Arachidonic acid rich ARASCO oil prevents type 1 diabetes mellitus

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Abstract

Background and Aim: To study the anti-diabetic action of ARASCO oil that is rich in arachidonic acid (AA, 20:4 n-6) in Wistar rats – *in vivo*.

Methods: ARASCO (100µl) was given orally to alloxan-induced type 1 diabetic Wistar rats using pre and simultaneous treatment schedule. The diagnosis of diabetes was confirmed when blood glucose value >250mg/dl. At the end of the experiment, animals were sacrificed and blood ad other tissues were collected to measure lipid peroxides, nitric oxide, anti oxidants and fatty acid analysis.

Results: In the present study, we observed that oral supplementation of ARASCO oil rich in AA protected the animals against alloxan-induced type 1 DM. ARASCO oil significantly attenuated chemical-induced diabetes mellitus and restored the antioxidant status to normal range as well. Changes in the concentrations of different fatty acids shown by the phospholipid fractions of plasma, liver, and muscle tissues that occurred as a result of alloxan-induced diabetes mellitus also reverted to normal in these animals.

Conclusion: Based on current study, we suggest that arachidonic acid can prevent alloxan-induced type 1 DM by enhancing antioxidant status and suppressing production of cytokines.

Introduction

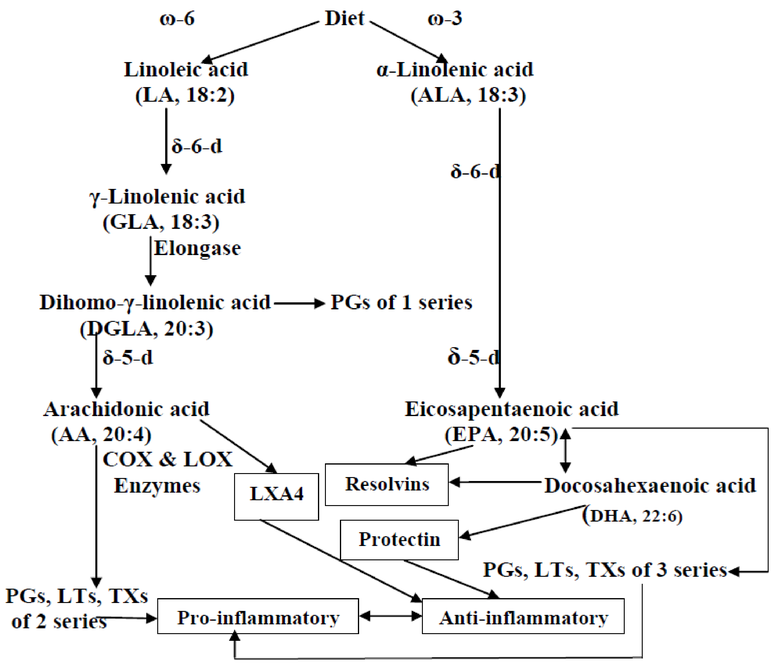


Figure 1. Metabolism of essential fatty acids-LA and ALA

Intellectual property Rights

US Patents

➢Inventor: U N Das; Title: Method of stabilizing and potentiating the action of anti-angiogenic substances. Patent no: 6,380,253. Date of grant: April 30, 2002.

➢Inventor: U N Das; Title: Methods for selectively occluding blood supplies to neoplasias. Patent no: 6,426,367. Date of grant: July 30, 2002.

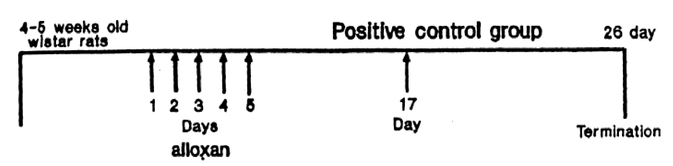
➢Inventor: U N Das; Title: Method of stabilizing and potentiating the action of anti-angiogenic substances. Patent no: 6,617,354. Date of grant: September 9, 2003

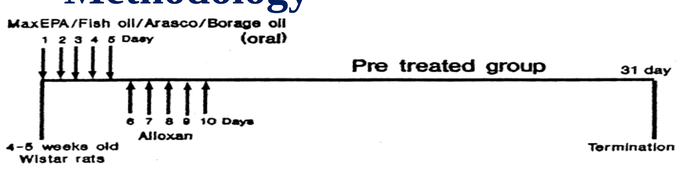
➢Inventor: U N Das; Title: Method of stabilizing and potentiating the action of anti-angiogenic substances (US 7,666,910) awarded on Feb 23, 2010).

