UDC 615.322:616-092 **https://doi.org/10.15407/biotech18.02.060**

EFFECT OF CORNUS FRUIT EXTRACTS ON OXIDATIVE STRESS IN DIABETES

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Received 2025/02/15
Revised 2025/03/07
Accepted 2025/04/30

The biological effects of fruits from different cultivars of the cornelian cherry under diabetes mellitus remain unclear.

Aim. This study was purposed to investigate the effect of fruit extracts from various cultivars of *Cornus mas* L. on primary biomarkers of oxidative stress.

***Materials and Methods*:** oxidative stress metabolites in erythrocytes were assessed by measuring the level of lipid peroxidation and protein oxidation products.

Results. The administration of *C. mas* and *C. mas* × *C. officinalis* hybrids fruit extracts to diabetic rats significantly reduced oxidative stress metabolite levels in erythrocytes.

Conclusions: cornelian cherry fruit extracts are perspective drugs that help inhibit oxidative stress development in erythrocytes under diabetic conditions.

Keywords: cornelian cherry, diabetes mellitus, erythrocytes, oxidative stress, thiobarbituric acid reactive substances, advanced oxidative protein products, oxidatively modified proteins.

Type 1 diabetes mellitus (DM) is a severe metabolic disorder with absolute insulin deficiency that is accompanied by chronic hyperglycemia and the development of oxidative stress. Excessive formation of reactive oxygen species (ROS) and an imbalance in the antioxidants contribute to cellular damage, particularly in erythrocytes [1]. To impede diverse violations caused by oxidation, scientists are exploring natural plant materials with potent antioxidant activity. Cornelian cherry, especially *C. mas* and *C. officinalis* are promising medicinal plants that have strong hypoglycaemic properties [2].

Aim. The effects of cornelian cherry on biomarkers of cell structure oxidation in erythrocytes have not been well studied. Therefore, our study aimed to investigate the effect of fruit extracts of *C. mas* L. (`Uholok´ and `Koralovyi´ cultivars) and *C. mas* × *C. officinalis* hybrids (`Jerzy´ and `Tomasz´ cultivars) on oxidative stress metabolites — thiobarbituric acid reactive substances (TBARS), advanced oxidation protein products (AOPPs) and oxidatively modified proteins of neutral (OMP370) and essential (OMP430) nature in the erythrocytes of rats with DM.

Methods. Type 1 DM was induced in male Wistar rats by intraperitoneal injection of streptozotocin (STZ) at a dose of 55 mg/kg of body weight. The animals were divided into five groups: *first* — control group (healthy rats); *second* — rats with STZ-induced DM; *third*, *fourth* and *fifth* groups — rats with DM that were orally administered fruit extracts from the `Uholok´ cultivar of *C. mas*, fruit extract from the `Koralovyi´ cultivar of *C. mas*, and fruit extract of the hybrids of *C. mas* × *C. officinalis*, respectively, at a dose of 20 mg/kg of body weight for 14 days. The dosage and duration of cornelian cherry extract administration were based on precedent research [2]. The level of TBARS, the contents of AOPPs, and OMPs of neutral and basic nature were measured spectrophotometrically

Citation: Moroz, A. A., Brodyak, I. V., Kucharsk, A. Z., Sybirna, N. O. (2025). Effect of cornus fruit extracts on oxidative stress in diabetes. *Biotechnologia Acta*, 18(2), 60–62. https://doi.org/10.15407/biotech18.02.060

at wavelengths of 532 nm, 340 nm, 370 nm, and 430 nm, respectively [3]. Statistical analysis was performed using a one-way analysis of variance followed by Dunnett's posthoc test ($P < 0.05$ was considered statistically significant).

Results and Discussion. The progressions of oxidative stress in DM lead to ROS interaction with lipids and proteins [1]. Our results showed a significant increase in the TBARS content in erythrocytes of diabetic rats compared to the control group (Figure *A*). Administration of studied fruit extracts to animals with DM reduced the level of this lipid oxidation metabolite (Fig. *A*). The study detected a 30.8% increase in the level of AOPPs in erythrocytes of diabetic rats (Fig. *B*). Additionally, our findings indicate a notable increase in the level of OMPs neutral and basic nature in the erythrocytes of rats with DM (Fig. *C*). The obtained results we associated with excess oxidants and a deficiency of antioxidants [4]. Oral administration of fruit extracts from the `Uholok´ and `Koralovyi´ cultivars and the hybrids `Jerzy´ and `Tomasz´ cultivars to diabetic rats led to a 25.3%, 52.7%, and 29.7% decline in TBARS content, respectively; 24.3%, 16.7% and 34.2% decrease in AOPPs level, accordingly; 35.6%, 27.7% and 35.2% decrease in OMPs of neutral nature content, respectively; and 30.7%, 26.7% and 30.2% decline in OMPs of basic nature level, accordingly (Fig. *A*, *B* and *C*). Such results suggested the potential of the extracts of cornelian cherry to reduce lipid and protein oxidation in blood erythrocytes.

