EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 9
Issue: 4
486-488
Year: 2022

MEMBRANE ACTIVE PROPERTIES OF SOME POLYPHENOL COMPOUNDS

Tolliboyeva Feruza To'lqin Qizi[1], Afzalova Sayyora Abduahadovna[3], Kukanova Nargiza Fahritdinovna[2], Pozilov Mamurjon Komiljonovich[1,2]*, Abdulladjanova Nodira Gulomjanovna[4]

[1]National University of Uzbekistan Named After Mirzo Ulugbek, Tashkent, Uzbekistan.
[2]Institute of Biophysics and Biochemistry at the National University of Uzbekistan Named After Mirzo Ulugbek, Tashkent, Uzbekistan.
[3]Tashkent State Pedagogical University Named After Nizami.
[4]Institute of Bioorganic chemistry of Academy of Sciences of Republic of Uzbekistan.

***Corresponding Author: Pozilov Mamurjon Komiljonovich**
Institute of Biophysics and Biochemistry at the National University of Uzbekistan Named After Mirzo Ulugbek, Tashkent, Uzbekistan.

Article Received on 14/02/2022 **Article Revised on 07/03/2022** **Article Accepted on 28/03/2022**

ABSTRACT
In this study, the effect of gossitane and plantagin polyphenols on the respiration and oxidative phosphorylation processes of rat liver mitochondria under in vitro experimental conditions was studied. Rat liver mitochondria were isolated using differential centrifugation. The effect of polyphenol compounds on the respiratory rate and various metabolic processes of the liver mitochondria was determined by polyarography. The calculation of the respiration coefficient and ADP/O values was performed using the Chans method. Concentrations of 20, 40, and 60 μM were selected because the gossitan ($C_{177}H_{154}O_{85}$) polyphenol was an individual compound selected for screening for the experiment. Since plantagin polyphenol compound consists of 4 composite compounds, their concentration was studied in μg / ml. Concentrations of plantagin 10 μg/ml, 20 μg/ml and 30 μg/ml were selected. Mitochondrial respiration accelerated as the concentration of gossitan in the incubation environment increased. While this was evident in case V_3, no significant change was observed relative to control in case V_4. Respiratory control and ADP/O value on mitochondrial Chans decreased at low concentrations of gossitan and plantagin, while at higher concentrations the respiratory coefficient and ADP/O index returned to control. With increasing concentrations of gossitan polyphenols in the incubation environment, mitochondrial respiration and oxidative phosphorylation began to have a positive effect on metabolic conditions. Plantagin polyphenol was found to increase liver mitochondrial respiration and oxidative phosphorylation processes relative to respiratory control and ADP/O performance.

KEYWORDS: Liver, mitochondria, respiratory rate, oxidative phosphorylation, gossitan, plantagin.

INTRODUCTION
Today, the response of cells to the action of biological substances in various pathological conditions is widely studied. Currently, there is an increase in demand for such natural drugs in medicine. It is no coincidence that in today's world there is a growing demand for treatment with natural preparations derived from plants, because biologically active substances derived from plant raw materials have a number of advantages over synthetic drugs. Plant raw materials contain natural substances necessary for the proper functioning of tissues and cells. One such natural biologically active substance is flavonoids, more than 10,000 species of which are now known to science [Saraei R. et al., 2019]. However, the biological activity and physiological mechanisms of action of all of them have not been sufficiently studied. Flavonoids are the largest class of phenolic compounds, distinguished by their structural structure, diversity, high biological activity, and low toxicity. Many representatives of flavanoids may exhibit antioxidant, cardioprotective, hepatoprotective, neuroprotective, and membrane stabilizing properties [Tungmunnithum D et al., 2018].

A number of questions remain unresolved regarding the effects of polyphenol compounds such as gossitane and plantagin on mitochondrial respiration and oxidative phosphorylation processes. In this regard, the authoritative scientific laboratories of many foreign countries are currently conducting intensive research in this area.

The purpose of the work. To study the effect of goscitan and plantagin polyphenol compounds on mitochondrial respiration and oxidative phosphorylation process and peroxidation of lipids.

MATERIALS AND METHODS

The polyphenolic compound gossitan, the structural formula of which is shown in Fig. 1, was isolated by us from the common cotton *Gossypium hirsutum* L. (malvaceae family) [Mavlyanov, 2002].

