Jurnal Info Kesehatan
Vol. 22, No. 1, March 2024, pp. 24-32
P-ISSN 0216-504X, E-ISSN 2620-536X
DOI: *10.31965/infokes.Vol22Iss1.1459*
Journal homepage:*http://jurnal.poltekeskupang.ac.id/index.php/infokes*

RESEARCH **Open Access**

Effectiveness of Bay Leaves (*Syzygium polyanthum*) to Reduce Body Mass Index Among Pre-Menopausal Obese Adults in South Jakarta Regency

Siti Syamsiah[1a*], Triana Indrayani[1b], Yuliani Munjanah[1c]

[1] Midwifery Study Program, Universitas Nasional, Jakarta, Indonesia

[a] Email address: sitisyamsiah@civitas.unas.ac.id
[b] Email address: trianaindrayani@civitas.unas.ac.id
[c] Email address: yulianimunjanah123@gmail.com

Received: 13 March 2024 Revised: 28 March 2024 Accepted: 31 March 2024

Abstract

Perimenopause is a transition phase towards menopause which is characterized by hormonal changes, including a decrease in the production of the hormone estrogen and an increase in belly fat which can cause obesity. This study aimed to examine the effectiveness of bay leaves to reduce body mass index (BMI). The research design used was quasi-experimental with a one-group pretest and posttest-only design. The population in this study were pre-menopausal adults with obesity who were selected using purposive sampling with a total respondents 30 adults. During 14 days, they are given the 4-5 bay leaves which were previously boiled with around 250 ml water. The BMI was calculated before and after giving the intervention. Data analysis used the Wilcoxon analysis test. The results revealed that there are significantly reduced BMI compared to before and after the intervention. The content of bay leaves can accelerate weight loss in pre-menopause because it has a thermogenic effect on the body and can be used as an alternative herbal therapy that is very easy to obtain and economical which can be used by obese women in perimenopause. The health promotion to introduce bay leaves could be started as bay leaves are easy to find and grow.

Keywords: Bay Leaves, Salam, Obesity, Pre-Menopausal, Adult.

Corresponding Author:

Siti Syamsiah
Midwifery Study Program, Universitas Nasional, Jakarta, Indonesia
Email: sitisyamsiah@civitas.unas.ac.id

1. INTRODUCTION

Obesity among pre-menopausal adult women is common due to unbalanced hormones and an increase the belly fat. Previous studies have highlighted the impact of obesity on gut microbiota composition, functionality, and gonadal steroid status in pre-menopausal women, indicating that obesity can eliminate differences observed among non-obese pre-menopausal women, post-menopausal women, and men (Mayneris-Perxachs et al., 2020). The association between obesity and sleep-disordered breathing has been emphasized, particularly in pre-menopausal women, suggesting a strong impact of obesity in this population (Matsumoto et al., 2020). The impact of being obese during the pre-menopausal period is important to prevent. Existing studies have explored the relationship between obesity, weight gain, and breast cancer risk in pre-menopausal women, indicating that adult weight gain may increase post-menopausal breast cancer risk among women with lower body mass index at a younger age (Renehan et al., 2020). Dietary factors have also been studied, with findings showing that higher fruit and vegetable intake is associated with a lower risk of central obesity among pre-menopausal women (Su et al., 2022). Structural equation model analysis has revealed significant differences in body fat percentage and visceral fat area between menopausal and pre/perimenopausal women, highlighting the impact of menopausal status on obesity-related factors (Darbandi et al., 2019). Studies have highlighted the paradoxical relationship between obesity and breast cancer risk in pre-menopausal women, where obesity appears to be protective in this population (García-Estévez et al., 2021). However, the integrative effects of modifiable risk factors, including obesity, on menstrual cycle irregularity and menopause, remain incompletely understood (Bae et al., 2018). Additionally, obesity has been associated with alterations in age at natural menopause, with a higher risk of early menopause observed among obese women (Zhu et al., 2018).

