Vol 01 2022, pp 1-7
e-ISSN: XXXX-XXXX
DOI: https://doi.org/10.54482/ELECTROLYTE/

In-Silico Analysis of Chemical Compounds Ascorbic Acid in Lemon (*Citrus limon*) for Antiobesity

Agung Dewantara[a], Mutiah Nasution[b], Novitri Fijri[c], Ahya Dani[d], Rela Faradina[e]

[a]Magister Programme of Biochemistry, Postgraduate, Universitas De La Salle, Philippines
[b]Department of Chemistry, Faculty oh Mathematics and Natural Science, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Air Tawar Barat, Padang Utara, West Sumatera, Indonesia, 25171
[c]Department of Educational Chemistry, Universitas Syiah Kuala, Jln. Teuku Nyak Arief Darussalam, Banda Aceh, Aceh, Indonesia, 23111
[d]Department of Educational English, Universitas Negeri Medan, Jl. Willem Iskandar / Pasar V, Medan, North Sumatera, Indonesia, 20221
[e]Magister Programme of Educational Chemistry, Postgraduate, Universitas Negeri Padang, Jl. Prof. Dr. Hamka, Air Tawar Barat, Padang Utara, West Sumatera, Indonesia, 25171

*Coresponding email: mmutiah100@gmail.com

ABSTRACT

Obesity is a condition in which fat is abnormally accumulated in fat tissue due to unhealthy lifestyles such as high carbohydrates and high fats diets. Lemon (*Citrus limon*) is one of the nutritious medicinal plants that have not been widely known to the public that is used as an obesity drug. The purpose of this research is to fi nd the chemical compound in lemon plants that potentially has an antiobesity activity at ascorbic acid. The method that been used in this research is in-silico analysis trough molecular docking of chemical compound that potentially has an antiobesity activity in Lemon plants.The software that been used in this research is Pyrx, Avogadro, Discovery Studio, PyMol, Chem3D, and ChemDraw. The resultsof this study are the ability of the active compound Ascorbic Acid (The most influential Glycogen Synthase Kinase 3 beta compound) to bind CuO ligands.

Keywords: Ascorvic Acid, Antiobesity, In-Silico

1. INTRODUCTION

Obesity is a complex disorder regulation of appetite and energy metabolism which is controlled by several biological factors specific. [1][2][3][4] Physiologically, obesity is defined as a state with an accumulationof fat abnormal or excessive adipose tissue so that it can interfere with health like diabetes, heart failure, hypertension, osteoarthritis, and cancer. [5][6][7][8] As it develops times as well as changing trends and patterns of life unhealthy, nowadays there are so many people suffering from obesity.[9][10][11] Obesity is considered a signal first the emergence of a group of non-diseases infection ((Non Communicable Diseases) a lot occurs in both developed and developing countries. [12][13][14][15] Obesity is characterized by an increase in the mass index body (BMI), which is defined as body weight individual divided by the square of height (kg / m²).[16][17][18]

The proposed weight classification based on BMI in adult Asian population: Normal (18.5 - 22.9 kg / m²), Risk (23 - 24.9 kg /m²), Obesity Grade I (25 - 29.9 kg / m²), Obesity Level II (≥ 30 kg / m²).[19][20][21] Obesity can occur because of internal and external factors. Causes from internal factors; such as genetic, endocrine, age. External factors; such as lifestyle, behavior,environmental, social and economic problems.[22][23]

2. LITERATURE REVIEW

Some of the compounds in the lemon plant have been discovered has potential as anti-obesity, and drink lemon extract is not a commonly consumed beverage only in Indonesia but in the world,

especially in Asia, there are ascorbic acid, which has the potential as anti-obesity.[24] The active compound Glycogen Synthase Kinase 3 beta is the most influential in remembering fat in the body.[25] he method that has been used in this study is in-silico analysis, because it is efficient and effective in terms of time and charge, selectively directly tested at receptors or cells target and accurate.[26][27][28][29][30]

3. EXPERIMENTAL

This paper will use the Systematic Literature Review (SLR) is a process for identifying, assessing, and interpreting all available research about the compounds contained in lemons for antiobesity. And Test the validity of this research instrument using a qualitative descriptive method and quantitative. This writing is supported from books, journals, optimization 3D structure Ascorbic Acid. The first thing to do is get data from https://pubchem.ncbi.nlm.nih.gov/ where we see data on the content of substances in herbal plants.

