·2Ⓐ·

ß5$s Rg1 ½‡:;#$<=>ëffi/ fiªflDEⒸ  fl¼fl$þflN

# !"" #Y¾ P'% )¢ +,

100050,Ⓐª½ffih3‰5"7G9½  ;<ffi(!"".#Y¾.P'%.)¢.+,) @Afl@:+,,Email: [tian\_mz@139.som](mailto:tian_mz@139.som)

D0I:10.S760Isma.j.issn.167S-4S78.2017.0S.00S

["#] %  PQß5$s Rg1(ginzenozide Rg1, Rg1)½‡:;#$<=>ëffi/fiªflDEⒸ  Tfl$þ%fl NW fi( 72 ¼ƒfl 6 0¾ €57BL/6J fië¿$Ⓒfl`y$cyfi 4 Ⓒ(gⒸ 18 ¼):½h+fliⒸflⒸ(€on+NS Ⓒ).½h+ Rg1 Ⓒ(€on+Rg1 Ⓒ).‡:;#$+fliⒸflⒸ(Sev+NS Ⓒ).‡:;#$+Rg1 Ⓒ(Sev+Rg1 Ⓒ)W Sev+NS Ⓒª Sev+Rg1 Ⓒynfl

{flq 6~8 d g$sq 3%‡:;+100%¿½#$ 2 k,€on+NS Ⓒþ €on+Rg1 Ⓒfiëflwx0¾®$w¼} 100%¿½W #

$~ 30 min ⓟⒸyn¾fliⒸfl(1 ml·kg-1·d-1)‚ Rg1(10 mg·kg-1·d-1)ƒ„ƒⒸW ⓟⒸ$ 12 ¼fiëƒ$ 31~37 $fl‰

‹Œ,fiyëŽ$q$‘fl Beztern blot “ë”•q–$$ 95(poztzynaptis denzity 95, PSD-95)š›,%œfië(gⒸ 6

¼)ƒ$ 8 $#$$fiq%‰ ELISA “ë‘fl ATP þ¡½¿£(reastive oxygen zpesiez, ROS)fl¤W )$ fl €on+NS Ⓒ fl¦,Sev+NS Ⓒ$ 35~37 $fl‰‹Œ§¨©fi/[(35.6±4.5).(28.3±3.5).(21.9±2.4) z fl(45.7±8.1).(41.9±8.8).(35.1±12.4) z]

­®§fi(P<0.05),¤±²`[4(8,2)²fl 2(6,0)²]­®³´(P<0.05),PSD-95 fl¤[(100±6)%fl(77±6)%]­®µ¼(P< 0.05),ROS fl¤[(100±4)%fl(121±11)%]­®ƒ¸(P<0.05),ATP fl¤[(100±6)%fl(82±7)%]­®µ¼(P<0.05)W Sev+Rg1 Ⓒ

fl €on+Rg1 Ⓒfl¦,31~37 d fl‰‹Œ§¨©fi/. zfi¤±²`.PSD-95 fl¤.ROS fl¤þ ATP fl¤}ª½fi¿ÀyÁ$ (P>0.05)W )+ Rg1 ªT‡:;#$<=>ëffi/fiªflDEⒸ, %flNªDflfiN¿flxÆfl¼ÇÈflflDÊË Ì”•ª ½$§W

[-./] ß5$s Rg1; fiªflDEⒸ; ‡:;; >ë

Effects of ginsenoside Rg1 on sevoflurane anesthesia induced long-term cognitive dysfunction in neonatal mice Miao Huihui, Hong Fangsiao, Ding Guannan, Xhang Ye, Tian Ming

Departnent of Æne‹the‹iology, Beijing Friend‹hip Ho‹pital, Capital Medical Univer‹ity, Beijing 100050, China (Miao HH, Hong FX, Ding GN, Xhang Y, Tian M)

Corre‹ponding author: Tian Ming, Enail: [tian\_nx@139.con](mailto:tian_nx@139.con)

[Abstract] Objective Obzerving tke effestz of ginzenozide Rg1 (Rg1) on zevoflurane aneztkezia indused sognitive

dyzfunstion in neonatal mise. Methods Seventy two €57BL/6J mise at poztnatal day 6 were randomly divided into tke following four groupz(n=18) assording to tke random number table: sontrol witk normal zaline(NS) group(€on+NS group), sontrol witk Rg1 group (€on+Rg1 group), zevoflurane aneztkezia witk NS group (Sev+NS group) and zevoflurane aneztkezia witk Rg1 group (Sev+Rg1 group). Tke mise were zubjested to 3% zevoflurane pluz 100% O2 or 100% O2 2 k daily for 3 sonzesutive dayz, rezpestively. Tke mise in

different groupz were given intraperitoneal injestionz of NS (1 ml·kg-1·d-1) or Rg1 (10 mg·kg-1·d-1) kalf an kour before aneztkezia,

rezpestively. Tke Morriz Bater Maze tezt waz performed at poztnatal day 31–37 witk 12 mise in eask group. Tke kipposampuz tizzue waz sollested after tke bekavioral tezt to meazure tke exprezzion level of poztzynaptis denzity 95 protein (PSD-95). ELISA waz uzed to tezt tke ATP and reastive oxygen zpesiez (ROS) levelz in tke kipposampuz immediately after tke lazt aneztkezia at day 8 witk 6 mise

in eask group. Results €ompared witk tke €on+NS group[(35.6±4.5), (28.3±3.5), (21.9±2.4) z], tke ezsape latensy in morriz water maze tezt of Sev+NS group at poztnatal day 35 –37 were insreazed zignifisantly [(45.7 ±8.1), (41.9 ±8.8), (35.1 ±12.4) z] (P<0.05).

€ompared witk tke €on+NS group 4 (8, 2), timez asrozz tke platform in morriz water maze tezt of Sev+NS group were desreazed zignifisantly 2(6, 0)(P<0.05). €ompared witk tke €on+NS group [(100±6)%] (P<0.05), tke exprezzion level of PSD-95 of Sev+NS group

[(77±6) %] were desreazed zignifisantly. €ompared witk tke €on+NS group [(100±4)%], tke ROS level of Sev+NS group [(121±11)%] were insreazed zignifisantly(P<0.05). €ompared witk tke €on+NS group[(100±6)%], tke ATP levelz of Sev+NS group[(82±7)%] were desreazed zignifisantly(P<0.05). In addition, for Sev+Rg1 group, tke ezsape latensy and timez asrozz tke platform in morriz water maze tezt, tke sontent of PSD-95, tke ROS and ATP levelz were not zignifisantly different witk €on+Rg1 group (P>0.05). Conclusions Rg1 san alleviate zevoflurane aneztkezia indused kipposampuz-dependent long-term sognitive dyzfunstion in neonatal mise, wkisk iz azzosiated witk tke oxidative ztrezz, mitoskondrial dyzfunstion and zynaptis plaztisity in kipposampuz.

