

Anti-inflammatory activity of date palm seed by downregulating interleukin-1b, TGF-b, cyclooxygenase-1 and -2: A study among middle age women

by Sarie Yono

Submission date: 22-Nov-2022 08:27AM (UTC+0700)

Submission ID: 1960795747

File name: jurnal_saudi_pharmaceutical.pdf (518.19K)

Word count: 3631

Character count: 20047



Original article

Anti-inflammatory activity of date palm seed by downregulating interleukin-1 β , TGF- β , cyclooxygenase-1 and -2: A study among middle age womenSaryono^{a,*}, Warsinah^b, Atyanti Isworo^a, Sarmoko^b^a School of Nursing, Faculty of Health Sciences, University of Jenderal Soedirman, Purwokerto, Indonesia^b School of Pharmacy, Faculty of Health Sciences, University of Jenderal Soedirman, Purwokerto, Indonesia

ARTICLE INFO

Article history: 13
Received 25 April 2020
Accepted 30 June 2020
Available online 3 July 2020

Keywords:

Date palm seeds
Middle age women
Proinflammatory mediators

ABSTRACT

The prevalence of degenerative diseases increases with age. Furthermore, various factors tend to trigger cells injury, thereby, causing inflammation. This study, therefore, aims to examine the anti-inflammatory mechanisms of steeped date seeds in middle age women. This is a quasi-experimental design with a pre- and post-test approach used to evaluate the anti-inflammatory effect of 2.5 g of steeped of date palm seed, consumed by 30 healthy middle-aged women per day (in 250 mL water) for 14 days. The final numbers (22 subjects) of recruited women were included in the statistical analysis. Their level of IL-1 β , TGF- β , IL-6, TNF- α , IL-12, COX-1, COX-2, and PGE2 were determined using ELISA. The results showed that the expression of IL-1 β , TGF- β , COX-1 and COX-2 in women significantly decreased after consuming date palm seed. Steeped of date seed acts as an anti-inflammatory by downregulating the expression of key proinflammatory mediators.

© 2020 The Author(s). Published by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Chronic and degenerative diseases in middle-aged women such as cancer, cardiovascular, and metabolic diseases are increasing. These diseases are the leading cause of death and disability disorders in developing countries. Kim et al., 2018 showed that large changes in behavior patterns due to the decreasing consumption of vegetables and fruits, which plays an important role in increasing the incidence of chronic and degenerative diseases. Bioactive compounds in fruits and vegetables such as polyphenols, flavonoids, anthocyanins, micronutrients, minerals and vitamins, have antioxidant and anti-inflammatory activities (Sofi and Dinu, 2016). Therefore, they possess preventive and therapeutic potentials against diseases (Aguilera et al., 2016; Wang et al., 2016).

Date palm (*Phoenix dactylifera* L.) seed is one of the rich source of polyphenols and flavonoids (Djaoudene et al., 2019). It has been extensively investigated for pharmacological activities such as anti-inflammatory (Saryono et al., 2018), immuno-stimulant (Saryono et al., 2019), antidiabetic (El-Fouhil et al., 2010), antibacterial (Chinelo et al., 2019), antiviral (Jassim and Naji, 2010), and antioxidant (Bouhlali et al., 2015; Djaoudene et al., 2019; Habib and Ibrahim, 2011; Platat et al., 2019). In previous studies, the date palm seeds were proven to work as anti-inflammatory (Saryono et al., 2019; Saryono et al., 2019b, 2019a), and antiatherogenic food substance (Saryono et al., 2017). Recent study showed that various compounds act as anti-inflammatory by metabolomic approach (Abdul-Hamid et al., 2019). Anti-inflammatory effect of date seeds in human has not been adequately studied, especially in middle-aged women. This study, therefore, aims to examine the anti-inflammatory mechanisms of steeped date palm seed in middle-aged women.

2. Material and methods

2.1. Study design and participants

This is a quasi-experimental design with a pre and post-test approach. Data were obtained from a total of 30 randomly selected

* Corresponding author at: Karangwangkal, Purwokerto Utara, Banyumas Regency, Central Java 53123, Indonesia.

E-mail address: saryono2016@unsoed.ac.id (Saryono).

Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

<https://doi.org/10.1016/j.sps.2020.06.024>

19-0164/© 2020 The Author(s). Published by Elsevier B.V. on behalf of King Saud University.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

middle-aged women living at Gununglurah, Cilongok District, Banyumas. The inclusion criteria were women between the age of 45–60 years, with no history of metabolic disease by measuring their blood glucose and total cholesterol levels. These women live in farming community and perform the domestic tasks of housewives. In this study, each subject received a single dose of 2.5 g seed powder per day for 14 days. The seed powder was consumed using 250 mL of boiling water. Subjects signed an informed consent before participating in this study, which was conducted after obtaining approval of ethical clearance from the medical research ethics committee of the Faculty of Medicine University of Negeri Sebelas Maret Surakarta, number: 541/IV/HREC/2019.

2.2. Preparation of date seeds powder

Deglet Nour dates collected from Tunisia, were obtained from a market at Purwokerto, Banyumas Regency, Indonesia. Seeds were manually separated from the date flesh, cleaned with water, selected, and dried for one day in sunlight. The dried seeds were roasted at medium temperature, crushed in a blender and filtered to obtain a fine powder.

2.3. Measurement pro-inflammatory mediators

A 3 mL blood sample was taken through the median cubital vein before and after treatment. The level of IL-1 β , TNF- α , IL-6, IL-12, TGF- β , COX-1, COX-2, and prostaglandin E2 were examined by ELISA kit (BT Laboratories, Shanghai) based on the manufacturer's protocol, using an ELISA machine Reader (Labotrone, Germany).

2.4. Statistical analysis

The mean score was compared before and after treatment with all data presented as mean \pm SEM. Differences in scores before and after treatment were analyzed using the student *t*-test. The graph pad software (GraphPad Prism, San Diego, CA) was used to analyze statistical and graphical data, with a *p* value < 0.05 considered significant.

3. Results

3.1. Characteristics of participants

Thirty subjects were initially recruited, however, eight were unable to complete the treatment. Therefore, a total of 22 subjects were included in the statistical analysis. The age of subjects ranged from 51 to 57 years, with a healthy weight status and an average body mass index of 24 kg/m², blood glucose below 140 mg/dL, and total cholesterol below 200 mg/dL (Table 1).

3.2. Expression of proinflammatory cytokines

The expression of IL-1 β and TGF- β reduced significantly after the consumption of date palm seeds in the post-treatment stage, while TNF- α , IL-12, and IL-6 did had no significant change

(Fig. 1). This result suggests the date palm seed reduces IL-1 β and TGF- β produced in healthy middle-aged women.

3.3. The role of dates palm seed on cyclooxygenase pathway

The cyclooxygenase (COX) pathway is important in arachidonic acid metabolism related to the inflammatory process (Levick et al., 2007). Therefore, the expression of COX-1, COX-2, as well as prostaglandin E2 level, showed that these mediators are important markers on the COX pathway. A significant decrease in the level of COX-1, COX-2 and PGE2 was observed in the post-treatment stage compared with pre-treatment of steeped of date palm seeds (Fig. 2). Interestingly, the expression of COX-2 substantially decreased (*p* < 0.001), which indicates that the inducible expression of COX-2 in middle-aged women was decreased by consumption of date palm seeds.

4. Discussion

Several studies have been conducted to examine the potential of date palm seeds as an anti-inflammatory (Barakat et al., 2020) *in vitro* and *in vivo* (Djaoudene et al., 2019; Maqsood et al., 2020; Saryono et al., 2018). However, no anti-inflammatory activity studies have been conducted on date palm seeds in humans, women middle age. This study, found that the expression of IL-1 β , TGF- β , COX-1 and COX-2 decreased after the administration of date palm seeds to middle age women.

Studies showed that the elderly and middle age women experience an increase in free radicals due to various factors such as aging, food, pollution, and excess activity. Free radicals in the body causes oxidation in normal cells, thereby, leading to inflammation and diseases (Sies, 2018; Suleman, 2018). Lymphocytes and other immune cells produce cytokines such as IL-1 β and TGF- β when there are inflammatory stimuli.

