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Effects of pharmacologic preconditioning by natural honey on arrhythmias and infarct size in isolated heart

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Objectives: In this study, prophylactic effects of natural honey as a pharmacologic preconditioning agent on ischemia/reperfusion (I/R) induced cardiac arrhythmias and infarct size were investigated in isolated rat heart. **Methods:** Isolated rat hearts were mounted on a Langendorff apparatus then subjected to 30min regional ischemia followed by 120min reperfusion. In control group, the hearts were perfused by a modified Krebs-Henseleit solution throughout the experiment, however, in the test groups they were perfused by enriched Krebs solution with natural honey (0.25, 0.5 and 1%) 10min before to 10min after ischemia. The arrhythmias were analyzed based on the Lambeth conventions. The infarct size was determined by Triphenyltetrazolium chloride and planimetry methods. **Results:** At the ischemia, the total number of ventricular ectopic beats (VEBs) in the control group was 667±116 while perfusion of natural honey (0.25, 0.5 and 1%) reduced it to 128±35 (p<0.01), 161±35 (p<0.01) and 303±94 (p<0.05), respectively. The number of ischemic ventricular tachycardia (VT) and the time spent in VT were significantly lowered by the same concentrations. Honey (0.25 and 0.5%) decreased the incidence of VT from 100% (control) to 13% (p<0.001) and 25% (p<0.01), respectively. During reperfusion phase, the number of VEBs and VT were significantly reduced by all used concentrations. In addition, honey (0.25%) significantly decreased the incidence and time spent for reversible ventricular fibrillation. Moreover, perfusion of honey (0.25, 0.5 and 1%) reduced infarct size from 46.3±2.9% (control value) to 3.3±1.3, 9.2±1.9 and 11.7±2.2%, respectively (p<0.001 for all). **Conclusion:** The results of this study showed antiarrhythmic and anti-infarct properties of natural honey as a preconditioning agent against I/R injuries in isolated rat heart. Probably, antioxidant activity of honey, scavenging of free radicals and presence of energy sources such as glucose may involve in these cardioprotective effects.

Key words: Natural honey, Arrhythmias, Infarct size, Pharmacologic preconditioning, Ischemia/Reperfusion, Isolated heart.

(I/R)

Lambeth

± (p<0.01) ± % / /

VT (VT) (p<0.05) ± (p<0.01)

(p<0.001) % / / VT % / / VT VEBs

/ ± / % / / (Rev VF)

(p<0.001) / ± / (p<0.001) / ± / (p<0.001) / ± / ()

I/R

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(Pharmacologic preconditioning; PP)

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(I/R)

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In Vitro

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(±)

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/

(PP

% /

.(mg/kg-ip)

.()

(pH= /)

(% %)

.()

) % / /

.(± VEBs

: (p<0.05) ± (p<0.05) ±

.() (p<0.05) ±

Risk Zone () ± VT

± (p<0.01) ± (p<0.001) ±

VT (p<0.05)

.(p<0.05 p<0.001) % / /

/ ± / % / % /

/ ± / (p<0.001) / ± / (p<0.001) ± VT

(p<0.01) ± (p<0.001) ±

(p<0.001) .() %

± () ± mm³ % /

± mm³ ±) Rev VF

" / .(

% / / .(p<0.001) % /

.(p<0.05) VT

% /

Risk Zone

.()

% /

: % / / :

Mean±SEM

Irrev VF	Rev VF	VT	Rev VF (sec)	VT (sec)	VEBs	VT	Salvos	Single
		±	±	±	±	±	±	±
		***†	±	± ***††	± **	± ***††	± ***††	± *** (% /)
		***	±	± ***††	± **	± ***††	±	± (% /)
			±	± *	± *	± **	±	± (%)

VT; Ventricular Tachycardia, VEBs; Ventricular Ectopic Beats (Single+Salvos+VT), Rev VF; Reversible Ventricular Fibrillation, Irrev VF; Irreversible Ventricular Fibrillation.

. % p<0.01 †† p<0.05 † . p<0.001 *** p<0.01 ** p<0.05 *

		Mean±SEM							
Irrev VF	Rev VF	VT	Rev VF (sec)	VT (sec)	VEBs	VT	Salvos	Single	
			±	±	±	±	±	±	
	*†	***†	± *†	± ***†	± *	± ***††	± ***††	±	(% /)
		*	±	± **°	± *	± **°	±	±	(% /)
			±	±	± *	± *	±	±	(%)