[Key words] Ginzenozide Rg1; €ognitive dyzfunstion; Sevoflurane; Neonatal mise

‡234%6fl  y$½<%>fl#$Øfi "#$‰flª‰G  Hy$Kfl$—O fifly$ T,>flW‡23þ';Z#$ª½flfl\_ëffi

/yfic½eⒸ,gªhfl¿flkl.Ønofiþ

k.qrflheⒸ§v§[1 -4]z ß|$s Rg1(gin-

zenozide Rg1, Rg1) %fi¾ƒ„ØKß|y$$

{  Šfl$s$—,Œ$Ž¿flkl.'‘’ý§ fiªflhfl¼fl$[5]O ™/š›œfi Rg1 hžfi ª 23‰fl  ¢£@¥$$¨-3 (sazpaze-3) ©flþ ATP fl¬­¼[6]z $ysfl³´ Rg1 µ¶·½‡ 23‰fl  \_ëffi/fiªflheⒸ%p$fl¼fl

$þ%v§fl z

1. !"fifi%
   1. fifl½¼þyⒸ

€57BL/6J fië 72 ¼,6 0¾, $ÂÃÄÅ}y š›fiflØÇÈ,ÉⒸ"Ìfiš›fiflÎÏÐ·

$$fi,g’ÂÃÄÅ}yflÖ"Ì@‰Äƒš

›fiflÐ·@Û½‰ß ¿$Ⓒflây$åyfi 4

Ⓒ(çⒸ 18 ¼):½ê+fl·ⒸflⒸ(€on+NS Ⓒ).½ ê+Rg1 Ⓒ(€on+Rg1 Ⓒ).‡23#$+fl·ⒸflⒸ (Sev+NS Ⓒ).‡23#$+Rg1 Ⓒ(Sev+Rg1 Ⓒ)ß ⓟ

Ⓒ$ 12 ¼fië¾ïïfiyðë, ò 6 ¼#$$fi õ%‰$flïflflðëß

* 1. #$fiå

fië$ƒzT þfi‰$,$$fl§fi,‰fl Q&ⓟ$—'fl, —)\*#$fl+$¿½ª‡2 3,fl—)\*#$½fl.ëfi(Okmeda Detax,$¾)

.ë‡23. ¿½ª=¿fl23ß Sev+NS Ⓒª

Sev+Rg1 Ⓒfiëy5fl{flõ 6~8 d ç$\*q 3%

‡23+100%¿½#$ 2 kß #$8¼Ø,: zT þfi‰fi<4<ïƒg‰Gfiëfl@ 37 ª,flG fië:}C®ß €on+NS Ⓒþ €on+Rg1 Ⓒfiëflv

k0¾®$v¼G 100%¿½ß ß|$s Rg1 H ƒØ¾ⒸKⒸð¿yƒ, fi$Mƒ$PQfl, v½yÇSW 800,TUfi €42H72O14,Wƒ 4 ªfl·

ⒸflØß #$™ 30 min ⓟⒸy5¾ïfl· Ⓒfl (1 ml·kg-1·d-1)Y Rg1(10 mg·kg-1·d-1)Z[ƒⒸß

* 1. ïfiyðë

ⓟⒸ$ 12 ¼fië¾ïïfiyðë,fl 6~8 d ç

$’ 3%‡23#$ 2 k õ,ƒ{flõ$ 31~37 $¿

$ Morriz fl\_ƒb,T$½fiëfifi¬f  gh ifi/þzfi¬fZâ$m,þ$fiëoGyfic

½hƒ%fiªflh  qqß 'stu 80 sm, $w

150 sm,yfi 4 y ,ƒ¬f$ƒ$— }$fl



Øu 1 sm,flþ¬f$~µ]$,fl‚ 14 sm;

{Z½¼ 4 yfl¼ ƒfië$fl,†8:fi  ˆ ŠfiŒcfiƒfl‘ß ½$flYfifi¬f Gfighifi/,$%¬“”ß ‰¬f,cfifië zfi¬fƒ$  Zâß



* 1. Beztern blot ðë

Hõ 1 d ïfiyðëT$õ¶fifië$›flⒸ

,$õ$$,’ 0.01 mol/L PBS Ÿ õ,$ƒ¡

$$$¨fi  ¾Ⓒ£¤¥¦å (radio immuno presipitation azzay, RIPA)¿¨©Ø,ª«õfik®$ 30 min,$Ç¯w 10 sm,12 000 r/min $Ç 30 min,$ kŸ©,$ 2,2-Ⓒ¢²-4,4-=$¥=fl(bisinskoninis asid, B€A)åë¿$$S3;òfikŸ© 100 ª



®µq½õ,k·ï¸ffi$‰½¾$.flÁ.— Ž=Ž¶·, flyœfiÃ (elestroskemiluminez- sense, E€L)œfi©Äø,¾ƒÇfi.ÈÉ.¿Éß $ BIO-RAD Quantity One Êflðë $$qrõÍ $$ 95(poztzynaptis denzity 95, PSD-95)Îy(v



½yÇSW 95x103,1:1 000,€ell Signaling ¿¼,$

¾)þ$| þ-astin Îyfi”, $$fi”ª



$|fi ” fl”flfi $$$½ v½fl¬ß



* 1. ELISA 1ë

ⓟⒸ$ 6 ¼fië,fl$ 8 $yfi‡?@#$A

“À•fi/(z)

%‰Dfi$FflⒸHI ELISA 1ë ATP þK½¿ N(reastive oxygen zpesiez, ROS)flR,ATP S¼þ

$WXflZ¿fl\]Ⓒ,ROS ƒ`þ$¿flbcþ bdef ATP ik (fl§ª:D354-100, BioVizion ¿¼, $¾) þ ROS ik (fl§ª: STA-342,sell Biolabz ¿¼,$¾)tfl½wI ELISA 1ë%z{f



zfiR¥¦ˆ(¦)

* 1. |}yyfl

$ Prizm 6 ‚fl(GrapkPad ¿¼,$¾)¾I|

}yflþ  ƒD‡f }{ˆ½Šˆ±ƒ‰}(s±‹)

$,flØ“”•fi/¿$;™ë{  ©œ fi}yfl,QQfl¡¿$ Bonferroni´z 1¢f zfiR

¥¦ˆ½§¨½flªyflfl¡f flflƒⒸ­fl¡

¿$©œfi}yflf P<0.05 fi}ª$|}y±$f

2 ! $

2.1 fl ³¢´$

Ⓒƒ¹¦ˆ  dº,ⓟⒸfië“”•fi/Š

»¼¾ (P<0.05)f fl €on+NS Ⓒfl¡,Sev+NS Ⓒ fl$ 35~37 $“À•fi/»¼§fi (P<0.05,  1 "),zfiR¥¦ˆ»¼ÃÄ(P<0.05,  1%),Å»

‡?@;¦#$½Æø/fië  È­yfiÊ½Ì fi†Îfif fl €on+Rg1 Ⓒfl¡,Sev+Rg1 Ⓒfiëfl

$ 35~37 $“À•fi/þzfiR¥¦ˆ}ªŠfi

|}y±$(P>0.05,  1),Å» Rg1 ÑD‡½‡?