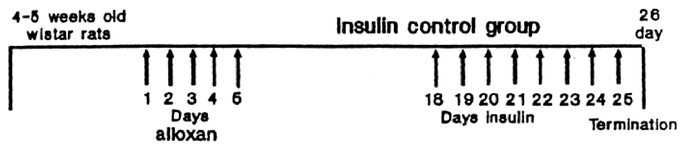
➢Inventor: U N Das; Title: Method(s) of preventing, arresting, reversing and treatment of atherosclerosis (US 8, 153, 392, issued on April 10, 2011).

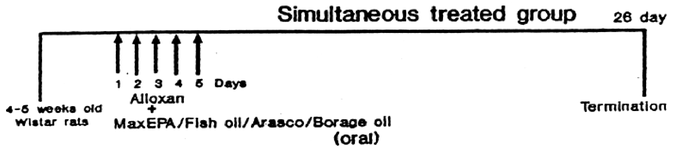
Awarded 3 patents in India as the sole inventor. Another 5 patents are pending in India.

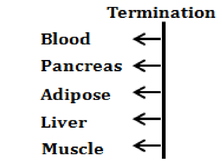
Methodology











Estimated lipid peroxides, nitric oxides, anti oxidants and fatty acid analysis.

Results

PERCENTAGE DISTRIBUTION OF FATTY ACIDS OF PLASMA PHOSPHOLIPID FRACTION OF WISTAR RATS TREATED WITH ALLOXAN, INSULIN, AND ARASCO OIL

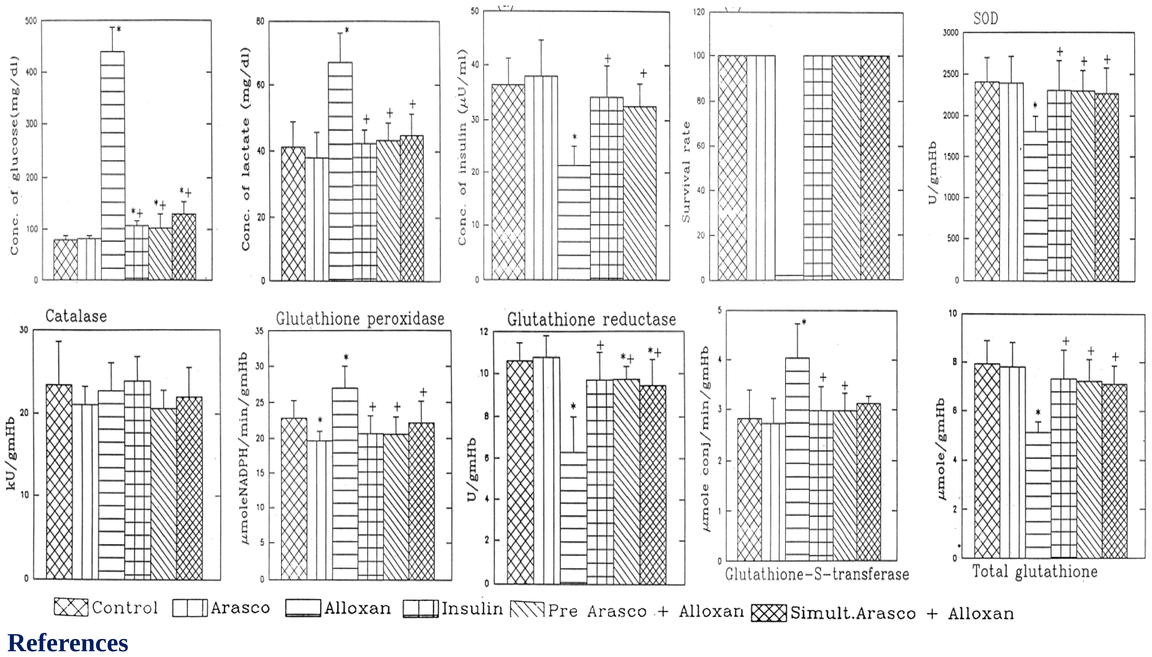
Fatty acid	Control (n = 12)	Arasco oil (n = 12)	Alloxan (n = 12)	Insulin (n = 12)	Arasco oil + alloxan: Pretreated (n = 12)	Arasco oil + alloxan: Simultaneously treated (n = 12)
16:0	23.15 ± 1.68	23.22 ± 0.94	23.64 ± 2.19	23.39 ± 2.48	22.20 ± 2.40	23.50 ± 1.61
18:0	17.20 ± 1.67	16.90 ± 1.72	16.63 ± 1.85	17.48 ± 2.38	11.80 ± 1.5*†	12.9 ± 1.8*†
18:1	11.21 ± 0.99	11.22 ± 1.08	12.39 ± 1.05*	11.34 ± 1.03	11.28 ± 2.07	11.47 ± 1.36
18:2	21.64 ± 1.89	20.78 ± 1.71	22.88 ± 2.58	21.05 ± 1.97	24.29 ± 2.81*	24.45 ± 3.78
18:3 ω-6	0.50 ± 0.10	0.47 ± 0.13	0.26 ± 0.10*	0.47 ± 0.11†	0.32 ± 0.11*	0.43 ± 0.18†
20:3	0.89 ± 0.38	0.67 ± 0.17	0.57 ± 0.15*	0.82 ± 0.33	1.39 ± 0.39*†	0.47 ± 0.15*
20:4	18.93 ± 2.46	21.44 ± 1.22*	14.84 ± 1.35*	19.10 ± 2.44†	20.56 ± 3.63†	19.6 ± 2.3†
18:3/18:2	0.023	0.022	0.011	0.022	0.013	0.017
20:4/18:2	0.87	1.03	0.65	0.90	0.84	0.80
20:4/20:3	21.26	32.0	26.03	23.29	14.79	41.63
18:3 ω-3	0.41 ± 0.17	0.33 ± 0.12	0.43 ± 0.21	0.43 ± 0.18	0.35 ± 0.16	0.32 ± 0.15
20:5	0.28 ± 0.09	0.50 ± 0.24*	0.16 ± 0.09*	0.24 ± 0.08	0.61 ± 0.39*†	0.63 ± 0.3*†
22:6	1.20 ± 0.32	1.18 ± 0.15	1.47 ± 0.32	1.28 ± 0.30	2.56 ± 0.27*†	1.54 ± 0.28*
20:5/18:3	0.68	1.51	0.37	0.55	1.74	1.96
22:6/20:5	4.28	2.36	9.18	5.33	4.19	2.44