Interleukin-1 β is highly elevated in chronic diseases such as obesity, osteoarthritis, and gout (Dinarello, 2011). IL-1 β affects lymphocytes and macrophages, induces the formation of prostaglandins, colony stimulating factors and other cytokines (Wojdasiewicz et al., 2014). IL-1 β expression is stimulated by various stimuli including sterile stimulus through the formation of inflammasomes (Shi et al., 2015). Since middle age women have developed accumulated agents capable of activating the inflammasome formation, such as cholesterol and uric acid (Qin et al., 2014), it is therefore, important to determine the ability of the date palm seed to reduce the expression of IL-1 β . Another interesting aspect is to reveal the role of date palm seeds in inhibiting IL-1 β expression, which is further investigated in future.

Although TGF- β was initially called as anti-inflammatory cytokines, it also induces inflammatory Th17 cells differentiation (Yoshimura et al., 2010). Although the role TGF- β in inflammation remains unclear, the date palm seed showed its ability to decrease.

Cyclooxygenase pathway has been well-established for their role in inflammation (Hanna and Hafez, 2018). Conversion of phospholipids to arachidonic acid is mediated by the enzyme cyclooxygenase. COX-1 is constitutively expressed and plays a role in the protection of the gastric mucosa. COX-2 is expressed inducibly by an inflammatory stimulus (Urban, 2000). Furthermore, various stimuli tend to induce COX-2 expression, which tends to occur with increasing age. In this study, COX-2 expression greatly decreased after the administration of date palm seeds to middle age women. Both enzymes induce the conversion of arachidonic acid into prostaglandins, e.g. PGE2 which plays a role in the vasodilation of blood vessels and increased vascular endothelial permeability (Kawahara et al., 2015). The expression of both COX

Table 1
Respondent characteristic.

Variable	Ranges	Mean
Age (years)	51–57	55
Blood pressure		
Systole (mmHg)	100–175	135
Diastole (mmHg)	65–100	93
Body mass index (kg/m ²)	23.5–24.5	24