Using https://phytochem.nal.usda.gov/phytochem/search to find out the name of the compound Glycogen Synthase Kinase 3 beta, then opening http://swisstargetprediction.ch/ to predict how much Lemon content has an effect on anti-obesity.

The process used is Glycogen Synthase Kinase 3 beta compound using PDB format for docking with CuO type ligands. Code 1h8f which is a compound Glycogen Synthase Kinase 3 beta is docked with some CuO one by one. Where later data will be obtained regarding the docked active compounds.

After that, we used the Avogadro application for testing into the Discovery Studio, which used a compound with PDB format with an early stage active compound.

After the matching process is carried out, the final result will be obtained in the form of an active compound that can bind the CuO compound that is carried out. This proves that the active compounds contained in Citrus limon can be used as an anti-obesity alternative.

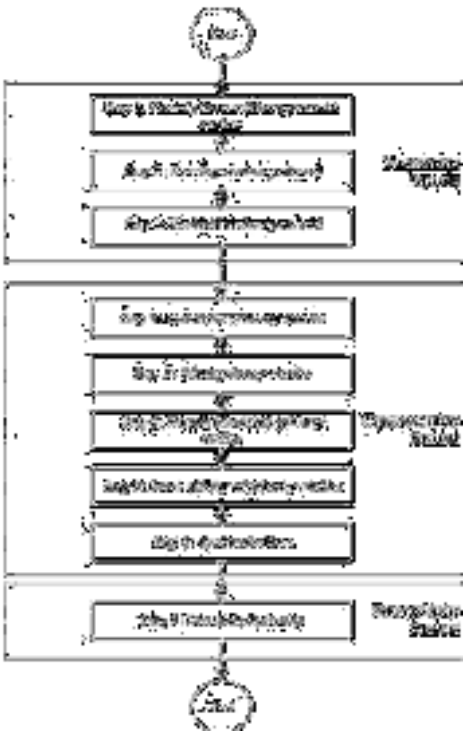

Figure 1. Systematic Review Diagram

Table 1. PICOC Criteria

Population	**Citrus limon**
Intervention	Assumption of Antiobesity
Comparison	-
Outcomes	-
Context	-

4. RESULTS AND DISCUSSION

4.1 Receptor Analysis Used

Receptors that play a role in controlling various target genes involved in lipid and glucose homeostasis are Glycogen Synthase Kinase 3 beta compound (1h8f). Receptors can be used in docking applications should be in the form of a crystalline structure, human, and after being validated it generates Root mean Square Deviation (RMSD) less than 2 Å . The test ligand is considered to have the potential to enterin the receptor and is absorbed by the body if it meets the Lipinski's rule with the following criteria:

1) BM<500 gram/mole
2) Number of hydrogen bond proton donor groups <5
3) The number of hydrogen bonding proton acceptor groups <10
4) The sum of the logarithms of the partition coefficients in water and 1-octanol < 5

4.2 Docking Simulation

Based on the results of docking test compounds and positive control of Glycogen Synthase Kinase 3 beta compound (1h8f). Molecular docking is a research with computational method which aims to estimate the interaction and affinity of a ligand for a macromolecule (usually proteins). A ligand and protein molecule predicted by placing techniques on the area certain (active site) so as to provide results optimal. Produces an interaction pose and a value that determines whether or not a pose is good interaction (docking score). The docking score is calculated between another with ChemPLP value units. ChemPLP Value calculated on the basis of the Gibbs free energy where the smaller (more negative) to the compound positive control then it can be said to have affinity good bonding, indicating that the compound It easily binds to the receptors.