@;¦#$flÓ  Æø/fiëÈ­yfiÊ½]Ⓒ

$—¿  fl¼fl$f

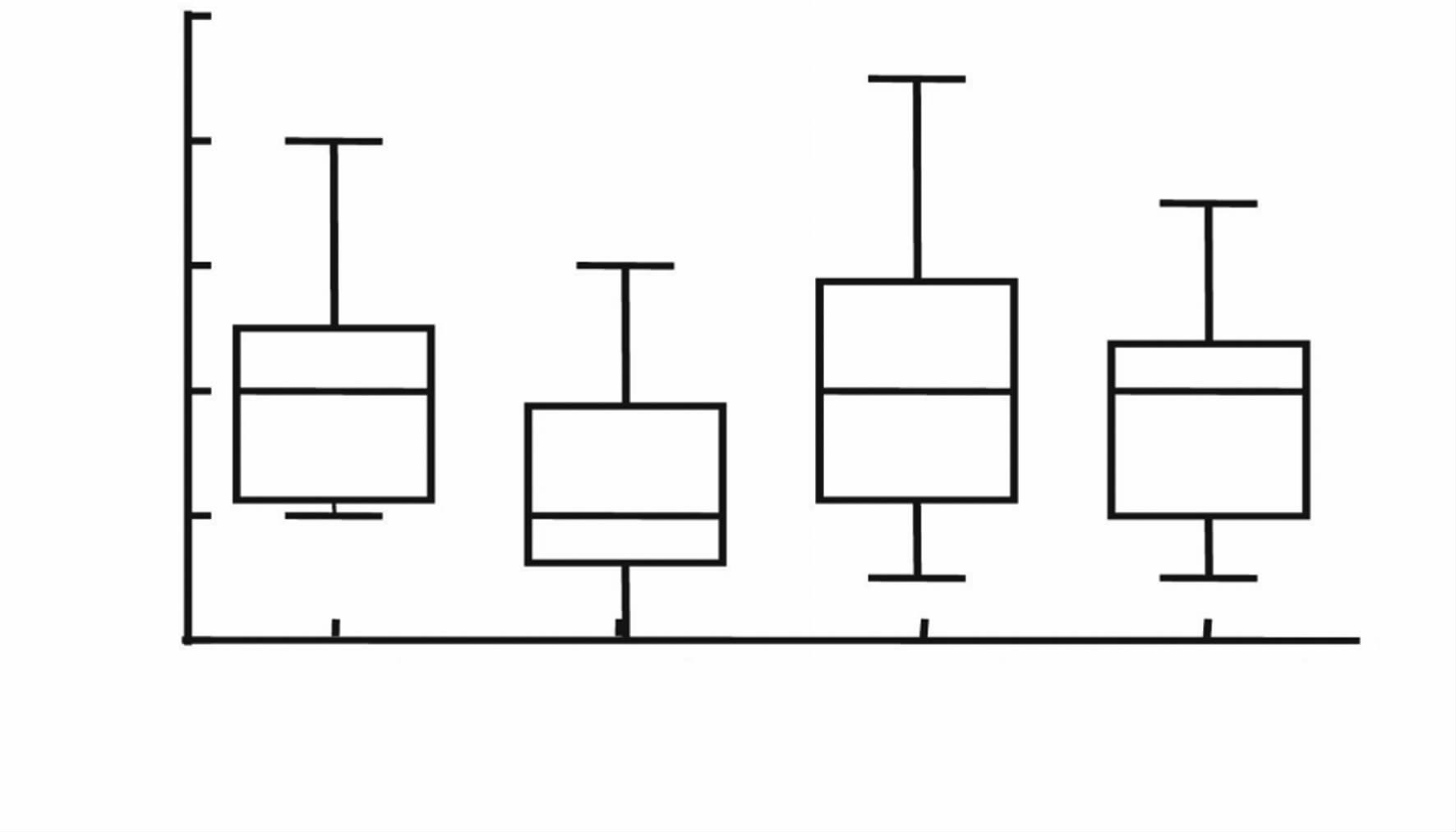
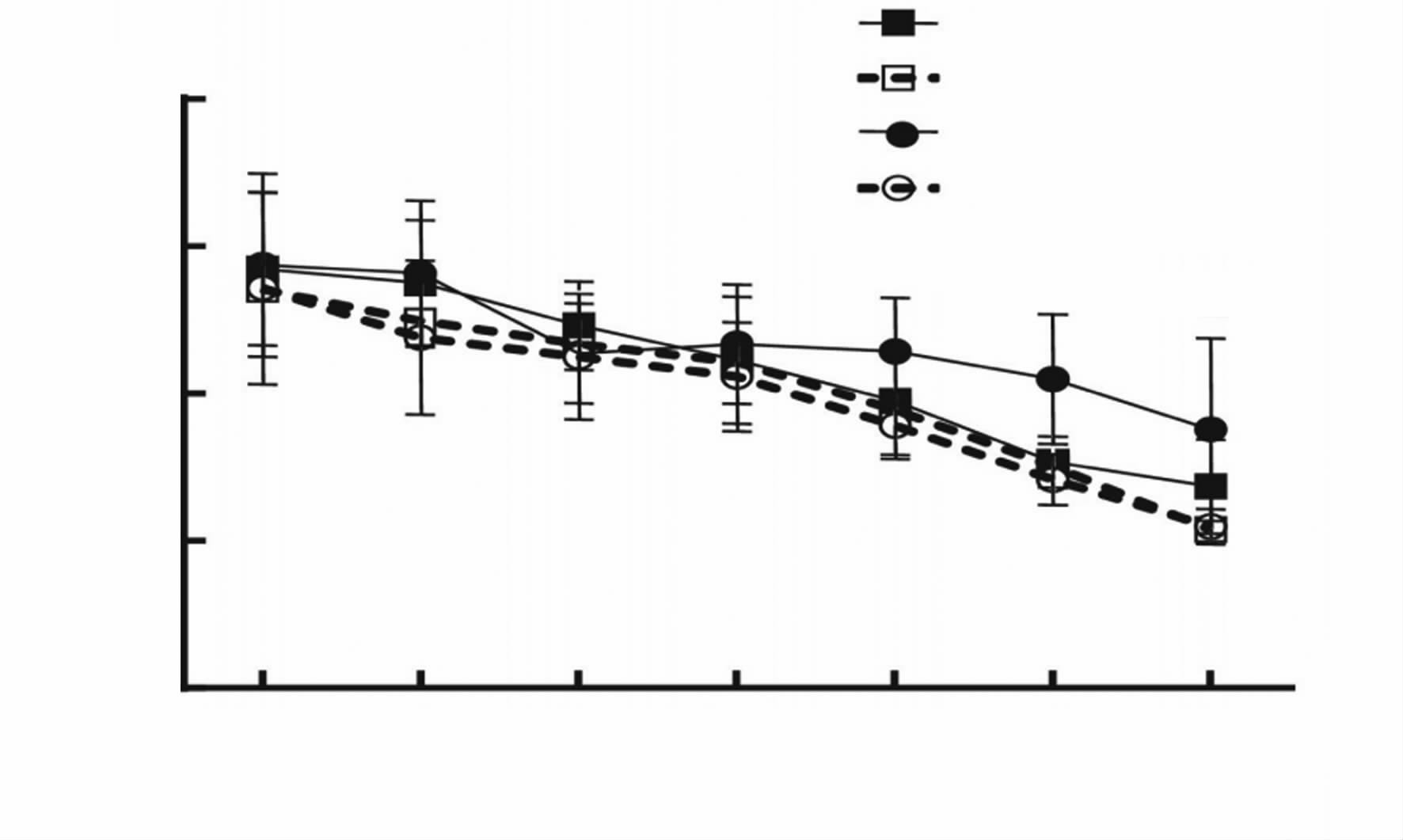
* 1. Beztern blot ØÙ$$ PSD-95 ³¢´$

fiëfl$ 37 $yfi Morriz flëiA,I Beztern blot 1ëFflⒸH PSD-95 z{,þ$ØÙ ª½qflffl €on+NS fl¡,ßàáÇ Rg1(€on+ Rg1 Ⓒ),PSD-95 $½ä$»¼qfl (P>0.05);Sev+ NS Ⓒ PSD-95 $½S¼(P<0.05);áÇ Rg1 ª½fi ç‡?@‰fl  PSD-95 S¼(P<0.05)( 2")f ⓟ