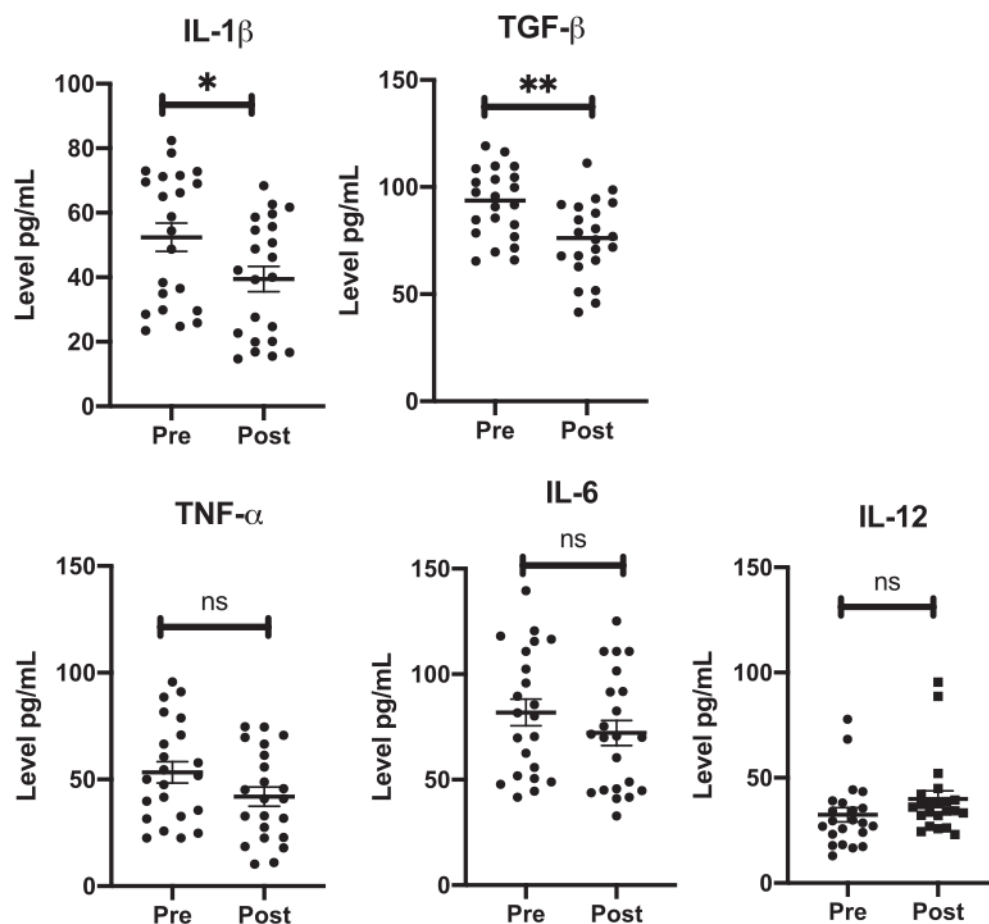


Fig. 1. Treatment date palm seed decreases IL-1 β and TGF- β expression. The cytokines levels were measured at day 0 (pre-treatment) and day 15 (post-treatment) by enzyme-linked immunosorbent assay (ELISA). Mean \pm SE are presented (n = 22). Asterisks indicate student t-test significance values; **P < 0.01, *P < 0.05, ns = not significant.

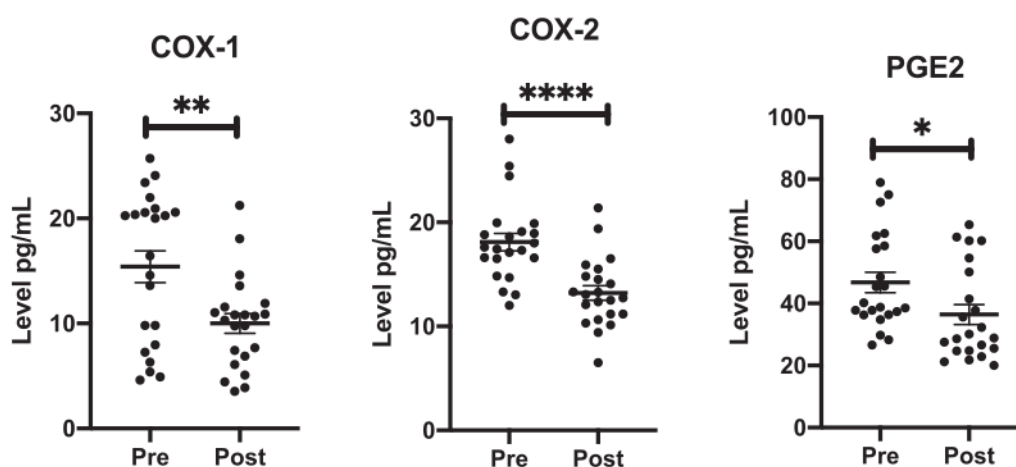


Fig. 2. Treatment date palm seed decreases COX-1, COX-2, PGE2 level. The enzyme/mediator levels were measured at day 0 (pre-treatment) and day 15 (post-treatment) by enzyme-linked immunosorbent assay (ELISA). Mean \pm SE are shown (n = 22). Asterisks indicate student t-test significance values: **P < 0.01, ****P < 0.0001, *P < 0.05.

enzymes is inhibited by date palm seeds, with a decrease in PGE2 production.

This study is limited to high of dropping out because the subject did not complete the consumption of date palm seed powder as assigned. In addition, the food consumed by the subjects and likely to affect the level of proinflammatory mediators in the human body were not recorded.

Date palm seeds may work as an anti-inflammatory and improve the performance of the immune system (Saryono et al., 2019). Rahmani et al., 2014 stated that it works to suppress NF- κ B, COX-1 and COX-2 enzymes, thereby, decreasing pro-inflammatory mediators. The anti-inflammatory activity of the aqueous extract of date palm seeds is related to components of polyphenols such as caffeoyl hexoside, 5-O-caffeoyl shikimic acid isomers, hydrocaffeic acid, and isorhamnetin (Thouri et al., 2017; John and Shahidi, 2019). This ingredient has also been proven safe for liver and kidney (El Fouhil et al., 2011), therefore, it can be consumed regularly by middle age women to maintain health status, improve immune systems, and prevent chronic diseases. Clinical implications obtained from this study shows that the physicians may suggest the steeped of palm seed powder as a functional beverage.

5. Conclusion

Dates seeds can act as an anti-inflammatory by reducing interleukin-1 β , TGF- β , cyclooxygenase-1 and -2 expression. Regular consumption of date palm seeds increases the body's immunity and prevent chronic diseases.

