# **Neonatal zingerone protects against the development of high-fructose diet-induced metabolic syndrome in adult Sprague Dawley rats**

**N. Muhammad1,2\*, B.W. Lembede1 and K.H. Erlwanger1**

*1School of Physiology, Faculty of Health Sciences, University of Witwatersrand, 7 York Road, Parktown, Johannesburg 2193, South Africa*

*2Department of Physiology, College of Health Sciences, Federal University Birnin Kebbi, P.M.B. 1157, Birnin Kebbi, Nigeria*

**\*Contact:** [nsmaaji@gmail.com](mailto:nsmaaji@gmail.com)

Supplementary Table S1: Effects of neonatally administered zingerone on weekly food (*A*), fluid (*B*) and calorie intake (*C*) of high-fructose diet fed rats in adulthood

***A***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Experimental Week | Sex | Weekly food intake (g/100g body mass) | | | |
| W | FS | ZF | ZW |
| 9 | M | 53.00 ± 1.60a | 32.00 ± 4.80b | 32.00 ± 5.20b | 55.00 ± 0.84a |
| F | 57.00 ± 2.60aλ | 32.00 ± 4.60bλ | 34.00 ± 5.50bλ | 55.00 ± 2.20aλ |
| 10 | M | 45.00 ± 0.55a | 30.00 ± 5.30b | 32.00 ± 3.20b | 47.00 ± 2.10a |
| F | 55.00 ± 1.50aλ | 29.00 ± 2.80bλ | 32.00 ± 6.00bλ | 54.00 ± 4.60aλ |
| 11 | M | 45.00 ± 1.20a | 28.00 ± 6.80b | 28.00 ± 2.70b | 45.00 ± 0.11a |
| F | 49.00 ± 3.90aλ | 24.00 ± 2.30bλ | 25.00 ± 3.50bλ | 49.00 ± 3.30aλ |
| 12 | M | 43.00 ± 2.20a | 22.00 ± 5.90b | 25.00 ± 4.40b | 47.00 ± 4.60a |
| F | 52.00 ± 5.10aλ | 25.00 ± 8.60bλ | 20.00 ± 3.60bλ | 54.00 ± 2.10aλ |

***B***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Experimental Week | Sex | Weekly fluid intake (ml/100g body mass) | | | |
| W | FS | ZF | ZW |
| 9 | M | 52.00 ± 0.11a | 84.00 ± 18.00b | 80.00 ± 14.00b | 47.00 ± 4.10a |
| F | 84.00 ± 9.70aλ | 110.00 ± 9.00bλ | 110.00 ± 14.00bλ | 79.00 ± 11.00aλ |
| 10 | M | 59.00 ± 5.50a | 100.00 ± 13.00b | 95.00 ± 6.40b | 61.00 ± 4.60a |
| F | 107.00 ± 9.20aλ | 138.00 ± 7.50bλ | 149.00 ± 23.00bλ | 100.00 ± 9.20aλ |
| 11 | M | 60.00 ± 8.20a | 94.00 ± 3.50b | 90.00 ± 1.90b | 66.00 ± 19.00 a |
| F | 93.00 ± 16.00aλ | 144.00 ± 12.00bλ | 133.00 ± 11.00bλ | 85.00 ± 8.70aλ |
| 12 | M | 62.00 ± 3.40a | 97.00 ± 8.40b | 99.00 ± 9.90b | 58.00 ± 1.70a |
| F | 92.00 ± 8.30aλ | 132.00 ± 13.00bλ | 141.00 ± 15.00bλ | 89.00 ± 15.00aλ |

***C***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Experimental Week | Sex | Total weekly calories intake (Kcal/100g body mass) | | | |
| W | FS | ZF | ZW |
| 9 | M | 120.96 ± 4.37a | 155.87 ± 8.12b | 154.23 ± 19.05b | 131.92 ± 1.61a |
| F | 158.96 ± 7.16aλ | 173.77 ± 1.07bλ | 171.79 ± 5.69bλ | 154.86 ± 6.08aλ |
| 10 | M | 119.41 ± 4.39a | 164.84 ± 6.98b | 160.92 ± 7.50b | 131.15 ± 5.93a |
| F | 153.86 ± 4.16aλ | 183.34 ± 14.73bλ | 203.48 ± 18.61bλ | 151.60 ± 12.97aλ |
| 11 | M | 115.38 ± 10.38a | 152.46 ± 16.57b | 142.65 ± 14.07b | 125.89 ± 0.30a |
| F | 136.78 ± 10.99aλ | 183.35 ± 4.95bλ | 165.14 ± 3.36bλ | 136.38 ± 9.17aλ |
| 12 | M | 120.27 ± 6.02a | 138.29 ± 13.44a | 147.98 ± 18.96b | 131.48 ± 12.98a |
| F | 145.60 ± 14.31aλ | 175.65 ± 28.46bλ | 167.84 ± 19.13bλ | 151.54 ± 6.00aλ |

Data expressed as mean ± standard deviation.ab= within row means with different letters significantly different at P < 0.05; λ=female rats significantly had higher food, fluid or calorie intake at P < 0.05; W= gavaged with 10 ml/kg body weight (bwt) of distilled water before weaning and then provided unlimited access to plain tap water post-weaning (M=9, F=11); FS= gavaged with 10 ml/kg bwt of a 20% fructose solution before weaning and then provided unlimited access to a 20% fructose solution to drink post-weaning (M=9, F=11); ZF= gavaged with a combination of 20% fructose solution (10 ml/kg bwt) and zingerone (40 mg/kg bwt) before weaning and then unlimited access to 20% fructose solution to drink post-weaning (M=9, F=12); ZW= gavaged with zingerone only at 40 mg/kg bwt dissolved in distilled water before weaning and given unlimited access to plain tap water to drink post-weaning (M=8, F=10); M= males; F= females.





Supplementary Fig S1: Effects of neonatally administered zingerone on average weekly body weight of high-fructose diet fed male (*A*) and female (*B*) rats in adulthood.

Data expressed as mean ± standard deviation.###= significant increase in body mass from induction (PND 8) to weaning (PND 21) and from weaning to termination (PND 91) at P < 0.0001; Q= postnatal day 42 at which the weekly body weight of the group FS started to differ compared to the other groups in the female rats; R= postnatal day 91 at which the terminal body weight of the group FS was significantly different at P < 0.0001 compared to the other groups in the female rats; W= gavaged with 10 ml/kg body weight (bwt) of distilled water before weaning and then provided unlimited access to plain tap water post-weaning (M=9, F=11); FS= gavaged with 10 ml/kg bwt of a 20% fructose solution before weaning and then provided unlimited access to a 20% fructose solution to drink post-weaning (M=9, F=11); ZF= gavaged with a combination of 20% fructose solution (10 ml/kg bwt) and zingerone (40 mg/kg bwt) before weaning and then unlimited access to 20% fructose solution to drink post-weaning (M=9, F=12); ZW= gavaged with zingerone only at 40 mg/kg bwt dissolved in distilled water before weaning and given unlimited access to plain tap water to drink post-weaning (M=8, F=10).