Effects of Cardiac Protection by Anthocyanin on Cardiac Dysfunction in Diabetic Rats

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Abstract

Diabetes represents a major threat to human health, with global incidence projected to reach 300 million by 2025. Cardiovascular complications including coronary heart disease and peripheral vascular disease are regarded as primary causes of morbidity and mortality in both type 1 and type 2 diabetes. Compelling epidemiological and clinical evidence has identified a specific cardiomyopathy in diabetes, characterized by cardiac dysfunction and adverse structural remodeling. In addition, epidemiological studies also suggest that increased consumption of anthocyanins lowers the risk of cardiovascular disease (CVD). The aim of the study was to identify the role of anthocyanin in type 1 diabetic model. Diabetes was induced in five-week-old male wistar rats using streptozotocin, then progressed for 1 weeks. The treatment of extract product from purple rice, anthocyanins were gastrogavage for 4 weeks constantly. Cardiac diastolic and systolic function was assessed using ecocardiogaphy, and heart weight, cardiomyocyte morphology, protein level were also assessed individually. As a result, anthocyanins significantly inhibited fas-associating protein with death domain (FADD) activation, both of prevent cardiomyocyte disarray and restored cardiac function.

Experimental Design

Fourty Wistar rats at 5 weeks of age were randomly divided into four groups, Control, Diabetes mellitus and Diabetes mellitus treated with Antrocyanin 250 mg/kgw and 500 mg/kgw (ANT250 and ANT500) groups for 4 weeks. Cardiac function determined by echocardiography Before sacrificed. The excised left ventricle from rats were measured by histological analysis, western blotting, and TUNEL assays. Diabetes mellitus induced cardiac abnormalities including abnormal myocardial architecture, and more cardiac TUNEL-positive apoptotic cells.

Results

Table 1. Body weight and Cardiac characteristics of Control, DM group and Antrocyanin

	Control	DM	ANT250	ANT500
Body weight,g	417.50 ± 16.65	257.50 ± 44.44***	275.00 ± 31.4o***###	292.50 ± 16.58***###
Whole heart,g	1.15 ±0.09	0.83± 0.03***	0.90 ± 0.07***	0.89 ± 0.09**
Left ventricular,g	0.82 ± 0.04	0.57 ± 0.06***	0.64 ± 0.06***	0.61 ± 0.06***
WHW/BW(10^3)	2.75 ± 0.19	3.28 ± 0.54*	3.27 ± 0.22**	3.02 ± 0.23
LVW/BW(10^3)	1.95 ± 0.12	2.25 ± 0.27*	2.34 ± 0.12***	2.09 ± 0.18*##
WHW/Tibia(10^2)	2.59 ± 0.30	2.14± 0.16*	2.23 ± 0.20	2.21 ±0.21
LVW/Tibia(10^3)	18.95 ±0.80	14.78 ± 1.71***	15.92 ± 1.39**	15.32 ± 1.56**###
Tibia (mm)	43.03 ± 1.39	38.84 ±0.57*	40.20 ± 0.57**	40.00 ± 1.19**

Values are means ± SD among Wistar rats (control) , streptozotocin-induced diabetic rats (DM) and diabetic rats with Antrocyanin 250 mg/kgw and 500 mg/kgw (ANT250 and ANT500). P<0.05, significant differences versus control group, P<0.01 **, significant differences versus control group, P<0.001 ***, significant differences versus control group, P<0.01 ##, significant differences versus DM group, P<0.001 ###, significant differences versus DM group .*

