Modulation of Adipogenesis in 3T3-L1 Cells Using Natural Products: A Strategy to Prevent Obesity

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PURPOSE

- Obesity is a leading cause of preventable death[1]
- Limited prevention options
- Natural products (NPs) like resveratrol (RES), quercetin (QUE), curcumin (CUR), glycyrrhetinic acid (18GA), epigallocatechin gallate (EGCG), and hydroxycitric acid (HCA) may prevent maturation of pre-adipocytes[2] (FIG 1)

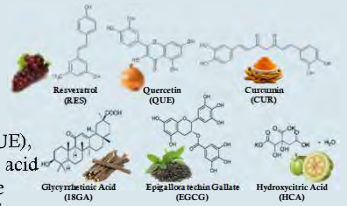


FIG 1 –Natural products used in experiments

HYPOTHESIS

NPs individually and in combination will prevent the maturation of pre-adipocytes (3T3-L1 cells)

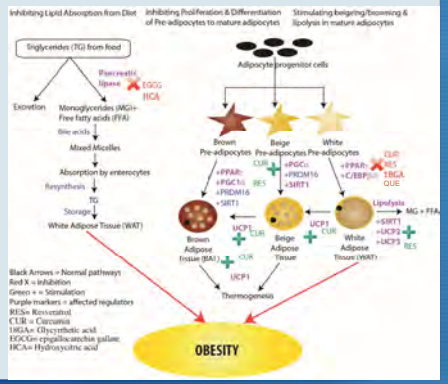
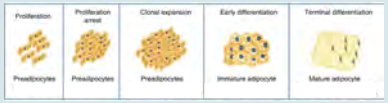


FIG 2 – Proposed mechanisms of action of NPs in preventing obesity

METHODS



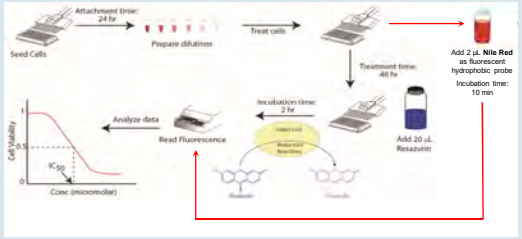


FIG 3 – (top) Differentiation of preadipocytes into adipocytes[3] (bottom) Methods for determining cell viability and inhibition of pre-adipocyte differentiation *in vitro*

RESULTS

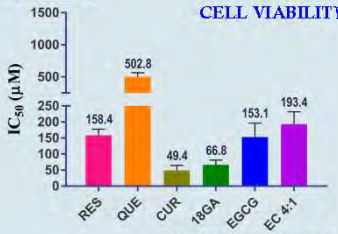


FIG 4 – IC50 values of NPs in 3T3-L1 cells with 24 hr attachment and 48 hr treatment. HCA tested but demonstrated no significant effect. Combination of EGCG and CUR 4:1 molar ratio showed effect but no synergy. Data is presented as Mean IC_{50} ± SD (n=5).

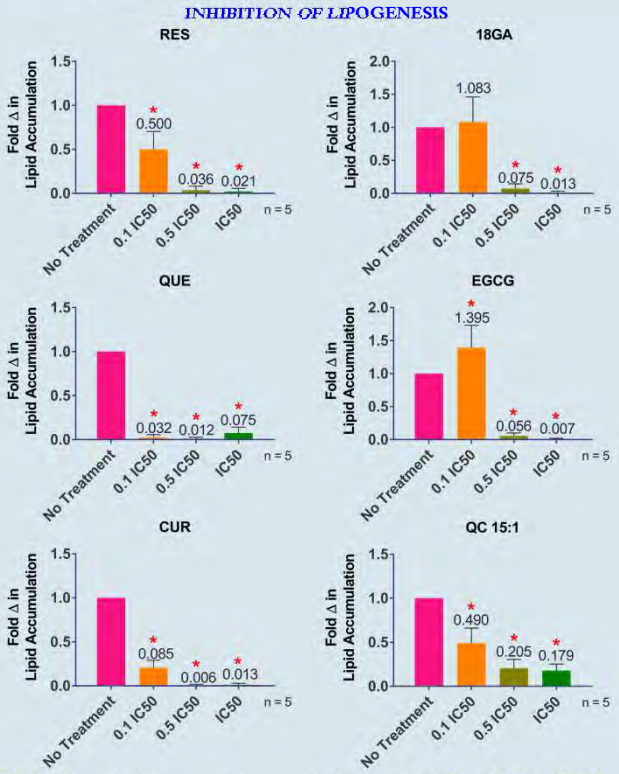


FIG 5 – Change in lipid accumulation measuring lipogenesis inhibition of NPs in *3T3-L1* cells. Combination of QUE and CUR 15:1 molar ratio showed less effect than individual treatment. Data is presented as Mean ± SD (n=5).

SUMMARY

Cell Viability in Pre-adipocytes (FIG 4)

- CUR and 18GA are the most potent NPs against pre-adipocytes with the lowest IC_{50} values
- HCA had no significant effect
- EC 4:1 combination not synergistic

Inhibition of Lipogenesis (FIG 5)

- NP inhibition of pre-adipocyte differentiation at $0.1IC_{50}$ (from greatest to least): QUE > CUR > RES
- NP inhibition of pre-adipocyte differentiation at 0.5 IC_{50} seen with all NPs
- QC 15:1 demonstrates inhibition of pre-adipocyte differentiation, though the degree of inhibition was lower than individual natural products.

CONCLUSION

- Individual and combination NPs are capable of preventing the maturation of pre-adipocytes

FUTURE STUDIES

- Determine efficacy of other NPs
- Confirm findings in side-by-side experiments for pre-adipocyte differentiation to assess within the same passage
- Look at adipolysis using NPs

REFERENCES

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3. Esteve Ràfols M. Tejido adiposo: heterogeneidad celular y diversidad funcional. Endocrinol Nutr. 2014;61:100–112.

ACKNOWLEDGEMENTS

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