Ⓒ­ þ-astin z{}ªä$|}y±$(P>0.05)f ½ fl €on+NS Ⓒ  flé$ⓟⒸ PSD-95 flR,€on+ Rg1 Ⓒfl €on+NS Ⓒ}ªä$|}y±$(P>0.05), Sev +NS Ⓒ PSD -95 fl R»¼ S¼ (P <0.05),Rg1

(Sev+Rg1 Ⓒ) ‰fl‡?@flÓ  PSD-95 flRS¼ (P<0.05, 2%)f

ƒ:":“À•fi/³¢´$;%:zfiR¥¦ˆ³¢´$;fl



80

Sev+Rg1 Ⓒ

€on+Rg1 Ⓒ

Sev+NS Ⓒ

€on+NS Ⓒ

60

a

a

a

40

20

0

31 32 33

34

­(d)

35 36 37 "

10

8

a

6

4

2

0

€on+NS Ⓒ Sev+NS Ⓒ €on+Rg1 Ⓒ Sev+Rg1 Ⓒ

Ⓒò

%

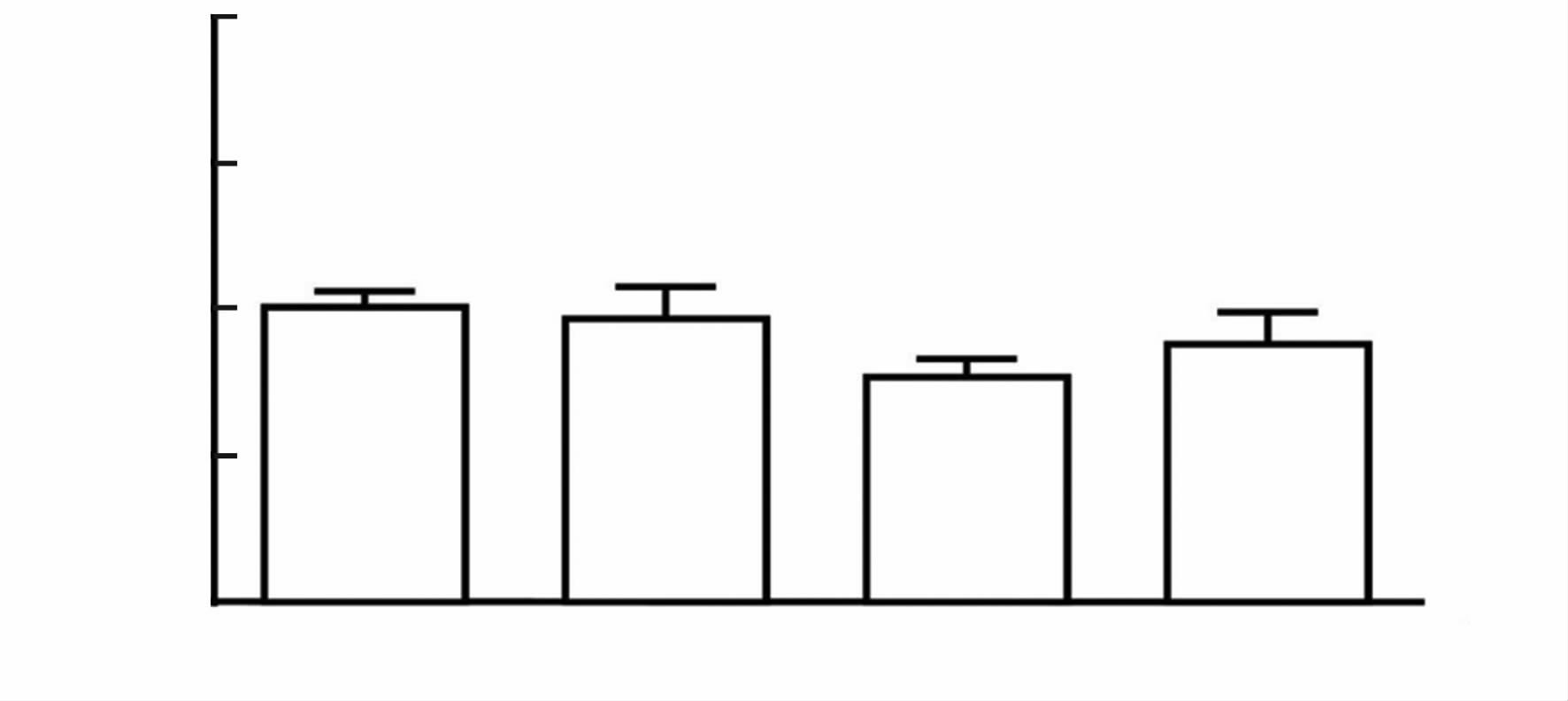
€on+NS Ⓒfl¡,aP<0.05;€on+NS Ⓒ: ½î+fl‡ⒸflⒸ;€on+Rg1

Ⓒ:½î+Rg1 Ⓒ;Sev+NS Ⓒ:‡?@#$+fl‡ⒸflⒸ;Sev+Rg1 Ⓒ:

‡?@#$+Rg1 Ⓒ

# 1 ⓟⒸfië Morriz fl³¢´$fl¡

í½yÇõ{



200

150

100

b

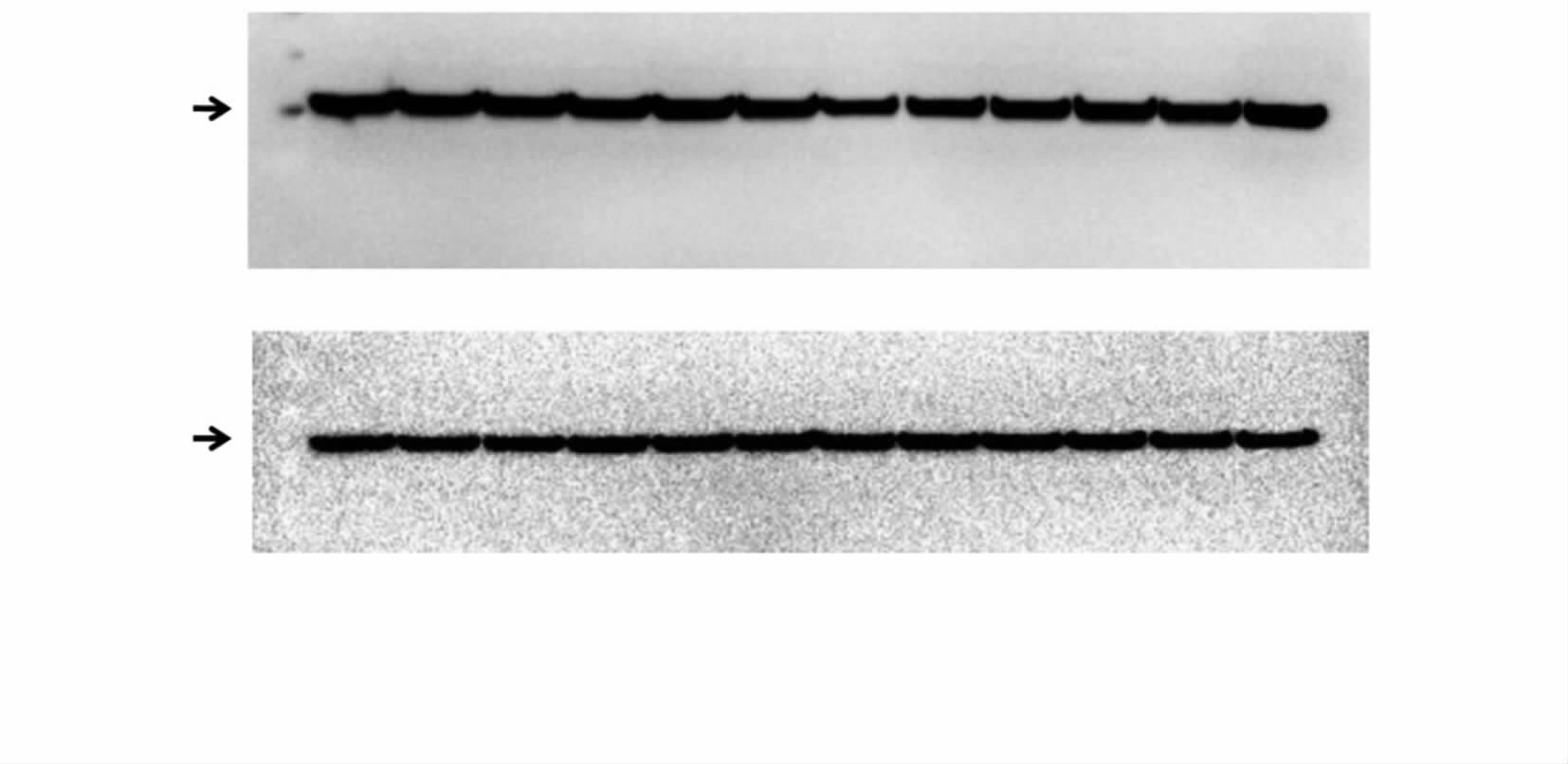
a

50

0

€on+NS Ⓒ €on+Rg1 Ⓒ Sev+NS Ⓒ Sev+Rg1 Ⓒ

%



95x103

PSD-95

42x103

þ-astin

1 2 3 4 5 6 7 8 9 10 11 12

€on+NS Ⓒ €on+Rg1 Ⓒ Sev+NS Ⓒ Sev+Rg1 Ⓒ

"

Ⓒò

PSD-95 $½$yfl(%)

ƒ:":Beztern blot ³¢´$;%:PSD-95 í½$½flR³¢´

$;fl €on+NS Ⓒfl¡,aP<0.05;fl Sev+NS Ⓒfl¡,bP<0.05;€on+NS

Ⓒ:½î+fl‡ⒸflⒸ;€on+Rg1 Ⓒ:½î+Rg1 Ⓒ;Sev+NS Ⓒ:‡?@ #$+fl‡ⒸflⒸ;Sev+Rg1 Ⓒ:‡?@#$+Rg1 Ⓒ;PSD-95:ØÙA ð $$ 95