The role of obesity in influencing adipose tissue milieu and its association with increased mortality risk, particularly central obesity, independent of BMI, underscores the significant impact of obesity on health outcomes (Bracht et al., 2019). The association between obesity and heart failure, as well as the differential risk patterns observed in pre-menopausal and post-menopausal women, highlights the nuanced relationship between obesity and cardiovascular health (Leedy et al., 2021). Obesity has been linked to low-grade inflammation, leucocytosis, and an increased risk of venous thromboembolism, emphasizing the broader health implications of obesity (Christakoudi et al., 2023).

There is evidence that being obese among pre-menopausal age is a high risk for non-communicable diseases and mortality. While obesity may have protective effects in certain contexts, such as breast cancer risk in pre-menopausal women, it remains a critical risk factor for various health conditions and mortality outcomes. There are some herbs to reduce body weight. It revealed several studies have explored the potential of herbal remedies. There is green tea, taraxacum officinale, guarana, and Irvingia gabonensis. However, there is a lack of studies to test the effectiveness of bay leaves in reducing body weight. Bay leaves have been studied for reducing blood pressure, gut, and cholesterol but limited study on their effect on reducing body weight. This study aimed to test the effectiveness of bay leaves in reducing body weight among pre-menopausal obese adults in South Jakarta.

2. RESEARCH METHOD

The current study used a quasi-experimental design to examine the effectiveness of bay leaves to reduce body mass index. The data collection was conducted in Posyandu (Integrated Healthcare Center) Anggrek, East Cilandak, South Jakarta, Indonesia. The data has been collected in January 2024.

The sample in this study needs to meet the criteria of pre-menopause adults aged 40 to 60 years old, obese and did not consume the obesity drug. The exclusion criteria in this study include the respondents with an unwillingness to join the whole interview and receive intervention. The population of the study consists of 45 adults, but the sample in this study was 30 who were selected using purposive sampling.

In this study, there is one group only. The intervention was given to the case group to observe the effectiveness of the intervention given. The intervention was given a decoction of bay leaves. The bay leaves were given about 4 to 5 leaves and boiled with 240 ml water. It was given for a once-a-day dose in the morning for 14 days. Before and after the given intervention, all the respondents were measured for height and weight to calculate body mass index (BMI). Body Mass Index in this study was calculated by the formula of weight in kg divided by height in meter square (kg/m2). The IMT in this study was used in the category by the Ministry of Health Indonesia.

The Wilcoxon test analyzed the data to examine the correlation between the independent variable and the dependent variable. The analysis was done by using SPSS software for Windows. The preliminary test and normality test were done using Shapiro-Wilk. The bivariate analysis in this study to test the hypothesis was done using paired t-test and t-test dependent.

This study including instruments and tools has been approved by the Ethical Committee University of Muhammadiyah Purwokerto with reference number: KEPK/UMP/43/II/2024.

3. RESULTS AND DISCUSSION

The results in this study consist of univariate and bivariate analyses. Table 1 below describes the general characteristics of the respondents. Among all respondents in this study (n = 30), the majority of them were female (70%), working (60%), and attended from senior high school (56.7%).

Table 1. The general characteristics of the sample (n = 30).

Characteristics	Frequency	Percentage
Sex		
Male	9	30
Female	21	70
Working status		
No	12	40
Yes	18	60
Educational level		
Uneducated	1	3.3
Elementary	5	16.7
Junior high school	3	10
Senior high school	17	56.7
College	4	13.3

In terms of the body mass index, Table 2 below shows the information about BMI. Before giving the intervention, the mean body mass index of respondents was 26.49, and the after-mean body mass index was 25.67. The standard deviation before and after giving the intervention was 0.85 and 0.83, respectively.

Table 2. The Body Mass Index before and after giving the intervention.

Variable	n	Mean	Std deviation
Pre	30	26.4863	0.84791
Post	30	25.6740	0.82903

The bivariate results analysis of this study is in Table 3. It shows that the difference between before and after intervention is significant with *p-value* of 0.000. So, in other words, the intervention is significantly effective in decreasing the body mass index.

Table 3. The result of *Paired t-test* Analysis.