Declaration of Competing Interest

The authors declared that there is no conflict of interest.

Acknowledgments

The authors are grateful to Dr. Hernayanti for her laboratory support; to Lita Kusuma and Nina Setiowati for critically reviewing the manuscript.

Funding

This study was supported by The Ministry of Research Technology and Higher Education of Indonesia through PDUPT funding.

Authors' contributions

SY, W, AI conceived and designed the experiments; SY, W, AI performed the experiments; SM analyzed the data; SY, W, AI contributed chemicals/reagents/materials/analysis tools; SY and SM wrote the paper. The authors read and approved the final manuscript.

Appendix

Availability of Data and Materials

All data generated or analyzed during this study are included in this manuscript. Raw data are available from the corresponding author on a reasonable request.

References

Abdul-Hamid, N.A., Abas, F., Ismail, I.S., Tham, C.L., Maulidiani, M., Mediani, A., Swarup, S., Umashankar, S., 2019. 1H-NMR-based metabolomics to investigate the effects of Phoenix dactylifera seed extracts in LPS-IFN- γ -induced RAW 264.7 cells. Food Res. Int. 125. <https://doi.org/10.1016/j.foodres.2019.108565>

Aguilera, Y., Martin-Cabrejas, M.A., González de Mejia, E., 2016. Phenolic compounds in fruits and beverages consumed as part of the mediterranean diet: their role in prevention of chronic diseases. Phytochem. Rev. 15, 405–423. <https://doi.org/10.1007/s11101-015-9443-z>.

Barakat, A.Z., Hamed, A.R., Bassuini, R.I., Abdel-Aty, A.M., Mohamed, S.A., 2020. Date palm and saw palmetto seeds functional properties: antioxidant, anti-inflammatory and antimicrobial activities. J. Food Meas. Charact. 14, 1064–1072. <https://doi.org/10.1007/s11694-019-00356-5>.

Bouhlali, E., dîne T., Alem, C., Ennassir, J., Benlyas, M., Mbark, A.N., Zegzouti, Y.F., 2015. Phytochemical compositions and antioxidant capacity of three date (Phoenix dactylifera L.) seeds varieties grown in the South East Morocco. Journal of the Saudi Society of Agricultural Sciences. doi:10.1016/j.jssas.2015.11.002.

Chinelo, C.E., Ezinwanne, N.E., Chizoba, A.O., Martina, C.A., Chineye, N.U., Somtochukwu, A.E., Uchechi, L.I., 2019. Evaluation of antimicrobial activities of crude methanol extract of phoenix dactylifera seeds on clinical isolates of different strains of E. coli. Int. J. Biochem. Res. Rev. 1–7 <https://doi.org/10.9734/ijbcr/2019/v25i130066>.

Dinarello, C.A., 2011. Interleukin-1 in the pathogenesis and treatment of inflammatory diseases. Blood 117, 3720–3732. <https://doi.org/10.1182/blood-2010-07-273417>.

Djaoudene, O., López, V., Cásedas, G., Les, F., Schisano, C., Bachir Bey, M., Tenore, G.C., 2019. Phoenix dactylifera L. seeds: a by-product as a source of bioactive compounds with antioxidant and enzyme inhibitory properties. Food Funct. 10, 4953–4965. <https://doi.org/10.1039/c9fo01125k>.

El Fouhil, A.F., Ahmed, A.M., Darwish, H.H., Atteya, M., Al-Roalle, A.H., 2011. An extract from date seeds having a hypoglycemic effect. Is it safe to use? Saudi Med. J. 32, 791–796.

El-Fouhil, A.F., Ahmed, A.M., Darwish, H.H., 2010. Hypoglycemic effect of an extract from date seeds on diabetic rats. Saudi Med. J. 31, 747–751.

Habib, H.M., Ibrahim, W.H., 2011. Effect of date seeds on oxidative damage and antioxidant status in vivo. J. Sci. Food Agric. 91, 1674–1679. <https://doi.org/10.1002/jsfa.4368>.

Hanna, V.S., Hafez, E.A.A., 2018. Synopsis of arachidonic acid metabolism: a review. J. Advanc. Res. 11, 23–32. <https://doi.org/10.1016/j.jare.2018.03.005>.