* $P \leq 0.05$ versus control group.
† $P \leq 0.05$ versus alloxan-treated group.

SUMMARY OF CHANGES IN FATTY ACID LEVELS IN THE PL FRACTION OF PLASMA, LIVER, AND MUSCLE TISSUE IN CONTROL RATS VERSUS RATS TREATED WITH ALLOXAN AND ARASCO OIL

Treatment	Plasma PL fraction		Liver PL fraction		Muscle PL fraction	
Alloxan	GLA ↓, DGLA ↓, AA ↓, EPA ↓	OA ↑	GLA ↓, DGLA ↓, AA ↓, EPA ↓	SA ↑	GLA ↓, DGLA ↓, AA ↓, EPA ↓	
Alloxan + Arasco oil	SA ↓	LA ↑, GLA →, DGLA ↑, AA →, EPA ↑, DHA ↑		GLA →, DGLA →, AA →, EPA →		GLA →, LA →, AA ↑, EPA →
Arasco oil		AA ↑, EPA ↑	OA ↓, LA ↓	AA ↑		AA ↑

↑, Increased; →, same as control group; ↓, decreased; AA, arachidonic acid; DGLA, dihomo-γ-linolenic acid; DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; GLA, γ-linolenic acid; LA, linolenic acid; OA, oleic acid; PL, phospholipid; SA, stearic acid.



Discussion

ARASCO may prevent type 1 DM in experimental animals by restoring to normal antioxidant and cytokine status and activating PPARs. In patients with DM, hypertension and coronary heart disease, we observed decreased plasma AA levels. AA metabolites such as PGI2 (prostacyclin) and lipoxin A4 have potent platelet anti-aggregator, vasodilator and anti-inflammatory actions. Based on this data, it is proposed that supplementation of AA or AA-rich ARASCO oil is of benefit to patients with DM, hypertension, and coronary heart disease. It is also suggested that AA has anti-inflammatory actions and may function as an endogenous anti-diabetic, anti-hypertensive and anti-atherosclerotic molecule. In view of this, it is likely that oral supplementation of ARASCO oil rich AA may be considered for all patients with DM, hypertension and coronary heart disease.

References

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