The following are the results of the study after the docking test was carried out with 36 ligands,but only 21 ligands were found successful when docking, here are the data:

1. Cu2O3_396

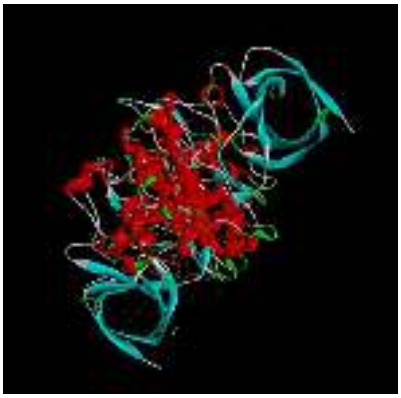

Figure 2. Shows Glycogen Synthase Kinase 3 Beta, Ascorbic Acid Compound Docked with Cu2O3_396

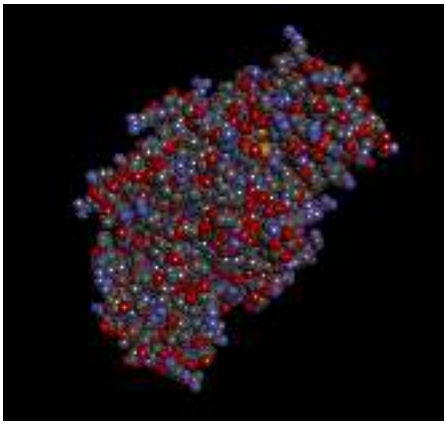

Figure 3. Shows Another Form of Glycogen Synthase Kinase 3 Beta, Ascorbic Acid Compound Docked with Cu2O3_396

Table 2. Ligand Binding Cu2O3_396

Ligand,Binding Affinity, rmsd/ub, rmsd/lb
1h8f_Cu2O3_396,-10.1,0.0,0.0
1h8f_Cu2O3_396,-10.0,33.269,27.262
1h8f_Cu2O3_396,-9.3,32.109,26.067
1h8f_Cu2O3_396,-9.3,10.402,2.292
1h8f_Cu2O3_396,-9.1,10.4,2.446
1h8f_Cu2O3_396,-8.4,32.326,26.677
1h8f_Cu2O3_396,-8.4,7.99,3.837
1h8f_Cu2O3_396,-8.3,9.239,3.584
1h8f_Cu2O3_396,-8.3,29.906,24.539

2. Cu2O3_755040

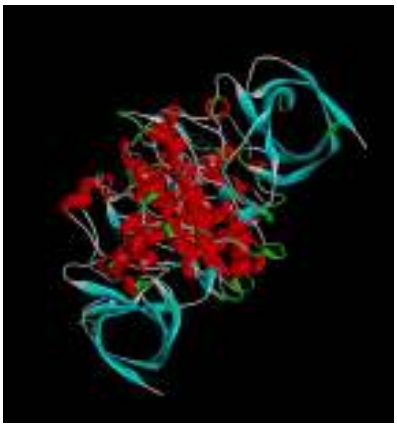

Figure 4. Shows Glycogen Synthase Kinase 3 Beta, Ascorbic Acid Compound Docked with Cu2O3_755040

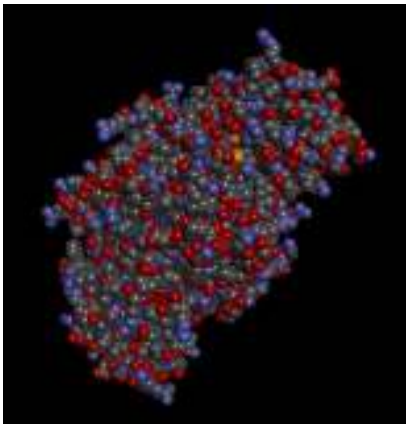

Figure 5. Shows Another Form of Glycogen Synthase Kinase 3 Beta, Ascorbic Acid Compound Docked with Cu2O3_755040