Jassim, S.A.A., Naji, M.A., 2010. In vitro evaluation of the antiviral activity of an extract of date palm (Phoenix dactylifera L.) pits on a pseudomonas phage. Evid. Based. Complement. Alternat. Med. 7, 57–62. <https://doi.org/10.1093/ecam/nem160>.

John, J.A., Shahidi, F., 2019. Phenolic content, antioxidant and anti-inflammatory activities of seeds and leaves of date palm (Phoenix dactylifera L.). J. Food Bioactives 5, 120–130. <https://doi.org/10.31665/JFB.2019.5179>.

Kawahara, K., Hohjoh, H., Inazumi, T., Tsuchiya, S., Sugimoto, Y., 2015. Prostaglandin E2-induced inflammation: Relevance of prostaglandin E receptors. BBA 1851, 414–421. <https://doi.org/10.1016/j.bbalip.2014.07.008>.

Kim, E.K., Kim, H., Kwon, O., Chang, N., 2018. Associations between fruits, vegetables, vitamin A, β -carotene and flavonol dietary intake, and age-related macular degeneration in elderly women in Korea: the Fifth Korea national health and nutrition examination survey. Eur. J. Clin. Nutr. 72, 161–167. <https://doi.org/10.1038/ejcn.2017.152>.

Levick, S.P., Loch, D.C., Taylor, S.M., Janicki, J.S., 2007. Arachidonic acid metabolism as a potential mediator of cardiac fibrosis associated with inflammation. J. Immunol. 178, 641–646. <https://doi.org/10.4049/jimmunol.178.2.641>.

Maqsood, S., Adiomo, O., Ahmad, M., Mudgil, P., 2020. Bioactive compounds from date fruit and seed as potential nutraceutical and functional food ingredients. Food Chem. 308. <https://doi.org/10.1016/j.foodchem.2019.125522>.

Platat, C., Hillary, S., Tomas-Barberan, F.A., Martinez-Blazquez, J.A., Al-Meqbali, F., Souka, U., Al-Hammadi, S., Ibrahim, W., 2019. Urine Metabolites and Antioxidant Effect after Oral Intake of Date (Phoenix dactylifera L.) Seeds-Based Products (Powder, Bread and Extract) by Human. Nutrients 11. doi:10.3390/nu11102489.

Qin, L., Yang, Z., Gu, H., Lu, S., Shi, Q., Xing, Y., Li, X., Li, R., Ning, G., Su, Q., 2014. Association between serum uric acid levels and cardiovascular disease in middle-aged and elderly Chinese individuals. BMC Cardiovasc. Disord. 14, 26. <https://doi.org/10.1186/1471-2261-14-26>.

Rahmani, A.H., Aly, S.M., Ali, H., Babiker, A.Y., Srikar, S., Khan, A.A., 2014. Therapeutic effects of date fruits (Phoenix dactylifera) in the prevention of diseases via modulation of anti-inflammatory, anti-oxidant and anti-tumour activity. Int. J. Clin. Exp. Med. 7, 483–491.

Saryono, Dardjito, E., Proverawati, A., Sumeru, A., Setiyani, R., Upoyo, A.S., Kamaludin, R., 2019. Date seeds (Phoenix dactylifera L.) consumption as anti-inflammatory and immunostimulant: a systematic review. IOP Conf. Ser.: Earth Environ. Sci. 250, 012038. doi:10.1088/1755-1315/250/1/012038.

Saryono, S., Eliyan, J., Herdiati, D., Khikmatullah, A.A., Silvana, C.P., Adi, H.P., 2017. Anti-atherogenic properties of Deglet Noor Date seeds (Phoenix dactylifera) Methanol extract on Diet-Induced Hypercholesterolemic Rats. IOP Conf. Ser.: Mater. Sci. Eng. 172, 012046. doi:10.1088/1757-899X/172/1/012046.

Saryono, S., Sumeru, A., Proverawati, A., Efendi, F., 2018. Decreasing Carbon Tetrachloride Toxicity using Date-seed (Phoenix dactylifera L.) Steeping in Rats. Toxicol. Environ. Health Sci. 10, 139–145. <https://doi.org/10.1007/s13530-018-0357-1>.