Observation	n	t	df	p-value
Pre	30	12.907	29	0.000
Post	30			

Bay leaves contain Vitamin B3, Vitamin C, and flavonoids. Flavonoids have been shown to inhibit body fat accumulation by reducing the activity of fatty acid synthase (FAS) in obese mice fed a high-fat diet (Cheon et al., 2021). Additionally, flavonoids have anti-obesity properties by reducing the absorption of carbohydrates and fats, which is essential in combating obesity (Liu et al., 2019). Existing studies have also demonstrated that flavonoids can regulate lipolysis, promoting weight loss and improving metabolic conditions associated with obesity (X. Yang et al., 2022). Flavonoids have been linked to preventing weight regain after successful weight loss (Lundgren & Thaiss, 2020). It has shown efficacy in treating conditions like intestinal mucositis and reversing weight loss (Miranda et al., 2020). Flavonoids have been associated with decreased body weight, as higher flavonoid intake has been linked to reduced body weight (Marranzano et al., 2018). Flavonoids have been found to have differential effects on adipogenesis, further supporting their role in weight management (Khalilpourfarshbafi et al., 2018). Specific flavonoids like quercetin and 8-Prenylnaringenin have shown promise in weight management. Quercetin has been reported to improve muscle mass and mitochondrial content, particularly in conditions like cancer and chemotherapy-induced cachexia (VanderVeen et al., 2022). On the other hand, 8-Prenylnaringenin, a hop flavonoid, has been identified as a food substance with health benefits (Tanaka et al., 2022).

Vitamin B3 may have potential benefits for overall health, including its impact on cholesterol levels and cellular metabolism (Sallabi et al., 2021). Vitamin B3 has been reported to lower total cholesterol, bad cholesterol (such as LDL), triglycerides, and lipoprotein levels in the blood, which are factors often associated with obesity. Moreover, vitamin B3 has been linked to potential protective effects against conditions that can lead to weight gain, such as inflammation-related degeneration in retinal ganglion cells (Chen et al., 2022). Vitamin B3 may inhibit apoptosis and promote autophagy of islet β cells under high glucose stress, which could have implications for metabolic health(Yu et al., 2023). Additionally, vitamin B3 is an important co-factor for cellular processes, including fatty acid metabolism and energy metabolism, which are crucial for overall health (Tinnevelt et al., 2020).

Vitamin C has been associated with reducing systemic inflammation by inhibiting pathways related to inflammation, such as CRP and TNF alpha, which can help protect against free radicals and decrease lipid peroxidation, potentially aiding in weight management (Totan et al., 2019). Vitamin C has been found to scavenge free radicals and suppress lipid peroxidation, which can lead to decreased vitamin C levels in obese individuals due to increased body fat and oxidative stress (Y. Yang et al., 2023). Vitamin C may inhibit metabolic changes induced by certain stressors like high-fat diets, with studies showing that high doses of vitamin C can induce weight loss safely in obese individuals (Yuan et al., 2021). Vitamin C has also been linked to inhibiting visceral adipocyte hypertrophy and lowering blood glucose levels in

high-fat-diet-induced obese mice, suggesting a potential role in combating obesity-related metabolic issues(Park et al., 2018). Vitamin C intake has been associated with promoting weight loss and reducing serum leptin levels, improving lipid profiles, and decreasing inflammatory biomarkers in obese individuals (Manuha, 2019).

There are other benefits of bay leaves. Syzygium polyanthum, commonly known as bay leaves, has been extensively researched for its potential health benefits. Studies have demonstrated its antioxidant, antidiabetic, and anti-inflammatory properties, with active compounds like flavonoids playing a key role in its therapeutic potential (Hadiyanti et al., 2023; Ismail & Ahmad, 2019). Research suggests that Syzygium polyanthum may help manage conditions such as hypercholesterolemia and diabetes mellitus (Muhammad et al., 2022). The plant is rich in antioxidants and antidiabetic agents, offering various health advantages (Halim & Maryani, 2022).Moreover, Syzygium polyanthum has shown promise in lowering blood glucose levels, possibly through its active compounds (Panambunan et al., 2019). Studies have also investigated its effects on histological changes in the kidney, indicating broader impacts on physiological functions (Muhammad et al., 2022).