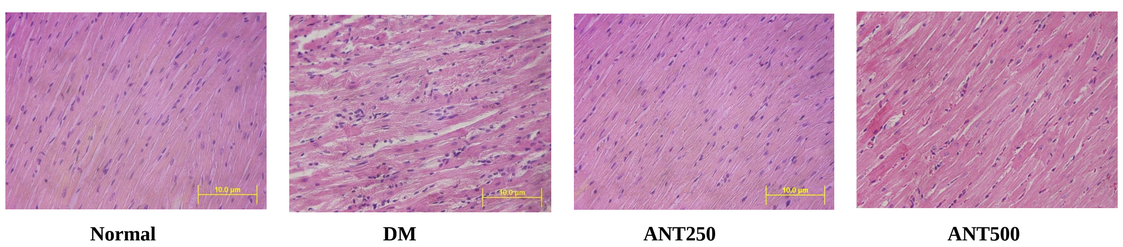


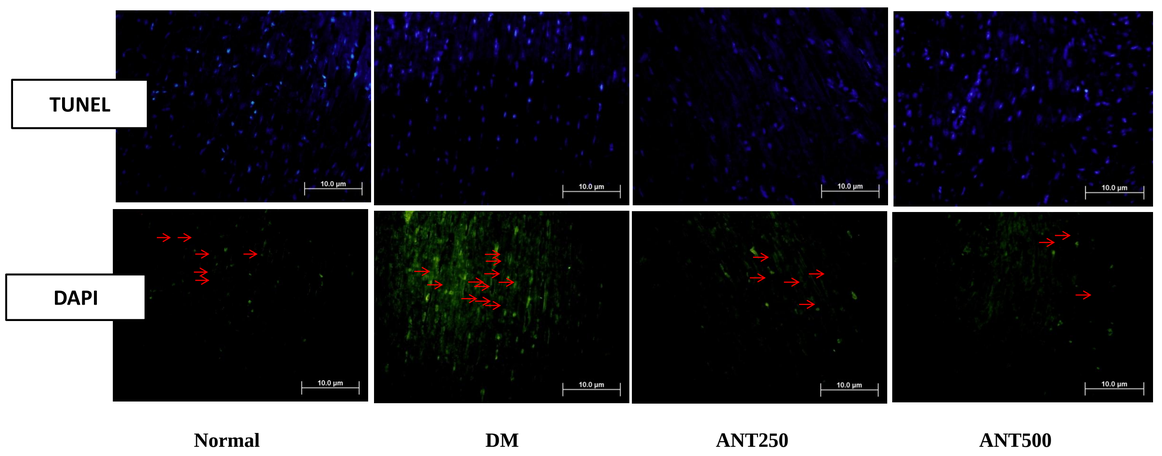
Fig. 1 Hematoxylin-eosin staining

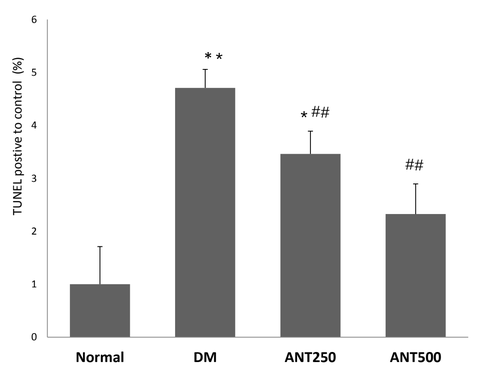
Representatives of histopathological analysis in the sections of cardiac tissue stained with hematoxylin and eosin. The images of myocardial architecture were magnified and ×400.

Table 2. Cardiac function determined by echocardiography of Control, DM group, Antrocyanin

	Control	DM	ANT250	ANT500
EF(Teich) [%]	80.97 ± 2.85	65.98 ± 3.86***	75.98 ± 3.56###	75.84± 3.79###
%FS [%]	44.98 ± 2.98	32.27 ±2.67***	40.26± 3.23##	40.19 ±3.29###

Values are means ± SD among Wistar rats (control) , streptozotocin-induced diabetic rats (DM) and diabetic rats with Antrocyanin 250 mg/kgw and 500 mg/kgw (ANT250 and ANT500). P<0.001 ***, significant differences versus control group. P<0.01 ##, significant differences versus DM group. P<0.001 ###, significant differences versus DM group





P<0.05*, significant differences versus Normal group
P<0.01 **, significant differences versus Normal group
P<0.01 ##, significant differences versus DM group.

Fig. 2 Antrocyanin had protective effects in diabetes- induced apoptosis.

Influence of Antrocyanin in diabetic rat induced cardiomyoblast apoptosis by DAPI (4, 6-diamidino-2-phenylindole ; 1 g/ml) staining and TUNEL assay.

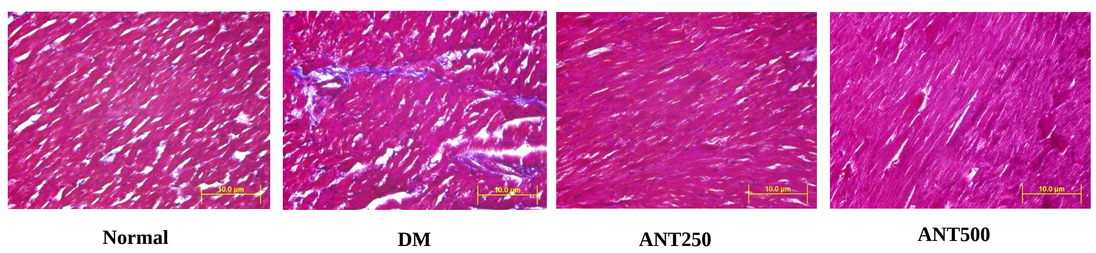


Fig. 3 Masson's Trichrom staining

Representatives of histopathological to observe collagen. The images of myocardial architecture were magnified and ×400.

Conclusion

In the present investigation, diabetes mellitus induced cardiac contractile dysfunction and apoptosis. Our findings demonstrate that inhibition of collagen product and further increased cardiac systolic function of Antrocyanin. This study suggest that Antrocyanin provides cardiovascular protection on cardiac contractile function and apoptosis.