Saryono, S., Taufik, A., Proverawati, A., Efendi, F., 2019a. Dietary supplementation of phoenix dactylifera L. seeds decreases pro-inflammatory mediators in CCl4-induced rats. J. Herbmed Pharmacol. 8, 212–217. <https://doi.org/10.15171/jhp.2019.31>.

- Saryono, S., Warsinah, W., Isworo, A., Efendi, F., 2019b. Anti-inflammatory effect of date seeds (*Phoenix dactylifera* L.) on carrageenan-induced edema in rats. *Trop. J. Pharm. Res.* 17, 2455. <https://doi.org/10.4314/tjpr.v17i12.22>.
- Shi, G., Chen, S., Wandu, W.S., Ogbeifun, O., Nugent, L.F., Maminishkis, A., Hinshaw, S.J.H., Rodriguez, I.R., Gery, I., 2015. Inflammasomes Induced by 7-Ketocholesterol and other stimuli in RPE and in bone marrow-derived cells differ markedly in their production of IL-1 β and IL-18. *Invest. Ophthalmol. Vis. Sci.* 56, 1658–1664. <https://doi.org/10.1167/iovs.14-14557>.
- Sies, H., 2018. On the history of oxidative stress: concept and some aspects of current development. *Curr. Opin. Toxicol.* 7, 122–126. <https://doi.org/10.1016/j.cotox.2018.01.002>.
- Sofi, F., Dinu, M.R., 2016. Nutrition and prevention of chronic-degenerative diseases. *Agric. Agric. Sci. Procedia* 8, 713–717. <https://doi.org/10.1016/j.aaspro.2016.02.052>.
- Suleman, M., 2018. Antioxidants, its role in preventing free radicals and infectious diseases in human body. *PAB* 7. <https://doi.org/10.19045/bspab.2018.700197>.
- Thouri, A., Chahdoura, H., El Arem, A., Omri Hichri, A., Ben Hassin, R., Achour, L., 2017. Effect of solvents extraction on phytochemical components and biological activities of Tunisian date seeds (var. Korkobbi and Arechti). *BMC Complement Altern. Med.* 17, 248. <https://doi.org/10.1186/s12906-017-1751-y>.
- Urban, M.K., 2000. COX-2 specific inhibitors offer improved advantages over traditional NSAIDs. *Orthopedics* 23, S761–4.
- Wang, P.-Y., Fang, J.-C., Gao, Z.-H., Zhang, C., Xie, S.-Y., 2016. Higher intake of fruits, vegetables or their fiber reduces the risk of type 2 diabetes: A meta-analysis. *J. Diabetes Investig.* 7, 56–69. <https://doi.org/10.1111/jdi.12376>.
- Wojdasiewicz, P., Poniatowski, Ł.A., Szukiewicz, D., 2014. The role of inflammatory and anti-inflammatory cytokines in the pathogenesis of osteoarthritis. *Mediators Inflamm.* 2014. <https://doi.org/10.1155/2014/561459>.
- Yoshimura, A., Wakabayashi, Y., Mori, T., 2010. Cellular and molecular basis for the regulation of inflammation by TGF- β . *J. Biochem.* 147, 781–792. <https://doi.org/10.1093/jb/mvq043>.

Anti-inflammatory activity of date palm seed by downregulating interleukin-1b, TGF-b, cyclooxygenase-1 and -2: A study among middle age women

ORIGINALITY REPORT

12%

SIMILARITY INDEX

8%

INTERNET SOURCES

8%

PUBLICATIONS

1%

STUDENT PAPERS

PRIMARY SOURCES

1

www.mdpi.com

Internet Source

1%

2

Eimad dine Tariq Bouhlali, Abdelbasset Hmidani, Bouchra Bourkhis, Tarik Khouya et al. "Effect of Phoenix dactylifera seeds (dates) extract in triton WR-1339 and high fat diet induced hyperlipidaemia in rats: A comparison with simvastatin", Journal of Ethnopharmacology, 2020

Publication

<1%

3

Jie Shi, Zhen Yang, Yixin Niu, Weiwei Zhang et al. "Mid-upper arm circumference, central obesity and metabolic syndrome in middle-aged and elderly Chinese: the REACTION study", Research Square Platform LLC, 2019

