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α-mangostin improves glucose uptake and inhibits adipocytes differentiation in 3T3-L1 cells via PPARγ, GLUT4, and leptin expressions


Abstract

Obesity has been often associated with the occurrence of cardiovascular diseases, type 2 diabetes, and cancer. The development of obesity is also accompanied by significant differentiation of preadipocytes into adipocytes. In this study, we investigated the activity of α-mangostin, a major xanthone component isolated from the stem bark of G. malaccensis, on glucose uptake and adipocyte differentiation of 3T3-L1 cells focusing on PPARγ, GLUT4, and leptin expressions. α-Mangostin was found to inhibit cytoplasmic lipid accumulation and adipogenic differentiation. Cells treated with 50 μM of α-mangostin reduced intracellular fat accumulation dose-dependently up to 44.4% relative to MDI-treated cells. Analyses of 2-deoxy-D-[3H] glucose uptake activity showed that α-mangostin significantly improved the glucose uptake (P < 0.05) with highest activity found at 25 μM. In addition, α-mangostin increased the amount of glucose transporter 4 (GLUT4) and leptin. These evidences propose that α-mangostin might be possible candidate for the effective management of obesity in future.

Indexed keywords

EMTREE drug terms: alpha mangostin fatty acid glucose glucose transporter 4 leptin peroxisome proliferator activated receptor gamma plant medicinal product unclassified drug

EMTREE medical terms: adipocyte adipogenesis animal cell Article bark cell differentiation cell viability controlled study drug isolation Garcinia Garcinia malaccensis gene expression glucose transport lipid storage mouse MTT assay nonhuman priority journal reverse transcription polymerase chain reaction
Exotic fruits as therapeutic complements for diabetes, obesity and metabolic syndrome

Devalaraja, S., Jain, S., Yadav, H.
Food Research International, 44 (7), pp. 1856-1865. Cited 54 times.
View at Publisher

Mitotic clonal expansion: A synchronous process required for adipogenesis

Tang, Q.-Q., Otto, T.C., Daniel Lane, M.
doi: 10.1073/pnas.0137044100
View at Publisher

Obesity and diabetes

Lois, K., Kumar, S.
doi: 10.1016/S1575-0922(09)73516-8
View at Publisher

Anti-obesity effect of Schisandra chinensis in 3T3-L1 cells and high fat diet-induced obese rats

doi: 10.1016/j.foodchem.2012.02.101
View at Publisher

Keynote review: The adipocyte as a drug discovery target

Nawrocki, A.R., Scherer, P.E.
Drug Discovery Today, 10 (18), pp. 1219-1230. Cited 102 times.
doi: 10.1016/S1359-6446(05)03569-5
View at Publisher

Obesity. Exotic fruits as therapeutic complements for diabetes, obesity and metabolic syndrome

