

Comparative dynamics of neutrophil mitochondrial activity across resveratrol delivery routes

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Background. Neutrophils are a tractable biosensor for systemic mitochondrial status. We implemented a “mitochondrial passport” based on intravital fluorescence of live leukocytes and compared the impact of different trans-resveratrol delivery routes [1, 2].

Methods. Prospective pilot in healthy adults (27–38 y; n=74): pellets 200 mg (n=16; ~91% bioavailability), transdermal 100 mg (n=20; ~95%), capsules 4000 mg (n=18; ~+30% vs. standard), tablets 500 mg (n=20; ~1% effective, first-pass). Metrics at baseline and 1 month: leukocytes with mitochondrial accumulation (MA), spontaneous membrane damage (oxidative stress, OS), NBT (oxygen-energy metabolism), phagocytosis, and ribosomal accumulation [3].

Results.

Table 1. Comparison of different methods of resveratrol delivery and its effect on leukocyte mitochondria depending on bioavailability

	Normal % of live stained leukocytes visualized in all fields of view	Resveratrol pellets 200 mg (total bioavailability about 91%) (n=16)			Resveratrol capsules 4000 mg (GS4000, Japan (bioavailability +30% of the standard) (n=18)			Resveratrol 100 mg transdermally (bioavailability 95%) (n=20)			Resveratrol tablets 500 mg (bioavailability 45%, first pass rule 80%, total bioavailability about 1%) (n=20)		
		to	1 month after	growth	to	1 month after	growth	to	1 month after	growth	to	1 month after	growth
Protein metabolism (number of leukocytes with accumulation of ribosomes)	60-80	39	63	38,1	20	30	33,3	30	57	47,4	49	52	5,8
Mitochondrial activity (number of leukocytes with mitochondrial accumulation)	30-60	0	47	100,0	10	23	56,5	11	38	71,1	11	20	45,0
Oxidative stress (test of spontaneous assessment of leukocyte membrane damage)	0-20	50	18	-177,8	35	50	30,0	70	23	-204,3	50	33	-51,5
Oxygen and energy metabolism of granulocytes (NST test)	30-60	15	18	16,7	0	68	100,0	17	33	48,5	55	67	17,9
Phagocytosis of granulocytes (latex test)	40-60	27	35	22,9	10	18	44,4	30	37	18,9	27	35	22,9

Conclusion. Delivery route and effective bioavailability critically shape neutrophil mitochondrial response to resveratrol. Pellets 200 mg and transdermal 100 mg outperform oral tablets and avoid the unfavorable OS rise seen with high-dose capsules. The mitochondrial passport is a sensitive, low-burden biomarker to personalize resveratrol delivery.

References (selected):

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2. Panov S. A. et al. A new approach to medical rehabilitation and palliative care for patients with oncopathology in the context of integrative medicine // Actual problems of theoretical and clinical medicine. - 2024. - Vol. 45. - No. 3. - P. 46-67.
3. Patent for Utility Model No. 6180, Baltabekov N.T., Panov S.A., Saidvakasov R.A. "Method for Assessing Neutrophil Activity in Cancer Patients"