

Norepinephrine/Free Fatty Acid -- their Growth, Decay and Diffusion at Locally Sonicated White Adipose Tissue with the Specific Ultrasound and Insight of the Mechanism

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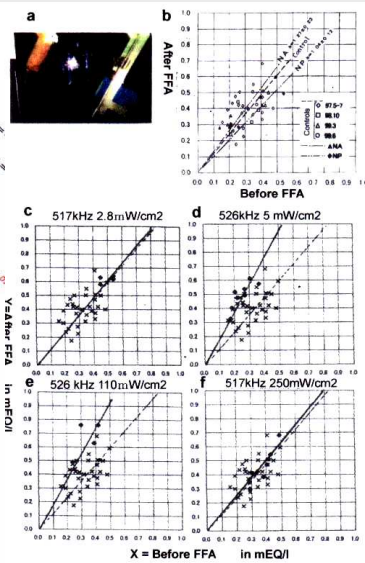
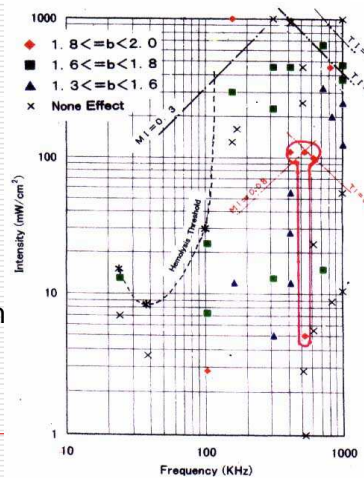
1. Background

1-1 Specific (517kHz-110mW/cm², NARL)
ultrasound doubled Noradrenaline (Norepinephrine)

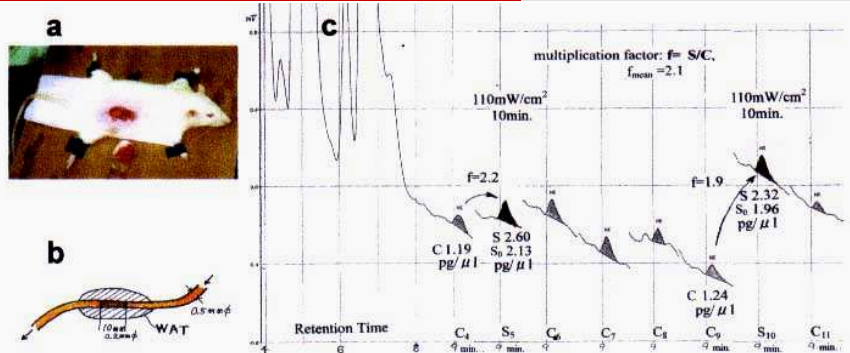
Whole Rat body was sonicated in
10min in 36 water

FFA was
increased.

Effective
frequency was
specific; 517kHz.
FFA was 2
folded in 110~5
mW/cm²,
independently with
sound energy &
independently
with Before FFA.



1-2 NA contribution was proved at locally sonicated WAT mass

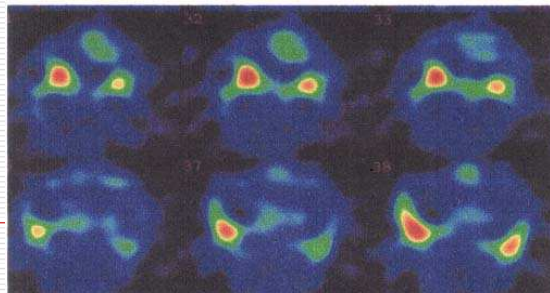


- # The released NA in intercellular liquid of Rat WAT mass was measured with micro dialysis and liquid chromatograph technology under anesthesia.
- # Every 15min, dialysis liquid were sampled. Within a certain period ,the WAT was 10min-sonicated and compared with the just before sample.
- # The NA was 2 folded at the sonicated period.
- # The released NA triggers lipolysis at nearby adipocytes.

1-3 NA release was visualized at Human Salivary Glands

- # Radio labeled NA* was injected ,
- # The NA* concentrates at Sympathetic Nerve Endings of Salivary Glands
- # Left Salivary Gland was NARL sonicated, and Right one was not.
- # The NA* distribution was visualized with Single Photon Emission Computer Tomography.

The Sonicated Left Side lost NA* by release, On the contrary, the non sonicated right side shows strong NA* concentration.



2 Growth and Decay of NA/FFA while and after NARL sonication

2-1 Objectives;

- # To take NA dynamic behavior for insighting mechanism.
- # To optimize sonication procedures

2-2 Protocole;

- # A staying needles were inserted at elbow and hand vein of right forearm.
- # The 20min recess was taken for mental mitigation.
- # Right forearm was NARL sonicated
- # Blood was sampled from elbow and hand initially and at each 1 min or proper min.s intervals.
- # NA and FFA was analyzed.

