SUBMITTED 9 JUN 24
REVISION REQ. 30 JUL 24; REVISION RECD. 11 AUG 24
ACCEPTED 5 SEP 24
ONLINE-FIRST: OCTOBER 2024
DOI: https://doi.org/10.18295/squmj.10.2024.064

Improving Female Health at Various Life Stages

A systematic review of date fruit products' impact

Elham Shirdel,[1] Farinaz Rahimi,[2] Masoumeh Jafarzadeh,[3] Fatemeh Abdi,[4] *Fatemeh A. Rahnemaei[5]

[1]Department of Midwifery, North Khorasan University of Medical Sciences, Bojnurd, Iran; [2]Department of Reproductive Health and Midwifery, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran; [3]Reproductive Health, School of Midwifery Nursing, Lorestan University of Medical Sciences, Khoramabad, Iran; [4]Nursing and Midwifery Care Research Center, Health Management Research Institute, Iran University of Medical Sciences, Tehran, Iran; [5]Reproductive Health Research Center, Guilan University of Medical Sciences, Rasht, Iran.

**Corresponding Author's e-mail:* f_rahnemaie@yahoo.com

Abstract

This systematic review study aimed to investigate the impact of date fruit products on female health at different stages of their lives. The quality of the included studies was evaluated using the risk of bias(RoB) assessment tool. After reviewing 21 eligible studies concluded that, date fruits have a beneficial impact on puberty, reproduction, and menopause periods. During puberty, the consumption of date fruits improved hemoglobin levels in adolescent girls. In reproductive age, date fruits have positive effects on fertility parameters and the sexual function of women and men. Furthermore, in the menopausal period, date fruits improve dyspareunia and help to maintain better ovarian reserves. Supporting women with proper nutrition and enhancing their diet can lead to cost savings compared to medical interventions, and is considered a key

Accepted Article

preventive measure for improving women's health. By offering simple advice, women can enhance their quality of life and better cope with life's challenges.

Keywords: Date Fruits, Puberty, Reproduction, Menopause, Female.

Introduction

Date palm (*Phoenix dactylifera L.*) is considered one of the most ancient fruit-bearing trees in the Arabian Peninsula, [1] as well as in other regions of the Middle East and the dry areas of North Africa. Although its exact place of origin remains uncertain, there are indications that it may have originated close to Iraq.[2] The date palm holds significant cultural value for the local population, in addition to serving as a crucial food and a primary source of revenue. This tree is renowned for its diverse range of products and uses. Apart from being a calorie-rich food source, date fruits also offer essential vitamins and minerals.[3] Consuming date fruits can boost brain vitality and help regulate blood sugar levels. Date fruits are known to increase sexual activity due to their phosphorus content.[4] Additionally, date fruits can enhance immunity, support thyroid function, and help regulate blood acidity.[5] Date fruits are considered an important fruit for treating anemia because of their high iron concentration.[6] They provide energy, facilitate digestion, and strengthen the nervous system due to their phosphorus, iron, calcium, potassium, magnesium, and sodium content.[7] Date fruits also promote uterine involution and reduce postpartum hemorrhage. Oxytocin found in date fruits can facilitate childbirth and regulate uterine contractions during labor.[8]

Being male or female has a profound influence on one's health due to both biological and gender-related distinctions.[9] The well-being of females, in particular, is a matter of great concern as they often face different challenges during different stages of their lives.[10] Throughout the various phases of life, women encounter distinct problems due to their hormonal and physical transformation. Numerous studies of iron deficiency anemia[11] play a negative role in menarche and menstrual bleeding among adolescent girls and reduce their learning capacity and other related problems.[12] Furthermore, women in their reproductive age may encounter challenges such as infertility, sexual dysfunction, and other health conditions that can impact their overall well-being.[13] The onset of menopause also has special effects on women's health.[14]

Accepted Article

Phoenix dactylifera L., known for its easy accessibility and high nutritional value, promotes women's health and addresses their health concerns.[15] Also, women's health is significantly influenced by nutritional intake.[16] For instance, it aids in maintaining appropriate hemoglobin levels during puberty,[17] enhances fertility rates,[18] and improves sexual function throughout different life stages.[19] It seems that the use of complementary and alternative medicine is safer than chemical drugs for the improvement of fertility, childbirth, and postpartum complications.[20]

Nutrition and health are two inseparable categories.[21] Women at different stages of their lives may face different issues and using foods with high nutritional value in their diet can help them overcome these issues. The studies that have been conducted so far on the impact of date fruits on women's health are mostly focused on pregnancy and breastfeeding and demonstrated the benefits of consuming certain amounts during this period had led to the improvement of natural vaginal delivery outcomes and the reduction of cesarean section rate.[22,23] Due to the advantages of date fruits and the existing research, it is imperative to compile studies focusing on the effects of date fruits at various stages of women's lives to thoroughly understand their impact on relevant stages. Prior literature reviews have highlighted the beneficial impact of date fruits during pregnancy and childbirth,[8] so the current study aimed to review the impact of date fruit products on female health at different stages of their life.