Table 3. Ligand Binding Cu2O3_755040

Ligand,Binding Affinity, rmsd/ub, rmsd/lb
1h8f_Cu2O3_755040,-2.6,0.0,0.0
1h8f_Cu2O3_755040,-2.6,3.145,3.145
1h8f_Cu2O3_755040,-2.5,25.028,25.028
1h8f_Cu2O3_755040,-2.5,9.29,9.29
1h8f_Cu2O3_755040,-2.5,21.265,21.265
1h8f_Cu2O3_755040,-2.4,21.857,21.857
1h8f_Cu2O3_755040,-2.4,10.043,10.043
1h8f_Cu2O3_755040,-2.4,9.251,9.251
1h8f_Cu2O3_755040,-2.4,9.227,9.227

5. CONCLUSION

There is a Glycogen Synthase Kinase 3 beta, Ascorbic acid compound in Citrus limon whichis an active compound that binds to fat which is used as an anti-obesity. In the docking test process,the active compound was able to bind to Cu-O ligands.

REFERENCES

[1] Alberca, R. W., Oliveira, L. D. M., Branco, A. C. C. C., Pereira, N. Z., & Sato, M. N. (2021). Obesity as a risk factor for COVID-19: an overview. *Critical Reviews in Food Science and Nutrition*, *61*(13), 2262-2276.

[2] Demeulemeester, F., de Punder, K., van Heijningen, M., & van Doesburg, F. (2021). Obesity as a risk factor for severe COVID-19 and complications: a review. *Cells*, *10*(4), 933.

[3] Clark, T. D., Reichelt, A. C., Ghosh-Swaby, O., Simpson, S. J., & Crean, A. J. (2022). Nutrition, anxiety and hormones. Why sex differences matter in the link between obesity and behavior. *Physiology & Behavior*, 113713.

[4] Zainul, R., Alif, A., Aziz, H., & Arief, S. (2015). Disain Geometri Reaktor Fotosel Cahaya Ruang. *Jurnal Riset Kimia*, *8*(2), 131.

[5] Chen, X., Xiao, Z., Cai, Y., Huang, L., & Chen, C. (2022). Hypothalamic mechanisms of obesity-associated disturbance of hypothalamic–pituitary–ovarian axis. *Trends in Endocrinology & Metabolism*.

[6] Goossens, G. H. (2021). The air that we (do not) breathe: lower adipose tissue oxygen availability in patients with obesity hypoventilation syndrome?. *International Journal of Obesity*, *45*(6), 1161-1162.

[7] Yasmin, I., Khan, W. A., Naz, S., Iqbal, M. W., Awuchi, C. G., Egbuna, C., ... & Uche, C. Z. (2021). Etiology of Obesity, Cancer, and Diabetes. In *Dietary Phytochemicals* (pp. 1-27). Springer, Cham.

[8] Candani, D., Ulfah, M., Noviana, W., & Zainul, R. (2018). A Review Pemanfaatan Teknologi Sonikasi.

[9] Lynch, M., Bucknall, M., Jagger, C., & Wilkie, R. (2022). Projections of healthy working life expectancy in England to the year 2035. *Nature Aging*, *2*(1), 13-18.

[10] Al-Kaabi, A., Baranov, N. S., van der Post, R. S., Schoon, E. J., Rosman, C., van Laarhoven, H. W., ... & Siersema, P. D. (2022). Age-specific incidence, treatment, and survival trends in esophageal cancer: a Dutch population-based cohort study. *Acta Oncologica*, 1-8.

[11] Luo, L. S., Jiang, J. F., Luan, H. H., Zi, H., Zhu, C., Li, B. H., & Zeng, X. T. (2022). Spatial and temporal patterns of prostate cancer burden and their association with Socio-Demographic Index in Asia, 1990–2019. *The Prostate*, *82*(2), 193-202.

[12] Bakhtiyari, M., Kazemian, E., Kabir, K., Hadaegh, F., Aghajanian, S., Mardi, P., ... & Azizi, F. (2022). Contribution of obesity and cardiometabolic risk factors in developing cardiovascular disease: a population-based cohort study. *Scientific Reports*, *12*(1), 1-10.

[13] Aaseth, J., Javorac, D., Djordjevic, A. B., Bulat, Z., Skalny, A. V., Zaitseva, I. P., ... & Tinkov, A. A. (2022). The Role of Persistent Organic Pollutants in Obesity: A Review of Laboratory and Epidemiological Studies. *Toxics*, *10*(2), 65.