The plant has been studied for its vasorelaxant effects, suggesting a potential role in managing blood pressure (Hassan et al., 2022). Syzygium polyanthum has been associated with anti-inflammatory properties, which could be beneficial for conditions like rheumatoid arthritis (Sulayha & Kustiawan, 2022). The traditional uses of Syzygium polyanthum in Indonesian and Malaysian cultures have been supported by scientific research, confirming its medicinal properties. From reducing cholesterol levels to improving insulin sensitivity and providing antioxidant effects, Syzygium polyanthum emerges as a versatile natural remedy with a range of potential health benefits.

However, there is a lack of existing studies evaluating the effectiveness of bay leaves in reducing body weight. To evaluate the potential impact of Syzygium polyanthum on body weight reduction, it is crucial to consider its documented health benefits. While the references provided focus on various aspects of Syzygium polyanthum, such as its antihypertensive, antidiabetic, and antioxidant properties, there is limited direct evidence on its specific effect on body weight reduction. The plant's active compounds, including gallic acid and other phenolics, have been associated with positive effects on metabolic health, which could indirectly influence body weight (Ismail et al., 2020; Ismail & Ahmad, 2019).

Research has indicated the potential of Syzygium polyanthum in managing conditions like diabetes and hypertension, which are often associated with weight management (Kustanti & Widyarani, 2023; Muhammad et al., 2022). The plant's capacity to lower blood glucose levels and enhance insulin sensitivity may contribute to overall metabolic regulation, potentially impacting body weight (Widodo, 2023). It is antioxidant properties and effects on inflammatory pathways could support overall health and potentially influence weight management (Rahim et al., 2021; Widyawati et al., 2021).

Bay leaves contain of Vitamin B3, Vitamin C, steroid, and flavonoid. Further research is necessary to gain a better understanding of the mechanisms of action and potential risks associated with herbal treatments for body weight reduction. This study found the fact that giving bay leaves for 14 days could reduce body weight. Future studies could add more details laboratory research to test the effectiveness of bay leaves in reducing body weight, especially among pre-menopausal obese adults.

4. CONCLUSION

Bay leaves effectively reduce body weight after 14 days of intervention. Bay leaves contain Vitamin B3, Vitamin C, and flavonoids. The content of bay leaves can accelerate weight loss in premenopausal because it has a thermogenic effect. Bay leaves can be one herbal

prevention alternative to prevent the risk of obesity. This study is limited to certain time and place and can not be generalized to other time and place. Future studies can include more respondents and longer intervention time.

REFERENCES

Bracht, J. R., Vieira-Potter, V. J., Santos, R. d. S., Öz, O. K., Palmer, B. F., & Clegg, D. J. (2019). The Role of Estrogens in the Adipose Tissue Milieu. Annals of the New York Academy of Sciences. https://doi.org/10.1111/nyas.14281

Chen, T.-W., Wu, P. C., Wen, Y.-T., Desai, T. D., Huang, C.-T., Liu, P.-K., & Tsai, R.-K. (2022). Vitamin B3 Provides Neuroprotection via Antioxidative Stress in a Rat Model of Anterior Ischemic Optic Neuropathy. Antioxidants. https://doi.org/10.3390/antiox11122422

Cheon, M., Chung, M. S., & Park, Y. (2021). Association Between Dietary Intake of Flavonoids and Cancer Recurrence Among Breast Cancer Survivors. Nutrients. https://doi.org/10.3390/nu13093049

Christakoudi, S., Tsilidis, K. K., Evangelou, E., & Riboli, E. (2023). Sex Differences in the Associations of Body Size and Body Shape With Platelets in the UK Biobank Cohort. Biology of Sex Differences. https://doi.org/10.1186/s13293-023-00494-y

Darbandi, M., Najafi, F., Pasdar, Y., & Rezaeian, S. (2019). Structural Equation Model Analysis for the Evaluation of Factors Associated With Overweight and Obesity in Menopausal Women in RaNCD Cohort Study. Menopause the Journal of the North American Menopause Society. https://doi.org/10.1097/gme.0000000000001452

García-Estévez, L., Cortés, J., Pérez, S., Calvo, I., Gallegos, I., & Moreno-Bueno, G. (2021). Obesity and Breast Cancer: A Paradoxical and Controversial Relationship Influenced by Menopausal Status. Frontiers in Oncology. https://doi.org/10.3389/fonc.2021.705911