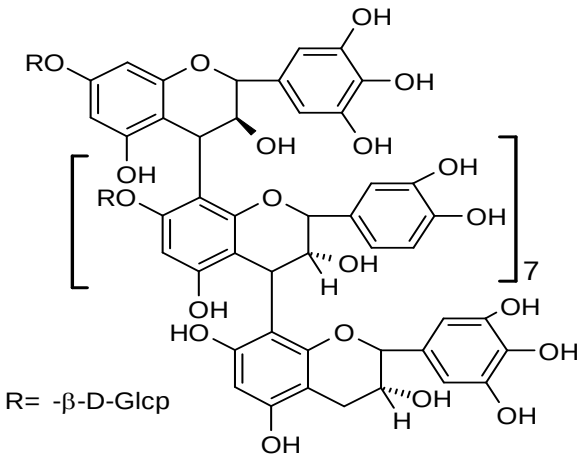

Figure 1. Structural formula of Gossitan ($C_{177}H_{154}O_{85}$) polyphenoine.

More than 15 flavonoid compounds and their derivatives, as well as other phenolic compounds, have been isolated from the P. *Major* plant by various researchers. In our experiments, the fraction containing a mixture of hydrolysable tannins (conditionally named Plantagin) yielded 4.56 g, i.e. 38.0% of the amount of polyphenols. Four individual compounds were isolated by rechromatography of this fraction on a silica gel column in the diethyl ether-ethyl acetate solvent system from a ratio of 2:8 to pure ethyl acetate.

Experiments were performed on outbred white rats weighing 180–200 g. Liver mitochondria were isolated by differential centrifugation [Schneider WC, et al., 1948]. The composition of the medium for isolation of liver mitochondria: 250 mM sucrose, 1 mM EDTA, 10 mM Tris-HCl, pH 7.4; Mitochondria were resuspended in isolation medium without EDTA.

The rate of mitochondrial respiration in various metabolic states and the values of respiratory control (RC) and ADP/O coefficients were determined according to the Chance method [Chance 2001]. When calculating respiration rates and parameters of oxidative phosphorylation, the oxygen content in 1 ml of the medium was taken equal to 500 ng-oxygen atoms at 26^0C.

The content of mitochondrial protein was determined by the method of Lowry modified by Peterson [Peterson GL. 1970]. The Origin 6.1 program was used for statistical processing of the results. A $P<0.05$ value was considered as an indicator of significant differences.

RESULTS AND DISCUSSION

In experiments, the effect of FAD-dependent substrate-succinate oxidation on mitochondria of rat liver and concentrations of gossitane at 20, 40 and 60 μM was studied. In the presence of a concentration of 20 μM of gossitane in the incubation medium, mitochondrial respiratory rate was inhibited by 14.4±1.1% relative to control in case V_3, and no significant change was found in control in case of V_4. However, when the concentration of gossitane in the incubation medium was increased to 40 μM, the respiratory rate of mitochondria in V_3 was close to the control, while at 60 μM it was 7.5±0.3% more active than in the control. At mitochondrial respiration rate V_4, gossitane concentrations of 40 and 60 μM were found to be 6.1±0.2% and 9.8±1.0% more active, respectively, than controls (Table 1).

Table 1: Influence of gossitane on respiration and oxidative phosphorylation of liver mitochondria in the presence of FAD-dependent substrate.

Experimental conditions	Respiratory rate ng atom O/min mg protein		RC	ADP/O	DNF
	V_3	V_4			
succinate					
Control	101.5±4.4	25.2±2.2	4.02±0.24	1.92±0.08	97.5±4.5
Gossitan 20 μM	86.9±4.6*	23.5±2.0	3.69±0.22*	1.81±0.09*	84.2±4.7*
Gossitan 40 μM	98.5±5.5	24.7±1.4	3.98±0.31	1.86±0.08*	89.2±5.4
Gossitan 60 μM	109.1±6.2	25.7±1.5	4.24±0.34	1.91±0.09	104.5±6.1

Note: (*P<0.05; **P<0.01; n=5).

Hence, mitochondrial respiration was accelerated as the concentration of the polyphenol compound in the incubation medium increased. While this was evident in case V_3, no significant change was observed relative to control in case V_4.

Respiratory control and ADP/O value on mitochondrial Chans decreased relative to control under the influence of goscitane at 20 μM, while respiration coefficient and ADP/O value at 40 μM were restored and approached control. While a concentration of 60 μM of gossitan completely restored mitochondrial respiratory control, it was noted that the ADP/O value was slightly higher than the control (Table 1). It was noted that the effect of dinitrophenol (DNF) separating the oxidative phosphorylation process was 20 and 40 μM gossitan slightly reduced the separation under control under existing conditions, while its amount of 60 μM was

increased relative to control. Hence, gossitan polyphenols at a small concentration of 20 µM begin to partially degrade oxidative phosphorylation of liver mitochondria. However, at 40 and 60 µM, oxidation and phosphorylation may exhibit functional activity in combination.

