced on the anterior depilated area of the animals after the intraperitoneal injection of thiopental sodium in the dose of 50 mg/kg [1]. The conventional wound was formed by removal of the dermal area of 2 cm × 2 cm (4 cm²) in size [7]. The wound surface was irrigated with 3% hydrogen peroxide.

The animals were divided into three groups containing 6 rats in each: the first group of animals – the control (the conventional wound), which were not treated after the injury process reproduction; the second group of animals treated with the Inula Helenium thick extract after the injury process reproduction (test-sample 1); the third group of animals received treatment with the Inula Britannica thick extract after the injury process reproduction (test-sample 2).

The treatment was started 24 hours after wounds reproduction until they healed completely. Tests-samples 1 and 2 were applied onto the wounds in the form of thick water extracts in the dose of 0.05 ml/cm². The area of wounds was measured daily (except the days off) up to the terminal scab rejection.

Such characteristics as the area of wound-healing and the rate of healing of the wound surface were determined in the process of research.

The area of wound-healing ($S_{wb}$) was determined by the formula:

$$S_{wb} = S_{dr} - S_{dbr} (\text{mm}^2),$$

where: $S_{wb}$ – is the area of the wound on the day of registration in the course of the experiment, mm²; $S_{dr}$ – is the area of the wound on the day before registration, mm².
The rate of healing \( (V_{wh}) \) of the wound surface was calculated by the formula:

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V_{wh} = \frac{S_{wh}}{n} \, (\text{mm}^2/\text{day}),
\]

where: \( S_{wh} \) – is the area of wound-healing, \( \text{mm}^2 \); \( n \) – is the number of days of treatment at the time of registration.

The clinical observations included the visual assessment of the animals’ state: changes in activity, behaviour and appetite. Besides, such an integral index as the body weight was recorded at certain periods of time.

To identify the wound-healing ability of the medicines a Square programme was used.

Results and Discussion

No deviations from the norm have been found while observing the general state of the rats, their behaviour, appetite and water intake.

To evaluate the effectiveness of treatment we calculated a daily reduction of the wound area (the area of wound-healing) when applying tests-samples 1 and 2. The data are given in the Table.

While comparing the efficiency of the wound-healing effect of the samples studied it has been shown that in comparison with the control group there was a statistically significant increase of the wound healing area in 4, 5 and 12 days after the day of the wound reproduction in the group of animals treated by test-sample 1, but in those treated by test-sample 2 – in 4, 7, 10, 14 and 18 days. The fastest reduction of the wound area was observed during the first week of treatment. The wound healing dynamics analysis has shown that the total wound healing in animals treated by test-samples 1 and 2 occurred in 18 days after wounds reproduction, whereas in animals from the control group – in 22 days.

In 5 days after the start of the treatment the tissues edema decreased in animals of the control group, however, the wound healing was slower in comparison with groups of animals that were treated. In contrast to the control rats the wounds of the experimental animals the beginning of granulation development was registered in 8 days after the wound reproduction. They looked like a bright red, granular, wet, glittering tissue filling the defect resulted from injury and putting the wound edges together.

Thus, based on the research carried out concerning the effect of thick extracts of Inula Helenium and Inula Britannica on the wound-healing dynamics of the dermal conventional injuries in rats the conclusion can be made that the samples studied show a marked wound-healing activity, accelerate proliferative processes in the wound and make connective tissues with the soft scar formation. It is accompanied with stimulation of the epithelium regeneration, its functional characteristics restoration.

CONCLUSIONS

1. Thick extracts of the Inula Helenium and Inula Britannica studied possess an expressed wound-healing action.

2. The total wound healing in animals treated by test-samples 1 and 2 occurred in 18 days after wounds reproduction, whereas in animals of the control group – in 22 days.

3. The area of wound healing on the 17-th day of the experiment using the extract of Inula Helenium was 9.8±2.4 mm² and the extract of Inula Britannica – 14.2±1.8 mm². It indicates a more pronounced effect of test-sample 1. Perspectives for further research. Further research will be aimed at studying the blood biochemical indices of the animals investigated.
REFERENCES


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ЕКСПЕРИМЕНТАЛЬНЕ ВИВЧЕННЯ РАНОЗАЖИВЛЯЮЧОГО ДЕЙСТВІЯ ГУСТИХ ЕКСТРАКТІВ ОМАНУ ВИСОКОГО ТА ОМАНУ БРИТАНСЬКОГО НА МОДЕЛІ ТРАФАРЕТНОЇ РАНИ У ЩУРІВ

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Ключові слова: оман високий; оман британський; ранозагоювальна активність; програма lpSquare

Пошук нових препаратів серед субстанцій рослинного походження з ранозагоювальним ефектом є актуальним і одним з пріоритетних напрямків сучасної медицини. В статті представлені матеріали експериментального вивчення ранозагоювальної дії густих екстрактів оману високого та оману британського на моделі трафаретної рані у щурів, які містять комплекс біологічно активних речовин переважно полісахаридів, вміст яких коливається в інтервалі 3,46-16,7%. Дослідження проводили на самцях щурів лінії Wistar з початковою масою тіла 300-350 г. У процесі дослідження визначали такі характеристики: площу загоєння рани та швидкість загоєння поверхні рани. Клінічні спостереження включали візуальну оцінку стану тварин: зміну активності, поведінки, апетиту. Також через певні проміжки часу фіксували такий інтегральний показник, як масу тіла. З метою оцінки ефективності лікування нами було розраховано щодобове зменшення площ ран (площа загоєння ран) за умов застосування тест-зразків 1 та 2 на основі оману високого та оману британського. Досліджувані зразки проявляли виражену ранозагоювальну активність, прискорювали проліферативні процеси в рані та сприяли формуванню сполучних тканин з утворенням м’якого рубця. Це супроводжувалося стимулюванням регенерації епітелію, відновленням його функціональних характеристик. Площа загоєння ран на 17 день експерименту при використанні екстракту оману високого становила 9,6±2,4 мм², а екстракту оману британського – 14,2±1,8 мм², що вказує на більш виражений ефект тест-зразка 1.
материалы экспериментального изучения ранозаживляющего действия густых экстрактов девясила высокого и девясила британского на модели трафаретной раны у крыс, которые содержат комплекс биологически активных веществ, преимущественно полисахаридов, содержание которых колеблется от 3,46% до 16,7%. Исследования проводили на самцах крыс линии Wistar с начальной массой тела 300-350 г. В процессе исследования нами изучены такие показатели: площадь заживления раны и скорость заживления поверхности раны. Клинические наблюдения заключались в визуальной оценке состояния животных: изменения активности, поведения, аппетита. Также через определенные промежутки времени фиксировали такой интегральный показатель, как масса тела. С целью оценки эффективности лечения нами было рассчитано ежедневное уменьшение площади ран (площадь заживления ран) при условии использования тест-образцов 1 и 2 на основе девясила высокого и девясила британского. Исследуемые образцы проявляли ранозаживляющую активность, ускоряли пролиферативные процессы в ране и способствовали формированию соединительных тканей с образованием мягкого рубца. Это сопровождалось стимулированием регенерации эпителия, восстановлением его функциональных характеристик. Площадь заживления ран на 17 день эксперимента при использовании экстракта девясила высокого составляла 9,8±2,4 мм², а экстракта девясила британского – 14,2±1,8 мм², что свидетельствует о более выраженной эффективности тест-образца 1.