Hadiyanti, H., Rahmat, D., & Chaidir, C. (2023). The EFFECT OF NANOPARTICLE STANDARDIZED EXTRACTS OF BAY LEAVES (Syzygium Polyanthum (Wight) Walp.) IN LOWERING BLOOD GLUCOSE LEVELS OF WHITE RATS (Rattus Norvegicus). Jurnal Ilmiah Farmako Bahari. https://doi.org/10.52434/jfb.v14i1.1980

Halim, Y., & Maryani. (2022). Functional and Sensory Properties of Indonesian Bay Leaf (Syzygium Polyanthum) Herbal Tea. Food Research. https://doi.org/10.26656/fr.2017.6(2).174

Hassan, N. A., Abdelfattah, M. A., Mandour, Y. M., El-Shazly, A. M., Sobeh, M., & Mahmoud, M. F. (2022). Vasorelaxant Effects of Syzygium Samarangense (Blume) Merr. And L.M.Perry Extract Are Mediated by NO/cGMP Pathway in Isolated Rat Thoracic Aorta. Pharmaceuticals. https://doi.org/10.3390/ph15111349

Ismail, A., & Ahmad, W. A. N. W. (2019). Syzygium Polyanthum (Wight) Walp: A Potential Phytomedicine. Pharmacognosy Journal. https://doi.org/10.5530/pj.2019.11.67

Ismail, A., Rahim, E. N. A. A., Omar, M. N., & Ahmad, W. A. N. W. (2020). Antihypertensive Assay-Guided Fractionation of Syzygium Polyanthum Leaves and Phenolics Profile Analysis Using LCQTOF/ MS. Pharmacognosy Journal. https://doi.org/10.5530/pj.2020.12.227

Khalilpourfarshbafi, M., Gholami, K., Murugan, D. D., Sattar, M. Z. A., & Abdullah, N. A. (2018). Differential Effects of Dietary Flavonoids on Adipogenesis. European Journal of Nutrition. https://doi.org/10.1007/s00394-018-1663-8

Kustanti, C., & Widyarani, L. (2023). Pemberdayaan Ibu Rumah Tangga Dalam Penanaman Dan Pemanfaatan Tanaman Obat Keluarga (TOGA) Sebagai Antidiabetik. Jurnal Kreativitas Pengabdian Kepada Masyarakat (PKM). https://doi.org/10.33024/jkpm.v6i4.9005

Leedy, D., Reding, K. W., Vasbinder, A., Anderson, G. L., Barac, A., Wactawski-Wende, J., Shadyab, A. H., Eaton, C. B., Levy, W. C., Qi, L. H., & Cheng, R. K. (2021). The Association Between Heart Failure and Incident Cancer in Women: An Analysis of the Women's Health Initiative. European Journal of Heart Failure. https://doi.org/10.1002/ejhf.2207

Liu, C., Zhang, X., Wu, Z., & Zheng, X. (2019). The Modulatory Effect and the Mechanism of Flavonoids on Obesity. Journal of Food Biochemistry. https://doi.org/10.1111/jfbc.12954

Lundgren, P., & Thaiss, C. A. (2020). The Microbiome-Adipose Tissue Axis in Systemic Metabolism. Ajp Gastrointestinal and Liver Physiology. https://doi.org/10.1152/ajpgi.00304.2019

Manuha, Dr. M. (2019). Quantitative Analysis of Vitamin C in Lime and Lemon in Vitro: Verification of Vitamin C on the Impairment of Obesity. International Journal of Advances in Scientific Research and Engineering. https://doi.org/10.31695/ijasre.2019.33549

Marranzano, M., Ray, S., & Godos, J. (2018). Association Between Dietary Flavonoids Intake and Obesity in a Cohort of Adults Living in the Mediterranean Area. International Journal of Food Sciences and Nutrition. https://doi.org/10.1080/09637486.2018.1452900