Jéquir, E., Tappy, L.
View at Publisher

Obesity and the regulation of energy balance

Spiegelman, B.M., Flier, J.S.
doi: 10.1016/S0092-8674(01)00240-9
View at Publisher
|   | 8 | Yun, J.W.  
Possible anti-obesity therapeutics from nature - A review  
View at Publisher |
|   | 9 | Vázquez-Vela, M.E.F., Torres, N., Tovar, A.R.  
White Adipose Tissue as Endocrine Organ and Its Role in Obesity  
View at Publisher |
|   | 10 | Brun, R.P., Spiegelman, B.M.  
PPARγ and the molecular control of adipogenesis  
doi: 10.1677/joe.0.1550217  
View at Publisher |
Artepillin C, as a PPARγ ligand, enhances adipocyte differentiation and glucose uptake in 3T3-L1 cells  
doi: 10.1016/j.bcp.2011.01.002  
View at Publisher |
|   | 12 | Huang, C., Zhang, Y., Gong, Z., Sheng, X., Li, Z., Zhang, W., Qin, Y.  
Berberine inhibits 3T3-L1 adipocyte differentiation through the PPARγ pathway  
doi: 10.1016/j.bbrc.2006.07.095  
View at Publisher |
|   | 13 | Watson, R.T., Pessin, J.E.  
GLUT4 translocation: The last 200 nanometers  
doi: 10.1016/j.cellsig.2007.06.003  
View at Publisher |
|   | 14 | Akiba, T., Yaguchi, K., Tsutsumi, K., Nishioka, T., Koyama, I., Nomura, M., Yokogawa, K., (...), Miyamoto, K.-I.  
Inhibitory mechanism of caffeine on insulin-stimulated glucose uptake in adipose cells  
View at Publisher |
|   | 15 | Flier, J.S.  
Obesity Wars: Molecular Progress Confronts an Expanding Epidemic  
doi: 10.1016/S0092-8674(03)01081-X  
View at Publisher |
<table>
<thead>
<tr>
<th>16</th>
<th>Fried, S.K., Ricci, M.R., Russell, C.D., Laferrère, B.</th>
<th>Regulation of leptin production in humans</th>
</tr>
</thead>
</table>

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<tr>
<th>17</th>
<th>Galic, S., Oakhill, J.S., Steinberg, G.R.</th>
<th>Adipose tissue as an endocrine organ</th>
</tr>
</thead>
</table>

<table>
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<tr>
<th>18</th>
<th>Jena, B.S., Jayaprakasha, G.K., Singh, R.P., Sakariah, K.K.</th>
<th>Chemistry and biochemistry of (-)-hydroxycitric acid from Garcinia</th>
</tr>
</thead>
</table>

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<tr>
<th>19</th>
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<th>Garcinia extract inhibits lipid droplet accumulation without affecting adipose conversion in 3T3-L1 cells</th>
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<th>22</th>
<th>Kim, M.S., Kim, J.K., Kwon, D.Y., Park, R.</th>
<th>Anti-adipogenic effects of Garcinia extract on the lipid droplet accumulation and the expression of transcription factor.</th>
</tr>
</thead>
</table>

|----|-------------------------------------------------|------------------------------------------|
http://www.hindawi.com/journals/jobes/
doi: 10.1155/2011/509038


doi: 10.1016/S1995-7645(12)60012-1


http://www.ingentaconnect.com/content/ben/mroc/2008/00000005/00000004/art00011
doi: 10.2174/157019308786242223

http://www.cmjournal.org/content/7/1/19

doi: 10.1016/j.fct.2012.08.037

View at Publisher
31 Gutierrez-Orozco, F., Chitchumroonchokchai, C., Lesinski, G.B., Suksumrarn, S., Failla, M.L.

α-Mangostin: Anti-inflammatory activity and metabolism by human cells

doi: 10.1021/jf4004434

View at Publisher


Anti-tumorigenicity of dietary α-mangostin in an HT-29 colon cell xenograft model and the tissue distribution of xanthones and their phase II metabolites

doi: 10.1002/mnfr.201200539

View at Publisher

33 Chang, H.-F., Huang, W.-T., Chen, H.-J., Yang, L.-L.

Apoptotic effects of γ-mangostin from the fruit hull of garcinia mangostana on human malignant glioma cells

http://www.mdpi.com/1420-3049/15/12/8953/pdf
doi: 10.3390/molecules15128953

View at Publisher

34 Krajarng, A., Nakamura, Y., Suksumrarn, S., Watanapokasin, R.

α-Mangostin induces apoptosis in human chondrosarcoma cells through downregulation of ERK/JNK and Akt signaling pathway

doi: 10.1021/jf200620n

View at Publisher

35 Kurose, H., Shibata, M.-A., Iinuma, M., Otsuki, Y.

Alterations in cell cycle and induction of apoptotic cell death in breast cancer cells treated with -mangostin extracted from mangosteen pericarp

doi: 10.1155/2012/672428

View at Publisher


Panaxanthon isolated from pericarp of Garcinia mangostana L. suppresses tumor growth and metastasis of a mouse model of mammary cancer