[14] Colleluori, G., Perugini, J., Giordano, A., & Cinti, S. (2022). From Obesity to Diabetes: The Role of the Adipose Organ.

[15] Desideria, S., Dj, L., & Zainul, R. (2018). Deskripsi Keterampilan Proses Sains Peserta Didik Kelas XI IPA pada Materi Larutan Penyangga di SMAN 15 Padang.

[16] Gálvez, I., Navarro, M. C., Martín-Cordero, L., Otero, E., Hinchado, M. D., & Ortega, E. (2022). The Influence of Obesity and Weight Loss on the Bioregulation of Innate/Inflammatory Responses: Macrophages and Immunometabolism. *Nutrients*, *14*(3), 612.

[17] Adnan, D., Trinh, J., & Bishehsari, F. (2022). Inconsistent eating time is associated with obesity: A prospective study. *EXCLI Journal*, *21*, 300-306.

[18] Soffer, S., Zimlichman, E., Glicksberg, B. S., Efros, O., Levin, M. A., Freeman, R., ... & Klang, E. (2022). Obesity as a mortality risk factor in the medical ward: a case control study. *BMC endocrine disorders*, *22*(1), 1-8.

[19] Jin, Z., Huang, J., Xiong, A., Pang, Y., Wang, W., & Ding, B. (2022). Attention Guided Deep Features for Accurate Body Mass Index Estimation. *Pattern Recognition Letters*.

[20] Jarnig, G., Jaunig, J., Kerbl, R., Strenger, V., Haeusler, G., & van Poppel, M. N. (2022). Acceleration in BMI gain following COVID-19 restrictions. A longitudinal study with 7-to 10-year-old primary school children. *Pediatric Obesity*, e12890.

[21] Liang, X., & Fan, J. (2022). The utilization of accurate body mass index classification is imperative for grouping based on BMI. *Human Reproduction*.

[22] Usta, E., Bozdemir, H., & Şen, S. (2022). Validity and reliability of the Turkish version of the Obesity-Related Well-Being Questionnaire (ORWELL 97-TR). *Perspectives in Psychiatric Care*.

[23] Hall, K. D., Farooqi, I. S., Friedman, J. M., Klein, S., Loos, R. J., Mangelsdorf, D. J., ... & Tobias, D. K. (2022). The energy balance model of obesity: beyond calories in, calories out. *The American Journal of Clinical Nutrition*.

[24] Kharisma, V. D., Ansori, A. N. M., Dian, F. A., Rizky, W. C., Dings, T. G. A., Zainul, R., & Nugraha, A. P. (2021). MOLECULAR DOCKING AND DYNAMIC SIMULATION OF ENTRY INHIBITOR FROM TAMARINDUS INDICA BIOACTIVE COMPOUNDS AGAINST SARS-COV-2 INFECTION VIA VIROINFORMATICS STUDY. *Biochemical and Cellular Archives*, 3323-3327.

[25] Zainul, R. SILVER SULFATE (Ag2SO4): MOLECULAR ANALYSIS AND ION TRANSPORT.

[26] Dinata, A. A., Rosyadi, A. M., Hamid, S., & Zainul, R. (2018). A Review Chemical Vapor Deposition: Process And Application.

[27] Fatimah, P., Jumalia, R., Novianti, E. R., & Zainul, R. (2018). A REVIEW Teknik Blended: Prinsip dan Dasar-Dasar.

[28] Kurniawati, D., & Zainul, R. (2015). Biosorption of Pb (II) from aqueous solutions using column method by lengkeng (Euphoria logan lour) seed and shell. *Journal of Chemical and Pharmaceutical Research*, *7*(12), 872-877.

[29] Febriani, S. S., Yolanda, T., Arianti, V. A., & Zainul, R. (2018). A Review Solid Stated: Principles and Methode.

[30] Zainul, R. (2015). Photoelectrosplitting water for hydrogen production using illumination of indoor lights. *Journal of Chemical and Pharmaceutical Research*, *11*(7), 57-67.