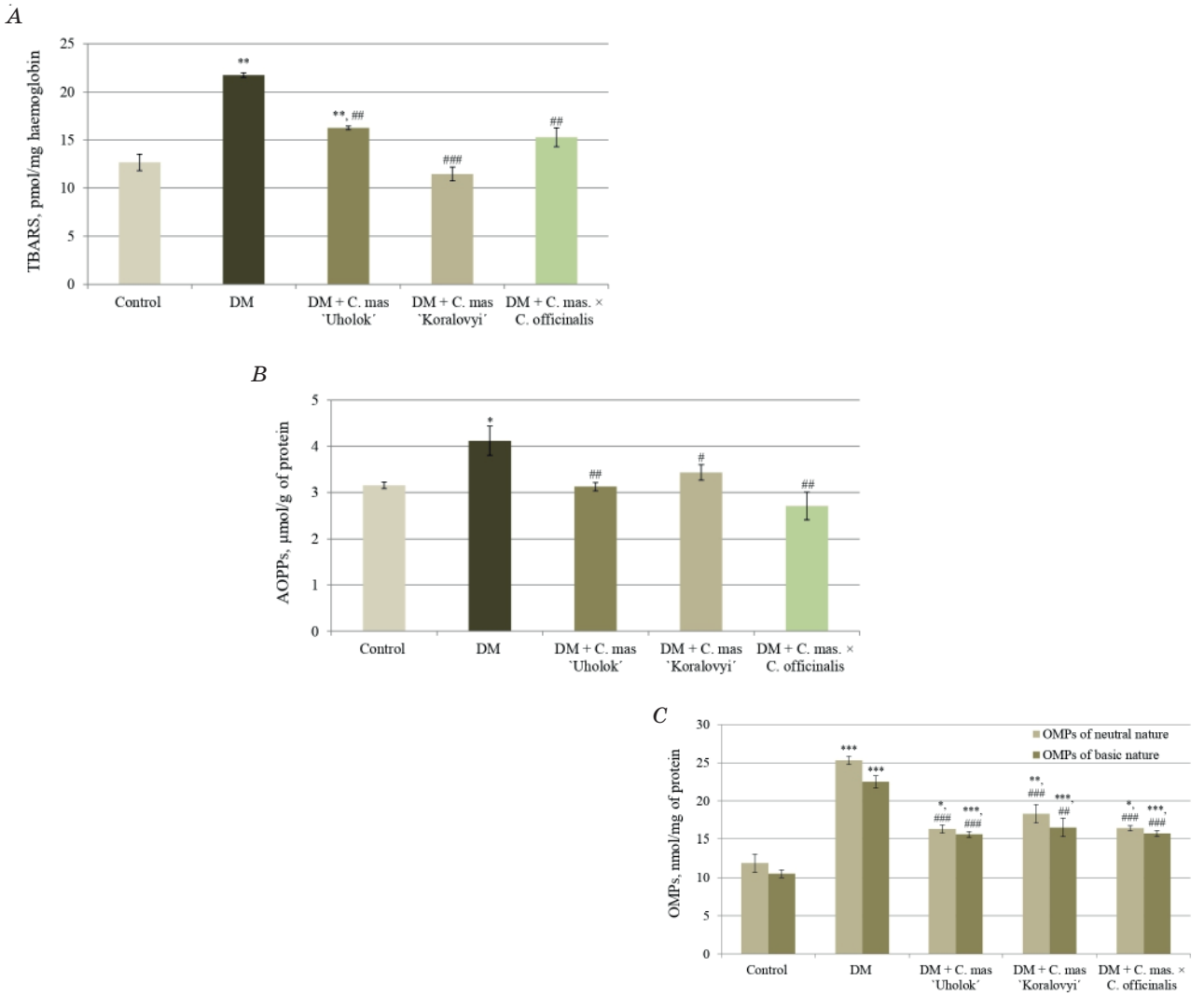

Figure. **Effect of fruit extracts from the `Uholok´ and `Koralovyi´ cultivars of *C. mas* L. and the hybrids of *C. mas* × *C. officinalis* `Jerzy´ and `Tomasz´ cultivars on the level of TBARS (*A*), AOPPs (*B*) and OMPs (*C*) in erythrocytes of rats with DM**

Note: All data are presented as the mean ± SEM ($n = 8$).
* — $P < 0.05$, ** — $P < 0.01$, *** — $P < 0.001$ compared to the control group;
# — $P < 0.05$, ## — $P < 0.01$, ### — $P < 0.001$ compared to the diabetic group

Conclusions. The fruit extracts of cornelian cherry inhibited the oxidation of erythrocytes structural components by ROS and prevented the accumulation of oxidative stress biomarkers in DM. The following positive effect can be attributed to the synergetic influence of bioactive components of extracts, such as iridoids, anthocyanins, tannins, flavonols, and phenolic acids.

Authors' contribution

A.A. Moroz — executing the biochemical part of the work on animal models, data analysis, graphical materials, writing, and presentation; I.V. Brodyak — conceptualization, data analysis, and writing; A.Z. Kucharska — analysis of *Cornus* fruit extracts composition; N.O. Sybirna — conceptualization and supervision.

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