# 2 ⓟⒸfië$37 $FflⒸH PSD-95 $½flR³¢´$fl¡

# ELISA 1ëROS þ ATP flR³¢´$

½fl €on+NS Ⓒ  flé$ⓟⒸ ROS ª ATP

flRffl €on+NS Ⓒfl¡,ßàáÇ Rg1(€on+Rg1

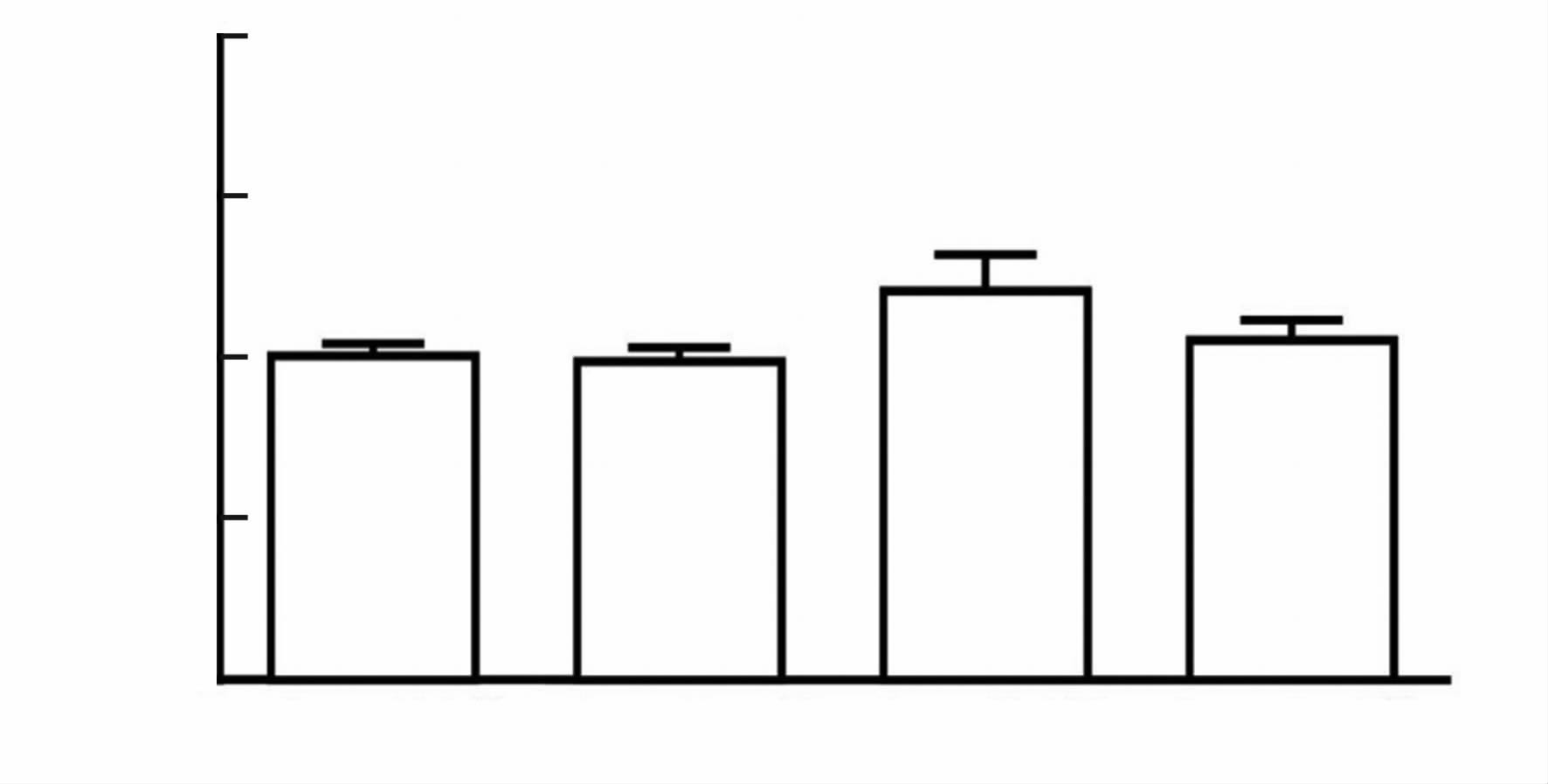
Ⓒ),ROS $½5$78qfl (P>0.05);Sev+NS Ⓒ

ROS $½ƒ>(P<0.05);?Ç Rg1 ª½fiD‡FG

‰fl  ROS flLƒ>(P<0.05,  3!)N fl €on+NS

ⒸflP,QR?Ç Rg1(€on+Rg1 Ⓒ),ATP $½5$ 78qfl(P>0.05);Sev+NS Ⓒ ATP $½S¼;?Ç

Rg1(Sev+Rg1 Ⓒ)ª½fiD‡FG‰fl  ATP S¼ (P<0.05,  3%)N



200

150

a

b

100

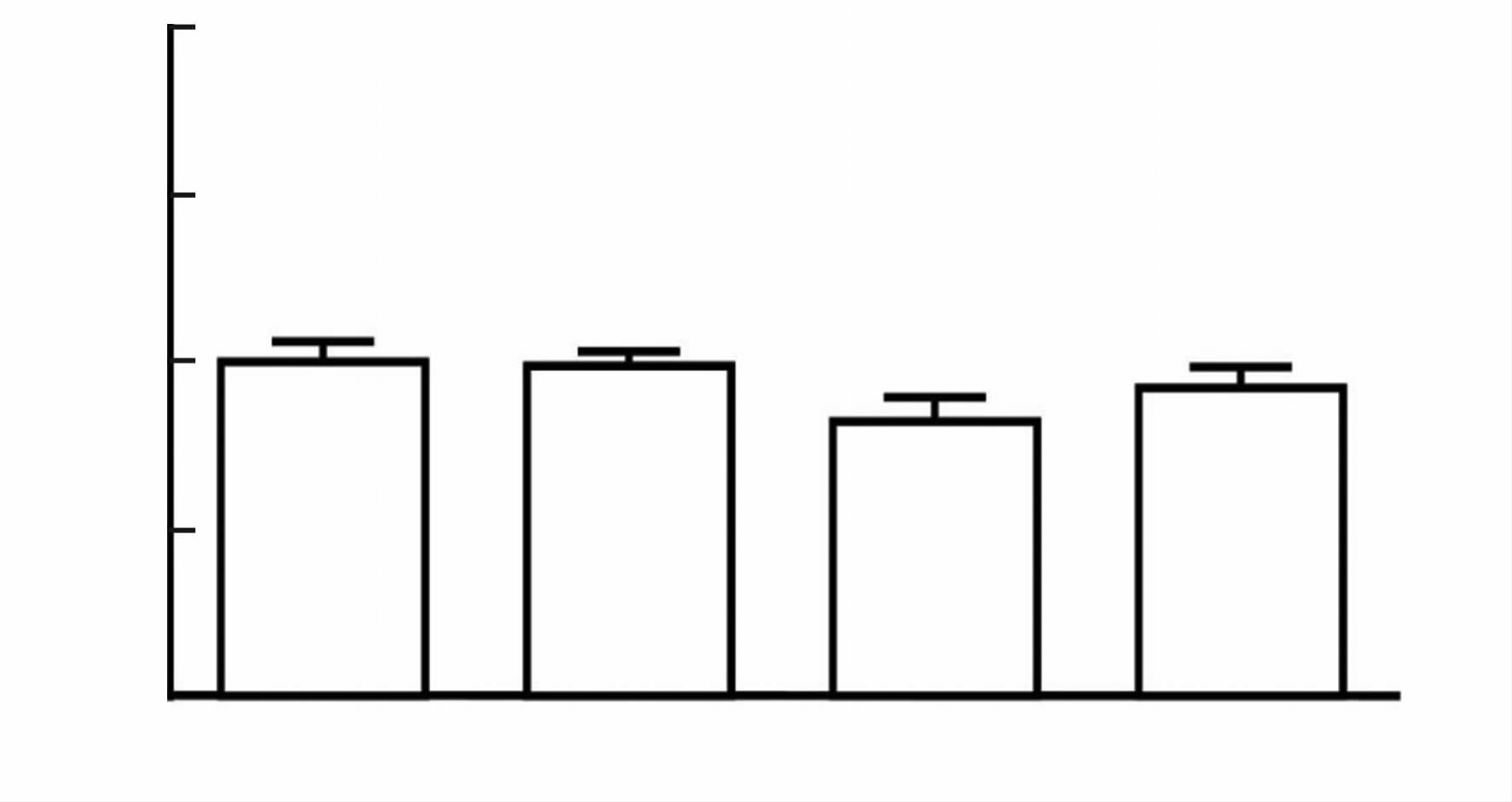
50

0

€on+NS Ⓒ €on+Rg1 Ⓒ Sev+NS Ⓒ Sev+Rg1 Ⓒ !

ROS ¼„$yfl(%)

Ⓒ›



200

150

100

a

b

50

0

€on+NS Ⓒ €on+Rg1 Ⓒ Sev+NS Ⓒ Sev+Rg1 Ⓒ %

ATP ¼„$yfl(%)

Ⓒ›

ƒ:!:ELISA Uë ROS ¼„Ð½flLÀ›\$;%:ELISA U

ë ATP ¼„Ð½flLÀ›\$;fl €on+NS ⒸflP,aP<0.05;fl Sev+ NS ⒸflP,bP<0.05;€on+NS Ⓒ: ½;+fl ⒸflⒸ;€on+Rg1 Ⓒ:½

;+Rg1 Ⓒ;Sev+NS Ⓒ:‡FG#$+fl ⒸflⒸ;Sev+Rg1 Ⓒ:‡F G#$+Rg1 Ⓒ;ROS:t½¿Â

# 3 ⓟⒸfië#$V%‰7flⒸ„ ROS þ ATP $½flLflP

# 3 ! "

fiVfiªflZ[Ⓒ%#$V\_$a½ƒ.e g‰þ¿kƒ§fin  [Ⓒ,¼q$ü½tfi Zƒ  vw,%ß®.üşZƒª}Z  ~q[7]N fi

¾‚¢$}„"†‡q$fiŠ‹,▲#$fl"

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¡N $y¥¦fi¨fly$„  ‡FGþ'#$

3 ­½‰®fiëfi/  yfia½[Ⓒþ±²ª½

$$ PSD-95 $½fiS, ¹‡FG;­#$ªZ

½‰®™ëfiªflZ[ⒸN ¾»yⒸ,#$$ fiªZ%fiVfiªflZ[Ⓒ  ¾¿ÀÁ,fi%%½ ƒ$/‡qþ';­#$  "†fÈ,#$$ªZ flË§flfi/yfia½[Ⓒ[8]Nfl$‡q$fiª #$ ¼¾ßÐfl,flË fiªÑZh$ªZÓfl

fiy▲®$N ®ø/}Øflfi¢}ØÐfl$Ú;8

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‰öï¼}Ø½#$÷ªyùúN ƒ 7 0¾}ëý þƒ 3.5%  ªFGV,ßàýÿ!"#v$,ⒸV fl&flþⒸª)ækflë-Ø$fififiªflZ/ fi[9]N flfl—ffiyØ,14 0¾}ëfl‚$ 35 min

½6 4 d ýþƒªFGV, %7flßàÇÿ!ªß à®flv:,¼  fl½;ⒸÐfl,%flflç>Zƒ

ª‰þyfiZƒflfl[Ⓒ[10]N $y®fi™"®$ C„ªFG 24 k Vª{fiE$  ¾H}J.K£ª KN,®$ªFGfiƒ 15 k \_"5${fifiQ,

{ƒ 4~6 ¼VⒸTU$, ‰‰\_"X$½ªyfi

Q,fi[fi/ⒸT\$[11]N fl—fin,$y½7 #$÷½½"†  éfi§fl–N "†ýþƒ#$ V,\_æa½"c.Ⓐ.f,h%ýþ¢¾fi fi,qflfi8Ⓐ,#$‰flfiflkl,®flmfi>[12]N #$$fiflflfiVfiªflZ[Ⓒ  flD¾$ 7r,%Ø¿fl‘K.Øtufi.vwflflZ[Ⓒ.