View at Publisher

37 Chao, A.-C., Hsu, Y.-L., Liu, C.-K., Kuo, P.-L.

α-mangostin, a dietary xanthone, induces autophagic cell death by activating the AMP-activated protein kinase pathway in glioblastoma cells

doi: 10.1021/jf1042757

View at Publisher
Alpha-mangostin extracted from the pericarp of the mangosteen (Garcinia mangostana Linn) reduces tumor growth and lymph node metastasis in an immunocompetent xenograft model of metastatic mammary cancer carrying a p53 mutation  
(2011) BMC Medicine, 9, art. no. 69. Cited 46 times.  
http://www.biomedcentral.com/1741-7015/9/69  
View at Publisher

Alpha-mangostin, a xanthone from mangosteen fruit, promotes cell cycle arrest in prostate cancer and decreases xenograft tumor growth  
doi: 10.1093/carcin/bgr291  
View at Publisher

40 Elsaid Ali, A.A., Taher, M., Mohamed, F.  
Microencapsulation of alpha-mangostin into PLGA microspheres and optimization using response surface methodology intended for pulmonary delivery  
View at Publisher

41 Mosmann, T.  
Rapid colorimetric assay for cellular growth and survival: Application to proliferation and cytotoxicity assays  
doi: 10.1016/0022-1759(83)90303-4  
View at Publisher

42 Susantia, D., Amiroudineb, M.Z.A.M., Rezalic, M.F., Taherb, M.  
Friedelin and lanosterol from Garcinia prainiana stimulated glucose uptake and adipocytes differentiation in 3T3-L1 adipocytes  
doi: 10.1080/14786419.2012.725399  
View at Publisher

Inhibitory effects of coumarins from the stem barks of fraxinus rhynchophylla on adipocyte differentiation in 3T3-L1 cells  
http://www.jstage.jst.go.jp/article/bpb/33/9/1610/-_pdf  
doi: 10.1248/bpb.33.1610  
View at Publisher

44 Tafuri, S.R.  
Troglitazone enhances differentiation, basal glucose uptake, and Glut1 protein levels in 3T3-L1 adipocytes  
doi: 10.1210/en.137.11.4706  
View at Publisher
45  Lefterova, M.I., Lazar, M.A.
New developments in adipogenesis
doi: 10.1016/j.tem.2008.11.005
View at Publisher

46  Ha, D.T., Trung, T.N., Phuong, T.T., Yim, N., Chen, Q.C., Bae, K.
The selected flavonol glycoside derived from Sophorae Flos improves glucose uptake and inhibits adipocyte differentiation via activation AMPK in 3T3-L1 cells
doi: 10.1016/j.bmcl.2010.08.054
View at Publisher

Aloe emodin glycosides stimulates glucose transport and glycogen storage through PI3K dependent mechanism in L6 myotubes and inhibits adipocyte differentiation in 3T3L1 adipocytes
doi: 10.1016/j.febslet.2010.06.004
View at Publisher

48  Thomson, M.J., Williams, M.G., Frost, S.C.
Development of insulin resistance in 3T3-L1 adipocytes
doi: 10.1074/jbc.272.12.7759
View at Publisher

49  Shang, W., Yang, Y., Jiang, B., Jin, H., Zhou, L., Liu, S., Chen, M.
Ginsenoside Rb1 promotes adipogenesis in 3T3-L1 cells by enhancing PPARγ2 and C/EBPα gene expression
doi: 10.1016/j.lfs.2006.10.021
View at Publisher

50  Gregoire, F.M., Smas, C.M., Sul, H.S.
Understanding adipocyte differentiation
View at Publisher

Sulforaphane induced adipolysis via hormone sensitive lipase activation, regulated by AMPK signaling pathway
doi: 10.1016/j.bbrc.2012.08.107
View at Publisher