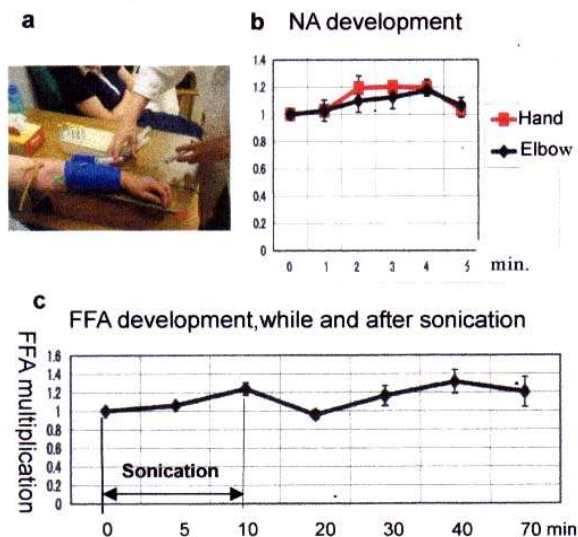
2-3 results

- # NA reached 1.2 fold at 2~4 min.
- # NA decreased to 1.03 at 5 min. and tends to 1.0 at 10min.
- # FFA was multiplied 1.2 fold at the end of 10min sonication.
- # FFA remained ~1.2 still in 70 min or more.

2-4 Conclusion

- # NA storage in vesicles of sympathetic nerve endings looks limited..

- # The NA storage may be exhausted in 10min. 10min is enough at a site.
- # NA spilt over into blood was fairly large.
- # Local sonication still may have whole body fat loss.
- # FFA remaining period without recomposing back to Fat, was fairly long, so 6 site-shifted sonications may be available before exercise.

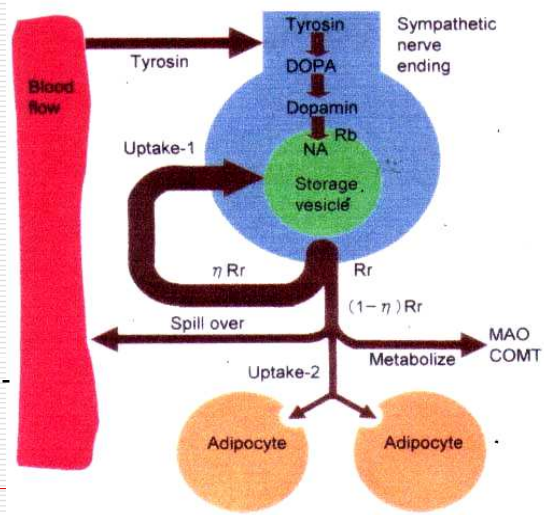


3 Insight of NA release at sympathetic nerve endings

3-1 NA release at steady state

NA is made from Tyrosin and stored in the vesicles in the endings.
 # The scheme of Noradrenaline release was cleared quantitatively by ³H labeled Tyrosin.

Central nerve controls NA release out rate R_{ro} at optimum. Same NA is composed and born newly ; R_b
 # There found a great NA circulation; Release R_r from vesicles and reuptake R_r to the vesicles (uptake-1). Usually, $\eta = 0.8-0.9$,
 # Really release out NA is $R_{ro} = (1 - \eta)R_r$ and small as 10~20% of R_r



3-2 NA release At NARL sonication

- NARL looks to increase release channels and / or decrease uptake channels so as to decrease reuptake ratio from η to η' .
- The η' -decrease increases R_{ro} transiently, where the transient Multiplication Factor ; M_f is

$$M_f = \frac{1 - (\eta' - \eta)}{1 - \eta} = 1 + \frac{\eta - \eta'}{1 - \eta}$$
- The temporal M_f increase means exhausting of stored NA in the vesicles, because the new supply is limited at R_b by central nerve control. So M_f returns to 1.0 in 10min.
- The multiplication factor during 10min sonication, is a time integral of M_f in 10min. This was "2 fold" at the experiment of 1-2.
- The 2 fold FFA multiplication looks reasonable from the 2 fold NA multiplication.

4 Conclusion

- NARL sonication releases NA from the NA storage vesicles in sympathetic nerve endings and exhausts the storage in 10min.
 - NARL sonication is deduced to modify the release and/or uptake-1 channels, namely great circulation particularly existing at the sympathetic nerve endings.
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- NA released in 10min NARL sonication, was doubled at the sonicated site.
 - FFA generation at nearby WAT was also doubled in 10 min at the site.
 - The spilt over NA into blood flow was recognized and whole body weight loss was also confirmed (JASSO 2005).
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Supplements

- Details of the background data are displayed under.
 - The document is prepared for the speech on
**CONGRÈS NATIONAL DE
MÉDICINE ESTHÉTIQUE**
to be held on Oct 26 2005 Paris.
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