Matsumoto, T., Murase, K., Tabara, Y., Minami, T., Kanai, O., Takeyama, H., Takahashi, N., Hamada, S., Tanizawa, K., Wakamura, T., Komenami, N., Setoh, K., Kawaguchi, T., Tsutsumi, T., Morita, S., Takahashi, Y., Nakayama, T., Hirai, T., Matsuda, F., & Chin, K. (2020). Sleep Disordered Breathing and Metabolic Comorbidities Across Sex and Menopausal Status in East Asians: The Nagahama Study. European Respiratory Journal. https://doi.org/10.1183/13993003.02251-2019

Mayneris-Perxachs, J., Arnoriaga-Rodríguez, M., Luque-Córdoba, D., Priego-Capote, F., Pérez-Brocal, V., Moya, A., Burokas, A., Maldonado, R., & Fernández-Real, J. M. (2020). Gut Microbiota Steroid Sexual Dimorphism and Its Impact on Gonadal Steroids: Influences of Obesity and Menopausal Status. Microbiome. https://doi.org/10.1186/s40168-020-00913-x

Miranda, J. A. L. de, Martins, C. d. S., Fideles, L. d. S., Barbosa, M. L. L., Barreto, J. E. F., Pimenta, H. B., Freitas, F. O. R., Pimentel, P. V. de S., Teixeira, C. S., Scafuri, A. G., Luciano, M. C. dos S., Araújo, J. L., Rocha, J. A., Vieira, Í. G. P., Ricardo, N. M. P. S., Campelo, M. d. S., Ribeiro, M. E. N. P., Brito, G. A. de C., & Cerqueira, G. S. (2020). Troxerutin Prevents 5-Fluorouracil Induced Morphological Changes in the Intestinal Mucosa: Role of Cyclooxygenase-2 Pathway. Pharmaceuticals. https://doi.org/10.3390/ph13010010

Muhammad, N. D. S., Salim, H. M., Virlliana, C. D., Donastin, A., & Adriansyah, A. A. (2022). The Effect of Syzygium Polyanthum (Wight) Extract in Histological Changes of Kidney in Diabetic Mice Model. Bali Medical Journal. https://doi.org/10.15562/bmj.v11i3.3545

Panambunan, M., Pangkahila, W., & Budhiarta, A. A. G. (2019). Combination Treatment of Vildagliptin and Bay Leaf (Syzygium Polyanthum) Extract Increased Pancreatic Beta Cells Number but Have No Effect Toward Glycated Albumin Levels in Diabetic Male Wistar Rats (Rattus Norvegicus). Ijaam (Indonesian Journal of Anti-Aging Medicine). https://doi.org/10.36675/ijaam.v3i2.43

Park, Y.-H., Jang, J., Lee, D., & Yoon, M. (2018). Vitamin C Inhibits Visceral Adipocyte Hypertrophy and Lowers Blood Glucose Levels in High-Fat-Diet-Induced Obese C57bl/6j Mice. Biomedical Science Letters. https://doi.org/10.15616/bsl.2018.24.4.311

Rahim, N. S. M., Ahmad, I. F., & Tan, T. Y. C. (2021). Potential of Syzygium Polyanthum (Daun Salam) in Lowering Blood Glucose Level: A Review. Pertanika Journal of Science and Technology. https://doi.org/10.47836/pjst.29.4.02

Renehan, A. G., Pegington, M., Harvie, M., Sperrin, M., Astley, S. M., Brentnall, A. R., Howell, A., Cuzick, J., & Evans, D. G. (2020). Young Adulthood Body Mass Index, Adult Weight Gain and Breast Cancer Risk: The PROCAS Study (United Kingdom). British Journal of Cancer. https://doi.org/10.1038/s41416-020-0807-9

Sallabi, S. M., Alhmoudi, A., Alshekaili, M., & Shah, I. (2021). Determination of Vitamin B3 Vitamer (Nicotinamide) and Vitamin B6 Vitamers in Human Hair Using LC-MS/MS. Molecules. https://doi.org/10.3390/molecules26154487

Su, J., Qingting, L., Mao, P., Peng, H., Han, H.-S., Wiley, J., Guo, J., & Chen, J.-L. (2022). Does the Association of Sedentary Time or Fruit/Vegetable Intake With Central Obesity Depend on Menopausal Status Among Women? International Journal of Environmental Research and Public Health. https://doi.org/10.3390/ijerph191610083