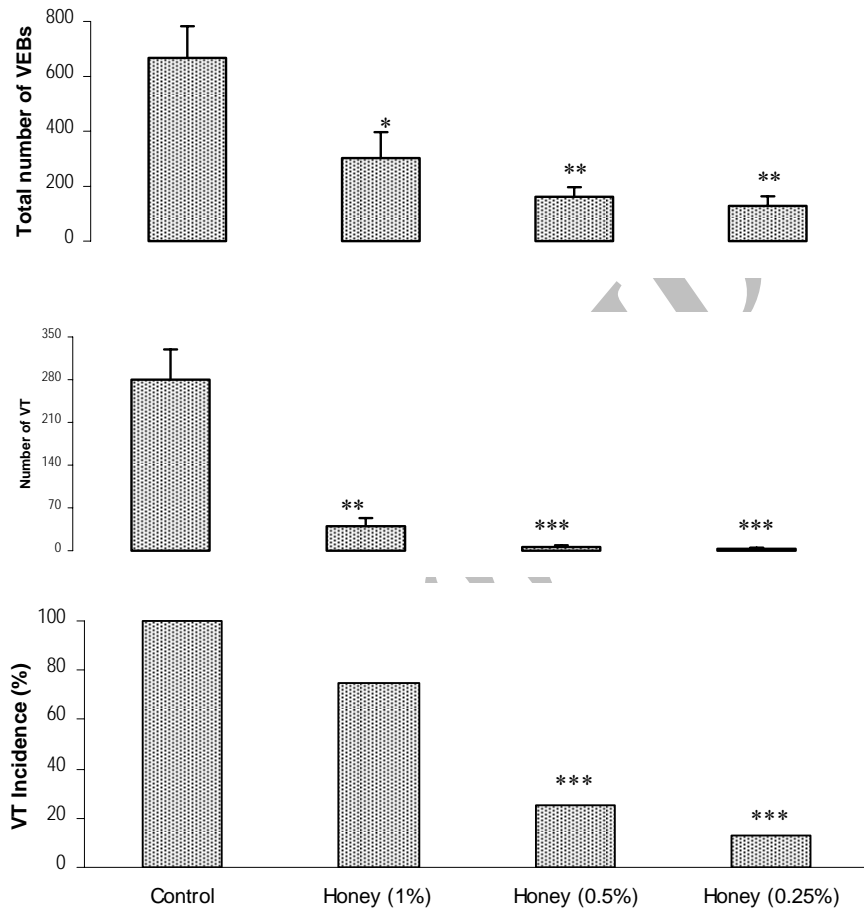
VT; Ventricular Tachycardia, VEBs; Ventricular Ectopic Beats (Single+Salvos+VT), Rev VF; Reversible Ventricular Fibrillation, Irrev VF; Irreversible Ventricular Fibrillation.