In our next experiment, we studied the effect of FAD-dependent substrate-succinate oxidation of rat liver mitochondria on the process of of, another polyphenolic compound plantagin at concentrations of 10, 20 and 30 µg/ml. In the presence of a concentration of 10 µg/ml of plantagin in an incubation medium, no significant change in mitochondrial respiration rate was observed in case V_3. However, in the V_4 case, the respiratory rate was found to be 51.5±4.2% higher than the control. When the concentration of plantagin in the incubation medium was increased to 20 µg/ml, the respiratory rate of mitochondria in case V_3 was not significantly different from the control, while at 30 µg/ml it was unreliably activated by 10.2±1.01% compared to control. Concentrations of 20 and 30 µg/ml of plantagin were found not to alter mitochondrial respiration rate V_4 status relative to control (Table 2).

Table 1: Effect of plantagin on respiration and oxidative phosphorylation of liver mitochondria in the presence of FAD-dependent substrate.

Experimental conditions	Respiratory rate ng atom O/min mg protein		RC	ADP/O	DNF
	V_3	V_4			
succinate					
Control	102.4±6.7	22.5±2.8	4.54±0.35	1.98±0.09	96.8±5.4
Plantagin 10 µg/ml	98.5±5.2	34.1±3.1*	4.21±0.32	1.74±0.08*	92.6±6.2
Plantagin 20 µg/ml	104.5±6.6*	22.0±2.2	4.75±0.38	1.87±0.09*	99.5±4.7
Plantagin 30 µg/ml	112.9±6.8	21.6±2.0	5.23±0.45	2.07±0.06*	104.3±5.9

Note: (*P<0.05; **P<0.01; n=5).

Respiratory control and ADP/O values according to Chans of hepatic mitochondria were reduced relative to control under the influence of 10 µg/ml of plantagin. However, concentrations of plantagin at 20 and 30 µg/ml were found to be slightly increased in the respiratory rate under control under existing conditions. ADP/O values were found to decrease at a concentration of 20 µg/ml relative to control, but increased at 30 µg/ml (Table 2). ADP, which separates the oxidative phosphorylation process, was found to further activate the decomposition with increasing concentrations of plantagin. Based on the experimental results obtained and the analysis of the available literature data, it can be hypothesized that the effect of goscitan and plantagin polyphenols on the functional activity of rat liver mitochondria may be related to the effect of I-respiratory complex on oxidative phosphorylation system.

CONCLUSION

Mitochondrial respiration accelerated as the concentration of goscitan in the incubation environment increased. While this was evident in case V_3, no significant change was observed relative to control in case V_4. Respiratory control and ADP/O value on mitochondrial Chans decreased at low concentrations of goscitane and plantagin, while at higher concentrations the respiratory coefficient and ADP/O index returned to control.

REFERENCES

1. Chance Mitochondria in pathology / Ed. M.N.Kondrashova, Yu.G.Kaminsky, E.I.Maevsky. Pushchino, 2001; 156.
2. Mavlyanov S.M., Abdulladjanova N.G., Pirniyazov A.J., Dalimov D.N., Salikhov Sh.I. Polyphenols of some plants of Uzbekistan and its activites // 23rd IUPAC-2002. Int. Symposium on the Chemistry of Natural Products. -Florence-Italy, 2002; 195.
3. Peterson GL. A simplification of the protein assay method of Lowry et al. which is more generally applicable. Analytical biochemistry, 1977; 2: 346-356.
4. Saraei R, Marofi F, Naimi A, Talebi M, Ghaebi M, Javan N, Salimi O, Hassanzadeh A. Leukemia therapy by flavonoids: future and involved mechanisms. J Cell Physiol, 2019; 234: 8203-8220.
5. Schneider WC, Hageboom GH, Pallade GE. Cytochemical studies of mammalian tissues; isolation of intact mitochondria from rat liver; some biochemical properties of mitochondria and submicroscopic particulate material. J. Biol. Chem., 1948; 172(2): 619-635.
6. Tungmunnithum D, Thongboonyou A, Pholboon A, Yangsabai A. Flavonoids and other phenolic compounds from medicinal plants for pharmaceutical and medical aspects: an overview. Medicines (Basel), 2018; 5(3): 1-16.