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Impact of brown fat activation and white fat browning in obesity after lifestyle modification

Chileka Chiyanika
Chinese University of Hong Kong (CUHK), Hong Kong

Brown adipose tissue (BAT) activation and white adipose tissue (WAT) browning have emerged as potential targets for combating obesity and metabolic disorders. However, it remains unclear in humans as to whether lifestyle modification program (LMP) in the treatment of obesity can activate BAT/induce WAT browning. The aim was to assess the activation of BAT, browning of white fat, and to detect reversal of metabolic syndrome, non-alcoholic fatty liver disease (NAFLD), non-alcoholic fatty pancreas disease (NAFPD), and altered insulin resistance over 6-month period.

Methods: 9 morbidly obese and 9 health lean control subjects were recruited in this pilot study. LMP was employed to induce weight loss and consequent activation of BAT and induction of WAT browning in morbidly obese subjects. MRI was used to measure BAT/WAT in the neck region (BAT depots) at baseline and 6 months by measuring their T2* and fat fraction using a validated in-house algorithm. Blood biochemistry and anthropometrics were also measured.

Results: A median %weight loss of -1.15%, p=0.593 was achieved. This %weight loss resulted in:

• Significant % decrease in pancreatic and liver fat fractions (-15.04%, p=0.021 and -31.77%, p=0.015, respectively).

• % decrease in BAT fat fraction of -3.22%, p=0.953 and BAT T2* of -4.47%, p=0.953.

• % decrease in WAT fat fraction of -25.74%, p=0.008 and WAT T2* of -57.63%, p=0.021. Indicating the possible occurrence of WAT browning.

• No difference between the intervention group-WAT fat fraction vs. control- BAT fat fraction (66.65% vs. 60.18%, p=0.853) and no difference between the intervention group-WAT T2* vs. control- BAT T2* (28.94ms vs. 17.22ms, p=0.060). Suggesting the occurrence of WAT browning.

• No statistically significant differences in the BAT fat fraction and BAT T2* between the intervention group and control group (66.22% vs. 60.18%, p=0.310 and 30.19ms vs. 19.43ms, p=0.171, respectively). Implying that the BAT metabolic activity in the intervention group was similar to that of the control group.

• BAT/WAT 2* at 6 months of LMP showed a trend of inverse correlation with obesity, metabolic disorder components, certain pro-inflammatory cytokines and adipokines.

Conclusion: LMP may be an effective method in inducing WAT browning but seems to have minimal effect on BAT activation, nonetheless, this outcome requires confirmation using large sample sizes. BAT and WAT browning could be a potential treatment of obesity and its comorbidities.

Biography

Chileka Chiyanika completed his PhD in 2023 from the Chinese University of Hong Kong under the supervision of Professor Winnie Chu. Soon after his graduation, he was employed as a Research Assistant Professor at The Hong Kong Polytechnic University. He has published a number of papers in reputed journals.