МЕДИЦИНА
MEDICINE

DOI 10.31489/2021BMG4/91-96

UDC 615.322:615.076

S.B. Akhmetova[1], K.Zh. Badekova[1]*, G.A. Atazhanova[1],
Ya.K. Levaya[1], M.K. Smagulov[2]

[1]Medical University of Karagandy, Kazakhstan;
[2]Karaganda University of the name of academician E.A. Buketov, Kazakhstan
**Corresponding author: badekova@qmu.kz*

Anti-inflammatory activity of a dental gel based on *Origanum vulgare* raw material

Inflammatory and destructive diseases of parodontosis are one of the most complex and common forms of the teeth diseases of human population. Search of the herbal preparation with anti-inflammatory activity is a prospect way for development of new drugs on the base of local raw material. A prerequisite for this study has been the presence of a high antimicrobial and anti-caries activity of the essential oil of medicinal plant *Origanum vulgare.* The article presents for the first time the results on the anti-inflammatory activity of dental anti-caries gel with essential oil and ethanol extract of oregano. A sample of dental gel at a dose of 25 mg / kg has anti-inflammatory activity, which was expressed in a significant decrease by 41.4 % in the amount of inflammatory lymph in the abdominal teeth in rats compared to controls. The anti-inflammatory activity of this sample is comparable to the reference drug diclofenac sodium.

Keywords: gel, essential oil, ethanol extract, *Origanum vulgare*, anti-inflammatory activity.

Introduction

Inflammatory and destructive diseases of parodontosis are one of the most complex and common forms of pathology and the prime cause of tooth loss among the adult population, therefore, the development and implementation of new dosage forms for the treatment of inflammatory periodontal diseases is an urgent task.

The use of herbal preparations is a promising direction today [1–5] due to the fact that the bioactive substances of medicinal plants are more related to the human body in nature, they are easier to enter into the life process, have a wider spectrum of action and are active against strains of microorganisms and viruses. Therefore, they are recommended for the prevention and treatment of many chronic diseases, including inflammatory periodontal diseases [6].

According to literature review, essential oils and extracts of many plants are used for various dental diseases [7–17]. For example, against gingivitis — *Larix sibirica, Acorus calamus, Origanum vulgare, Cedrus libani*, and etc.; against stomatitis — plants from genera *Rosa, Salvia, Chamomilla, Eucalyptus*, etc. Applications of bee wax with essential oils are actively used. Thus, for the treatment of stomatitis and ulcer were observed the beneficial effects of waxes with application of *Rose, Citrus, Salvia, Lavandula* on the mucous membranes of the mouth and prosthetic field tissue.

Essential oil of *Salvia* is effective in the treatment of root pulpits — the acute inflammatory process dies out in the pulp, its transition to the chronic stage stops. In the case of inflammation of gums, a chewing gums and preparations in the form of rinds of plants from genus *Juniper* is also used. Besides, the following essential oils are effective for the treatment of the parodontosis: *Citrus limon, Citrus x sinensis, Syzygium*

aromaticum, Monarda didyma, Myrtus communis, Citrus x bergamia, Lavandula officinalis, Thymus serpyllum, Mentha piperita, Pogostemon cablin, and etc.

The pharmaceutical market offers a wide range of drugs applied in the local treatment of inflammatory periodontal diseases [18]. However, there are a few combination of drugs. In addition, the presence of side effects, sensitivity reactions, and the phenomenon of antibiotic resistance make it paramount to search for new treatments. A prerequisite for this study was the presence of a high antimicrobial and anti-caries activity of the essential oil of medicinal plant *Origanum vulgare* [19–22].

Experimental

Raw material. As a plant material, we used the aboveground part of *Origanum vulgare* L. (family *Lamiaceae*), collected in the vicinity of the Ridder town (the Eastern — Kazakhstan region) during the flowering phase, July — August, 2020 (Fig. 1).

Figure 1. Internal view of flowering plants of *Origanum vulgare*

Before extraction, fresh leaves and flowers were dried at temperature +22 – 25 °C, avoiding exposure to direct sunlight, for 10 days. The humidity of the herb of *O. vulgare* after drying was not more than 6.38 %.

For the preparation of antimicrobial dental gel, essential oil was isolated from oregano (*Origanum vulgare L.),* which was carried out by the method of hydrodistillation. EM yield — 0.7 %. The content of cymophenol in the oil reaches up to 85 %. A thick ethanol extract of dark green color with a pleasant smell and a yield of 6.2 % was also obtained. To obtain the gel, Na-CMC was used as a gel base, glycerin, essential oil, and oregano extract as an active pharmaceutical ingredient, glycerin as a plasticizer, a sweetener — saccharin, water for dissolution.

In order to obtain 100.0 grams of gel, the calculated volume of Na-CMC was placed in a beaker with a capacity of 500 ml and poured with cold purified water, stirred and left to swell for 15–20 minutes. Then the solution was stirred with the mixer turned on 50–100 rpm until fully dissolved. Afterwards, in a separate container, the extract of oregano was dissolved in a measured amount of glycerin, and then the calculated amount of essential oil of oregano and other substances were added dropwise. The prepared solution was added to the gel base with the mixer turned on at 100 rpm and stirred until a homogeneous mass was obtained.