Sulayha, S., & Kustiawan, P. M. (2022). Study of Ethnopharmaceutical Plants With Anti-Inflammatory Properties in Loa Lepu Village, Kutai Kartanegara. Jurnal Serambi Engineering. https://doi.org/10.32672/jse.v7i3.4215

Tanaka, Y., Okuyama, H., Nishikawa, M., Ikushiro, S., Ikeda-Imafuku, M., Ishima, Y., Ukawa, Y., Oe, K., Terao, J., & Mukai, R. (2022). 8-Prenylnaringenin Tissue Distribution and Pharmacokinetics in Mice and Its Binding to Human Serum Albumin and Cellular Uptake in Human Embryonic Kidney Cells. Food Science & Nutrition. https://doi.org/10.1002/fsn3.2733

Tinnevelt, G. H., Engelke, U. F. H., Wevers, R. A., Veenhuis, S., Willemsen, M. A. A. P., Coene, K. L. M., & Kulkarni, P. (2020). Variable Selection in Untargeted Metabolomics and the Danger of Sparsity. Metabolites. https://doi.org/10.3390/metabo10110470

Totan, B., Baygut, H., & Karadağ, M. G. (2019). Vitamin C Physiology: The Known and the Unknown in Obesity. Journal of Food and Nutrition Research. https://doi.org/10.12691/jfnr-7-8-9

VanderVeen, B. N., Cardaci, T. D., Cunningham, P., McDonald, S. J., Bullard, B. M., Fan, D., Murphy, E. A., & Velázquez, K. T. (2022). Quercetin Improved Muscle Mass and Mitochondrial Content in a Murine Model of Cancer and Chemotherapy-Induced Cachexia. Nutrients. https://doi.org/10.3390/nu15010102

Widodo, W. D. P. (2023). The Potential of Bay Leave (Syzygium Polyanthum) as an Anti-Diabetic Agent. International Journal of Islamic and Complementary Medicine. https://doi.org/10.55116/ijicm.v4i2.60

Widyawati, T., Pase, A., Daulay, M., & Sumantri, I. B. (2021). Syzygium Polyanthum (Wight.) Walp Ethanol Extract Decreased Malondialdehyde Level in Type 2 Diabetic Patients. Pharmacognosy Journal. https://doi.org/10.5530/pj.2021.13.198

Yang, X., Ge, X.-C., Jiang, S., & Yang, Y. (2022). Potential Lipolytic Regulators Derived From Natural Products as Effective Approaches to Treat Obesity. Frontiers in Endocrinology. https://doi.org/10.3389/fendo.2022.1000739

Yang, Y., Xu, H., Zhang, Y., Chen, L., Tian, C., Huang, B., Chen, Y.-P., & Ma, L. (2023). Associations of Dietary Antioxidant Micronutrients With the Prevalence of Obesity in Adults. Frontiers in Nutrition. https://doi.org/10.3389/fnut.2023.1098761

Yu, Z., Zhou, X., ZHANG, C., Lai, D., LIU, D., & Wu, Y. (2023). Vitamin B3 Inhibits Apoptosis and Promotes Autophagy of Islet B Cells Under High Glucose Stress. Biocell. https://doi.org/10.32604/biocell.2023.026429

Yuan, Y., Liu, C., Chen, X., Sun, Y., Xiong, M., Fan, Y., Petersen, R. B., Chen, H., Huang, K., & Zheng, L. (2021). Vitamin C Inhibits the Metabolic Changes Induced by Tet1 Insufficiency Under High Fat Diet Stress. Molecular Nutrition & Food Research. https://doi.org/10.1002/mnfr.202100417

Zhu, D., Chung, H.-F., Pandeya, N., Dobson, A., Kuh, D., Crawford, S. L., Gold, E. B., Avis, N. E., Giles, G. G., Bruinsma, F., Adami, H. O., Weiderpass, E., Greenwood, D. C., Cade, J., Mitchell, E. S., Woods, N. F., Brunner, E. J., Simonsen, M. K., & Mishra, G. D. (2018). Body Mass Index and Age at Natural Menopause: An International Pooled Analysis of 11 Prospective Studies. European Journal of Epidemiology. https://doi.org/10.1007/s10654-018-0367-y