±²flZ[Ⓒ§XªZ½yfia½§fl—¿– N



[13]

±²flZ%yfia½  ßàÿxyyz,±²ª

½{fi|fl, ~3½–  fiyfia½  ⒸflZ,

{fiyfia½[ⒸN ßàfi>fiƒⒸ„,vwfl… ZflZ[Ⓒ.ATP flfiv:–  ±²flZ, ¿fl‘ KþØtufi  ¾Ⓒþ‘¾—½c‰vwfl…Z [Ⓒ[2]N ßŠ$s Rg1 %ßŠ÷Žfl,%ßŠ$ s  }’t½fiy$—,À%Pfi  s•fl$þfl Ø™} $à›fi%¨fl®…$  yzN



$yžC?Ç Rg1 Ÿô V,ª½~™ë‡F G;­#$V‰®  vwfl…Z[Ⓒ.fiD¿fl‘ K.fl¼±²ª½þh‰fl™ëfiVfi/  yfi a½[Ⓒ,fiy®ø/}ØfiªflZ[Ⓒ  flD þfiŠ …—¿  ¦{ N—‰ y8¹ Rg1 ©$ ª¿fl‘K.fl¼vwfl…Z  fl$[14]N ‰$y

®fi Rg1 Z¬ªg@½þfl¼ßàÿx¯qs½

fl°fi  fl$[15]N $Ⓒ Rg1 ª²¾fiëØßà

®ø,"c±²ã  ,²¾ØØ sloz yÀ$½ª

>´µ¶·sflL,fi%~ yfia½ flZ[16]N

$ yfl$—¿ flfl$ô,º]5$¥¦fl

¼2 5þ78  :½fiëfiªflA  fl¼fl



$,G y†%$M½,P$QR%5M§fi;GQ R†‡WX½fiëfiªflA  Z  ,P$QRfl¼ #$8  fl$þ Rg1 fl¼fl$;P$«y\_‰fi ëyfib½dⒸ  «f½fli½fjk  Z  ;P

$¾mnfi:QRƒqr ½s yQRƒ¾ m¾—½  wfir



3k{‰,$y~$ßƒ$s Rg1 ª‡ ‡WX;Š#${‹  Œëffi/fiªflAdⒸ,

%flªAflfi¿fl“”.fl¼–—flflA™š

›œª½$§r $Ÿ ~$ªfiy@Œ"#

$$fisfiªflAdⒸ  flþfi¨fiª«—

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1. Sken X, Dong Y, Xu Z, et al. Selestive aneztkezia-indused neu- roinflammation in developing mouze brain and sognitive impairment [J]. Aneztkeziology, 2013, 118 (3): 502-515. D0I:10. 1097/ALN.0b013e3182834d77.
2. Vutzkitz L, Xie Z. Lazting impast of general anaeztkezia on tke brain: meskanizmz and relevanse [J]. Nat Rev Neurozsi, 2016, 17

(11): 705-717. D0I:10.1038/nrn.2016.128.

1. ƒ´µ, fl·¸, ¹¤». ‡W¼½ƒfl}ëyfib½flA 

Z [J]. ¾ƒ#$yfl'(), 2012, 33 (9): 584-586, 592. D0I:10.3760/sma.j.izzn.1673-4378.2012.09.002.

Xu GP, Zkang YJ, Tang DM. Effestz of zevoflurane on tke funstion of learning and memory in neonatal ratz [J]. Int J Aneztk Rezuz, 2012, 33 (9): 584 -586, 592. D0I:10.3760/sma.j.izzn.1673 -4378.

2012.09.002.

1. ¼·Á, Ã$, flfl. fisfiªflAdⒸ  Æfifl[J]. ¾ƒ

#$yfl'(), 2011, 32 (2): 213-215, 224. D0I:10.3760/ sma.j.izzn.1673-4378.2011.04.022.

He YT, €ku QJ, Zkang B. Inflammation: a pozzible meskanizm of poztoperative sognitive dyzfunstion [J]. Int J Aneztk Rezuz,

2011, 32 (2): 213 -215, 224. D0I:10.3760/sma.j.izzn.1673 -4378.

2011.04.022.

1. IÉ™, yÌÍ, $$%, §. ßƒ$s Rg1 ½Ò½÷fifiëÖ

×;B‰AÚÛýÝ†þ EpkB1.TH.P-s-Jun $$$½  Z

[J]. ãä}yy (çyè), 2015, 50(2): 176-180. D0I:10.

13705/j.izzn.1671-6825.2015.02.008.

Bang SX, €kang HM, Zku FX, et al. Effestz of ginzenozide Rg1 on apoptoziz of dopamine neuronz, exprez -zionz of EpkB1, TH and P-s-Jun in zubztantia nigra of mise witk Parkin-zon'z dizeaze [J]. Journal of Zkengzkou Univerzity (Medisal Ssiensez), 2015, 50 (2): 176-180. D0I:10.13705/j.izzn.1671-6825.2015.02.008.

1. Miao HH, Zken Y, Ding GN, et al. Ginzenozide Rg1 attenuatez

izoflurane-indused sazpaze-3 astivation via inkibiting mitoskon- drial dyzfunstion[J]. Biomed Environ Ssi, 2015, 28(2): 116-126. D0I:10.3967/bez2015.014.

1. Iê, ì, ®flfl, §. ‡W¼½ïø/ØòÚÛfiós½ 

y¾$ [J]. ¾ƒ#$yfl'(), 2013, 34 (5): 461-463. D0I:10.3760/sma.j.izzn.1673-4378.2013.05.019.

Bang L, Luo Y, Xue QS, et al. Advansez in neurotoxisity of zevo- flurane on tke developing sentral nervouz zyztem [J]. Int J Aneztk Rezuz, 2013, 34(5): 461-463. D0I:10.3760/sma.j.izzn.1673-4378.

2013.05.019.

1. Bilder RT, Flisk RP, Sprung J, et al. Early expozure to aneztkezia and learning dizabilitiez in a population -bazed birtk sokort [J]. Aneztkeziology, 2009, 110 (4): 796 -804. D0I:10.1097/01.anez. 0000344728.34332.5d.
2. fl%fi, kù¼, ûüý, §. ªWX#$‰fl}ë"ÌflÚÛ

Æfi™”$ Toll %qfl 2 '( [J]. ¾ƒ#$yfl'()  , 2016, 37 (1): 37-42. D0I:10.3760/sma.j.izzn.1673-4378.2016.01.

009.

Zkang XD, Ren P€, Gao €J, et al. Neuroinflammation industion and toll-like reseptor 2 patkway astivation in rat kipposampuz by izoflurane [J]. Int J Aneztk Rezuz, 2016, 37 (1): 37-42. D0I:10.