Statistical processing of the results was conducted using the “Statistica 6.0” software package. The results are presented as “mean ± standard error of the mean”. Intergroup differences were assessed by the nonparametric Mann-Whitney U test. Differences were considered significant at the achieved level of significance $p < 0.05$.

Discussion

Screening of a dental gel for anti-inflammatory activity

The studies were carried out on 48 white rats of both sexes with a mass 210–220 g, which were divided into 8 groups of 6 animals each: 1–6 experimental groups — animals receiving dental gel at a dose of

25 mg/kg; 7 comparison groups — animals receiving the comparison drug diclofenac sodium, 8 control groups — animals receiving the solvent.

Acute exudative reaction (peritonitis) was caused by intra peritoneal injection of 1 % acetic acid solution in a volume of 1 ml per 100 g of rat body weight. After 3 hours, the animals were sacrificed, the abdominal cavity was opened, the exudate was collected and its volume was estimated [23]. The objects under study were examined at a dose of 25 mg / kg when administered orally in the form of starch mucus. The sodium diclofenac comparison drug was administered to animals intragastrically once at an effective dose of 8 mg/kg (ED_{50}). Control animals received an equal volume of starch mucus. The test objects were injected once in 1 hour before the introduction of a 1 % solution of acetic acid.

Anti-inflammatory activity was expressed as a percentage of the decrease in inflammatory exudiation in the abdomen of experienced rats compared to control rats.

The results of an anti-inflammatory activity study of samples of test gel and sodium diclofenac are illustrated in Table 1.

Table 1

Anti-inflammatory activity of studied samples

Name samples	Dose, mg/kg	Exudate amount, ml	% to control	Anti-inflammatory activity
Control	–	7.0± 0.6	100	-
Diclofenac sodium	8	4.4 ± 0.8*	37.1	62.9
Dental gel	25	4.1 ± 0.5*	41.4	58.6

Note. * — p <0.05 compared to control.

As a result of the experiment, a sample of dental gel at a dose of 25 mg/kg was found to have anti-inflammatory activity, resulting in a reliable decrease of 41.4 % corresponding to the amount of inflammatory exudiation in the abdomen in rats compared to control.

The anti-inflammatory activity of stomatological gel with essential oil and ethanol extract of common cholera is comparable to that of sodium diclofenac.

Conclusions

It has been established that the sample of new dental gel based on common saline in vivo experiments has a high level of anti-inflammatory activity.

Acknowledgment

This research has been funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (Grant No. AP09562096).

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С.Б. Ахметова, К.Ж. Бадекова, Г.А. Атажанова, Я.К. Левая, М.К. Смагулов

Origanum vulgare өсімдік шикізатына негізделген тіс гелінің қабынуғақарсы белсенділігі

Парадонтоздың қабыну және деструктивті аурулары — адам популяциясындағы тіс ауруларының ең күрделі және жалпы түрлерінің бірі. Қабынуғақарсы белсенділігі бар өсімдіктерді іздеу жергілікті өсімдік шикізатына негізделген дәрі-дәрмектерді әзірлеудің перспективалы бағыты болып табылады. Бұл зерттеудің алғышарты *Origanum vulgare* дәрілік өсімдігінің эфир майының жоғары микробқақарсы және кариескеқарсы белсенділігінің болуы. Мақалада алғаш рет эфир майы мен этанол орегано сығындысы бар тіс кариескеқарсы гельдің қабынуғақарсы белсенділігін зерттеу нәтижелері келтірілген. 25 мг/кг дозадағы тіс гелінің үлгісі қабынуғақарсы белсенділікке ие, ол егеуқұйрықтардың іш тістеріндегі бақылауды салыстырғанда қабыну лимфасының мөлшерін 41,4 %-ға едәуір төмендеткен. Бұл үлгінің қабынуғақарсы белсенділігі диклофенак натрийінің анықтамалық препаратымен салыстырылды.

Кілт сөздер: гель, эфир майы, этанол сығындысы, *Origanum vulgare*, қабынуғақарсы белсенділік.

С.Б. Ахметова, К.Ж. Бадекова, Г.А. Атажанова, Я.К. Левая, М.К. Смагулов

Противовоспалительная активность зубного геля на основе растительного сырья *Origanum vulgare*

Воспалительные и деструктивные заболевания парадонтоза — одни из наиболее комплексных и общих форм зубных заболеваний человеческой популяции. Поиск растительных средств с антивоспалительной активностью является перспективным направлением для разработки лекарств на основе местного растительного сырья. Предпосылкой для данного исследования явилось наличие высокой антимикробной и противокариесной активности эфирного масла лекарственного растения *Origanum vulgare*. В статье впервые представлены результаты по изучению противовоспалительной активности зубного противокариесного геля с эфирным маслом и этанольным экстрактом душицы. Образец зубного геля в дозе 25 мг/кг обладает противовоспалительной активностью, которая выражалась в значительном снижении на 41,4 % количества воспалительной лимфы в брюшных зубах у крыс по сравнению с контролем. Противовоспалительная активность этого образца сопоставима с эталонным препаратом «Диклофенак натрия».

Ключевые слова: гель, эфирное масло, этанольный экстракт, *Origanum vulgare*, противовоспалительная активность.

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