p<0.05 ° . % p<0.01 †† p<0.05 † . p<0.001 *** p<0.01 ** p<0.05 *

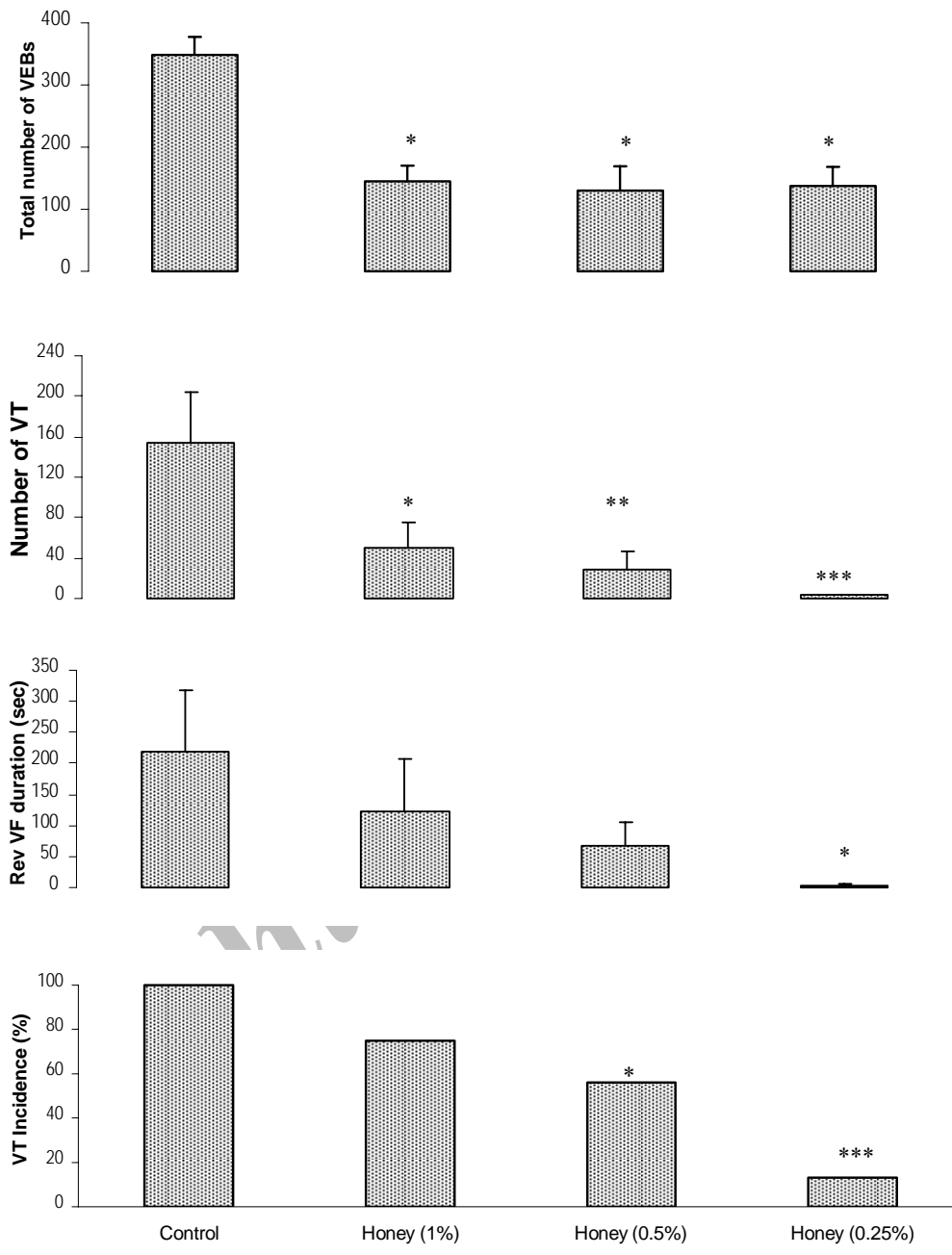
(Risk zone volume) % / / (Infarcted volume)

	(mm) ³	(mm) ³	
/ ± /	±	±	
/ ± / *	± *	±	(% /)
/ ± / *	± *	±	(% /)
/ ± / *	± *	±	(%)

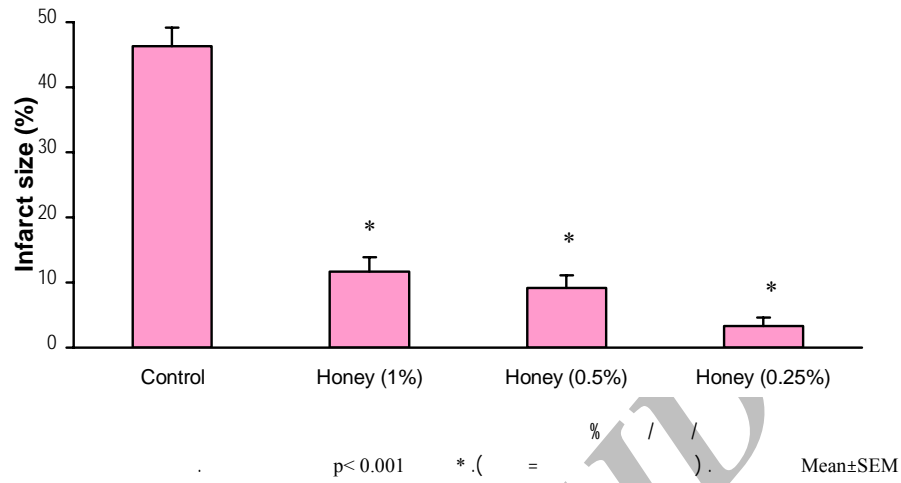
p< 0.001 * . Mean±SEM



(VT) SEM±Mean (VEBs) % / / VT p<0.001 *** p<0.01 ** p<0.05 * . :



(VT) (VEBs) % / / VT
 p<0.001 *** p<0.01 ** p<0.05 * : SEM±Mean



) % (p<0.01) % (p<0.001) %
 (I/R
 % / % /
 % / VT
) % Salvos %
 % / VT
 %
 VT VF
 VT VEBs
 ()
 VT ()
 % /
 Rev VF I/R
 ()
 % / /
 VT " I/R
 % / % / /
 VEBs
 VT
 / /
 () % VT %

I/R

In Vitro
 ()

Gheldof ()

Buckwheat honey ()

In Vivo ()

Schramm ()

()

()

() Maillard

In () ()

Vivo

()

tumor necrosis % / / I/R

IL-6 interleukin (IL)-1 β factor-Alfa (TNF- α) (p<0.001)

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() (p<0.001)

" I/R

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In Vivo

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