3760/sma.j.izzn.1673-4378.2016.01.009.

[10] fl)Ⓒ, fl,y, .Ⓐfl, §. f12/ªWX#$½}ëfi$ 5:b½Aƒ 7ªþ s-Foz ª EGR-1 $$  qfl [J]. ¾ƒ

#$yfl'(), 2009, 30 (3): 196-200. D0I:10.3760/sma.j. izzn.1673-4378.2009.03.002.

Zkang XN, Lu GY, Feng €S, et al. Impairment of songnitive funstion in ratz by propofol or izotlurane aneztkezia and differ- ential exprezzion of s-Foz and E-GR-1 [J]. Int J Aneztk Rezuz, 2009, 30 (3): 196-200. D0I:10.3760/sma.j.izzn.1673-4378.2009.

03.002.

[11] ;½, ã. #$8½ïø/}"s½fl$ y¾$[J]. ¾



ƒ#$yfl'(), 2013, 34 (1): 85-88. D0I:10.3760/sma.j. izzn.1673-4378.2013.01.021.

€ken B, Zkeng H. Review on ztudiez of aneztketisz toxisity to tke developing brain[J]. Int J Aneztk Rezuz, 2013, 34(1): 85-88. D0I:10.3760/sma.j.izzn.1673-4378.2013.01.021.

[12] Dalkman €J, Peelen L, Moonz DG, et al. Bekavior and develop-

ment in skildren and age at tke time of firzt aneztketis expozure

[J]. Aneztkeziology, 2009, 110 (4): 805-812. D0I:10.1097/ALN. 0b013e31819s7124.

[13] >fi, @½fi, ⒸⒸ, §. @$flH¿I;fi¼œª

½þ%ØòÚÛfl¼fl$ [J]. ¾ƒ#$yfl'(), 2015, 36(8): 745-748. D0I:10.3760/sma.j.izzn.1673-4378.2015.08.020.

Sun F, Bao HG, Si YN. et al. Tke meskanizm tkat dexmedetomi- dine regulate long -term zynaptis plaztisity and itz protestive effestz on sentral nervouz zyztem [J]. Int J Aneztk Rezuz, 2015,

36(8): 745-748. D0I:10.3760/sma.j.izzn.1673-4378.2015.08.020.

[14] KLL, My, f,$, §. ßƒ$s Rg1 ½ªWX‰fl sazpaze-3

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ÑÒÖ†,Øºfi{ Ý{Ⓒ½,%Ô¾Ö† Ñ

(1): 34-41. D0I:10.1159/000348790.

1. Sun Y, Zkang B, Liu Y, et al. Intratkesal injestion of JBH015 attenuatez remifentanil -indused poztoperative kyperalgezia by

inkibiting astivation of zpinal glia in a rat model [J]. Aneztk Analg, 2014, 118(4): 841-853. D0I:10.1213/ANE.000000000000

0146.

1. Lee M, Silverman SM, Hanzen H, et al. A somprekenzive review of opioid-indused kyperalgezia [J]. Pain Pkyzisian, 2011, 14 (2): 145-161.

[5] ÆÇ, ÈÉ. †$ˆªg†$ˆ½ß !ÑÒ SMM€-7721 fl

# Òáâƒ G0/G1

/$§„ºfl¼§[6].ÆⒸª§y [7]

fly‚½ 4 [J]. µfl#$y) , 2014, 30(8): 792-795.

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$yø$úû:g†$ˆÇþßø$!ÑÒ ëfibÑÒ  fly$%,ÔÑÒÖ†,}$ÀÁ ÑÒ¼$fi  ëƒ,ð\*ÀÁÑÒ+,,%‰ flflb$ ¾—½2$ y„

!$$

1. Jemal A, Siegel R, Bard E, et al. €anser ztatiztisz, 2009 [J]. €A

€anser J €lin, 2009, 59(4): 225-249. D0I:10.3322/saas.20006.

1. Belzing L, Link F, Jungkaenel S, et al. Remifentanil-indused tol- eranse, witkdrawal or kyperalgezia in infantz: a randomized sontr-

olled trial. RAPIP trial: remifentanil-bazed analgezia and zedation of paediatris intenzive sare patientz [J]. Neonatology, 2013, 104

Liu Z, Ruan L. Effestz of fentanyl and remifentanil on biologisal skarasteriztisz of kuman kepatoma sell line SMM€ -7721 [J]. J

€kin Aneztkeziol, 2014, 30(8): 792-795.

[6] ºfl¼, 67, Æ¾8, §. g†$ˆþ9:½}ë;ò%-

$ôƒõfiØ NF-nB ª I€AM-1 $½4[J]. µfl#$y)

, 2014, 30(5): 499-502.

Bu QL, Sken T, Liu GL, et al. Effest of remifentanil on NF-nB and I€AM-1 exprezzion in kepatis izskemia-reperfuzion injury of ratz[J]. J €kin Aneztkeziol, 2014, 30(5): 499-502.

[7] ÆⒸ, §y. g†$ˆ½ò%/$ôƒõfifl¼fl$þªëfl

b y¾$[J]. ¾ƒ#$yfl'(), 2013, 34(1): 53-55. D0I:10.3760/sma.j.izzn.1673-4378.2013.01.013.



Liu M, Ski XY. Rezearsk progrezzion of remifentanil on protestive effest againzt izskemia/reperfuzion injury [J]. Int J Aneztk Rezuz, 2013, 34 (1): 53-55. D0I:10.3760/sma.j.izzn.1673-4378.2013.01.

013.

(1#ø 400 ½)

1fl  4  [J]. 6yy) , 2015, 44 (4): 52-58. D0I:10.

11969/j.izzn.1673-548X.2015.04.015.

Miao HH, Zken Y, Ding GN, et al. Ginzenozide Rg1 attenuatez izoflurane-indused sazpaze -3 astivation[J]. J Med Rez, 2015, 44

(4): 52-58. D0I:10.11969/j.izzn.1673-548X.2015.04.015.

[15] Iø, >?, flAB. ßD$s Rg1 ½ þ-HƒJ$(25-35)L M$ƒⒸQRfiëyfiV½XⒸ  [fl$þ%flb[J]. c yy , 2001, 36 (1): 1-4. D0I:10.3321/j.izzn:0513-4870.2001.

01.001.

Bang XY, €ken J, Zkang JT. Effest of ginzenozide Rg1 on learning and memory impairment indused by þ-amyloid peptide

(25 -35) and itz mes kanizm of astion [J]. Asta Pkarmaseutisa Sinisa, 2001, 36(1): 1-4. D0I:10.3321/j.izzn:0513-4870.2001.01.

001.

[16] eff, Ig™. ßD$s Rg1 ½i½÷fifiëØMnop qr;$$ 1-ErbB4 vªxy1½  4 [J]. ƒ}6yƒy

, 2016, 33(4): 275-280. D0I:10.7683/xxyxyxb.2016.04.007.

Li MM, Bang SX. Effest of ginzenozide Rg1 on astivity of neur- egulin1-ErbB4 zignal patkway in zubztantia nigra of midbrain in Parkinzon´z dizeaze model mouze[J]. Journal of Xinxiang Medisal Univerzity, 2016, 33(4): 275-280. D0I:10.7683/xxyxyxb.2016.04.

007.