Publication

<1%

4

journals.uran.ua

Internet Source

<1%

www.e-sc.org

5

Internet Source

<1 %

6

epdf.pub

Internet Source

<1 %

7

ouci.dntb.gov.ua

Internet Source

<1 %

8

Chen Xu, Meng-Yuan Fang, Ke Wang, Jing Liu, Guang-Ping Tai, Zhao-Ting Zhang, Ban-Feng Ruan. "Discovery and Development of Inflammatory Inhibitors from 2-Phenylchromonone (Flavone) Scaffolds", Current Topics in Medicinal Chemistry, 2020

Publication

<1 %

9

Jing-Ji Jin, Hong-Duck Kim, J Adam Maxwell, Ling Li, Ken-ichiro Fukuchi. "Toll-like receptor 4-dependent upregulation of cytokines in a transgenic mouse model of Alzheimer's disease", Journal of Neuroinflammation, 2008

Publication

<1 %

10

Seyed Jaber Pourshoaib, Ebrahim Rajabzadeh Ghatrami, Mohammad Amin Shamekhi. "Comparing ultrasonic- and microwave-assisted methods for extraction of phenolic compounds from Kabkab date seed (Phoenix dactylifera L.) and stepwise regression analysis of extracts antioxidant activity", Sustainable Chemistry and Pharmacy, 2022

Publication

<1 %

11

Viera Holíková, Iveta Štibrániová, Pavlína Bartíková, Mirko Slovák, Mária Kazimírová. "Ixodid tick salivary gland extracts suppress human transforming growth factor- β 1 triggered signalling pathways in cervical carcinoma cells", Biologia, 2018

Publication

<1 %

12

Xianqiang Chen, Zilun Lei, Jun Cao, Wen Zhang, Rong Wu, Fuliang Cao, Qirong Guo, Jiahong Wang. "Traditional uses, phytochemistry, pharmacology and current uses of underutilized Xanthoceras sorbifolium bunge: A review", Journal of Ethnopharmacology, 2022

Publication

<1 %

13

journals.iucr.org

Internet Source

<1 %

14

journalspress.com

Internet Source

<1 %

15

jsurgmed.com

Internet Source

<1 %

16

profdoc.um.ac.ir

Internet Source

<1 %

17

real.mtak.hu

Internet Source

<1 %

uknowledge.uky.edu

18

Internet Source

<1 %

19

www.karger.com

Internet Source

<1 %

20

www.zora.uzh.ch

Internet Source

<1 %

21

Samir Bikri, Youssef Aboussaleh, Assia Berrani, Ismail Louragli, Affaf Hafid, Soukaina Chakib, Ahmed Ahami. "Effects of date seeds administration on anxiety and depressive symptoms in streptozotocin-induced diabetic rats: biochemical and behavioral evidences", Journal of Basic and Clinical Physiology and Pharmacology, 2021

Publication

<1 %

22

Submitted to University College London

Student Paper

<1 %

23

bmccancer.biomedcentral.com

Internet Source

<1 %

24

bmccomplementmedtherapies.biomedcentral.com

Internet Source

<1 %

25

dspace.uef.fi

Internet Source

<1 %

26

vdoc.pub

Internet Source

<1 %

27

www.ajbasweb.com

Internet Source

<1 %

28

www.ijfans.com

Internet Source

<1 %

29

Dian Windy Dwiasi, Mudasir Mudasir, Roto Roto. "Ion Exchange of Benzoate in Ni-Al-Benzoate Layered Double Hydroxide by Amoxicillin", Open Chemistry, 2019

Publication

<1 %

30

Hadjer Chenini Bendiab, Noureddine Djebli, Yakub Kara, Meltem Uçar, Sevgi Kolayli. "An Investigation of Algerian Dates (*Phoenix dactylifera* L.); Antioxidant, Anti-inflammatory Properties and Phenolic Compositons H", Emirates Journal of Food and Agriculture, 2021

Publication

<1 %

31

Desiré Greyvensteyn, Corinna May Walsh, Mariette Nel, Elizabeth Margaretha Jordaan. "Nutrigenomics: Perceptions of South African Dietitians and General Practitioners", Lifestyle Genomics, 2022

Publication

<1 %

Exclude quotes On

Exclude matches Off

Exclude bibliography On