Methods

Design and Registration

This systematic review adhered to the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework.[24] The study protocol has been registered in the International Prospective Register of Systematic Reviews (PROSPERO) under the identifier "CRD42024499896".

Search Strategy

The databases used included Web of Sciences (WoS), PubMed, Scopus, ProQuest, and Google Scholar were searched to find relevant studies. For searching in mentioned databases use MeSH keywords as: "Puberty, OR" Puberties", OR "Adolescents", OR "Adolescence', OR "Teenager", OR "Teenagers", OR "Teen", OR "Teens", OR "Youth", OR "Youths", OR "Reproduction", OR

Accepted Article

"Reproductive Period", OR " Period, Reproductive", OR " Periods, Reproductive", OR " Reproductive Periods", OR "Menopause", "Menopausal", OR "Menopausal Period", OR "Period, Menopausal", OR "Postmenopause", OR "Postmenopausal Period", OR "Perimenopause", OR "Premenopausal Period", OR " Change of Life, Female", **AND** "*Phoenix dactylifera*", OR "Date Palm Trees", OR "Date Palm Tree", OR "Palm Tree, Date", OR "Palm Trees, Date", OR "Tree, Date Palm", OR "Trees, Date Palm", OR "Date Palms", OR "Date Palm", OR "Palm, Date", OR "Palms, Date", OR "Dates, Palm", OR "Date, Palm", OR "Palm Date", OR "Date Palm Fruit", OR "Date Palm Fruits", OR "Fruit, Date Palm", OR "Fruits, Date Palm", OR "Palm Fruit, Date", OR "Palm Fruits, Date", OR "Date Fruit", OR "Date Fruits", OR "Fruit, Date", OR "Fruits, Date", OR "Palm Dates", **AND** "Female", OR "Females".

In the first stage, the keywords were searched separately, and then, they were combined with "AND" or "OR" to make some new keywords or phrases. The search process was conducted on articles published from January 2013 until 6th March 2024.

Eligibility Criteria

Following the PICO criteria, the criteria for selecting or excluding studies for review were as outlined below:

Types of Participants: Female species in different stages of their lives (puberty, reproduction, menopause).

Types of Intervention: Date fruit products.

Types of Comparison: Placebo, routine intervention, or without intervention.

Types of Outcome Measures: Puberty problems (anemia, puberty age, sexual maturity), Reproductive problems(sexual dysfunction, infertility, polycystic ovary syndrome(PCOs), menstrual problems, hormonal parameters), menopausal problems(sexual disorders and ovarian reserve parameters).

Accepted Article

Types of Studies: All experimental studies.

Study Selection

Two authors, FAR and ESH, independently conducted a selection process to include studies. Initially, they assessed the titles and abstracts of the returned results using the PICO criteria. In case of any disagreement between the authors, they resolved it through discussion or by involving a third review author [16]. The manuscripts of potentially interesting works were further evaluated based on the previously explained strategy, resulting in a pool of candidate papers. All relevant articles were then assessed in full text. If the content of the studies was unclear, the authors of the publications were directly contacted. The study selection process is demonstrated in Figure 1.

Data Extraction

The two authors separately reviewed published scientific studies and evaluated their quality. Afterward, they exchanged views and resolved any existing disagreements. The collected information, including study details (author, year, study design, region, sample size), participants characteristics (species, stage, age (months or year), parameters), trial details (intervention, control, period, date products), outcome(results) presented in Table 1.

Quality Assessment

Risk of bias (RoB) assessment was performed through the Cochrane RoB 2 tool for included studies, following the Cochrane Handbook for Systematic Reviews of Interventions.[25] The tool comprises five distinct domains utilized for assessing the overall risk of bias (RoB). The evaluation of RoB for the second domain, which examines deviations from the intended interventions, aimed to gauge the effect of assignment to the intervention. Each domain underwent assessment using one of three categories: "Low RoB," "Some Concerns," or "High RoB." Two authors conducted the RoB assessment for each study, with any discrepancies being resolved through negotiation(Table 2).

Accepted Article

AI Statement

While preparing this work the authors used the "Free AI Paraphrasing Tool" (https://ahrefs.com/writing-tools/paraphrasing-tool) to paraphrase. In this AI, we enter the translated text and the text will be paraphrased based on the academic style for free, but after that, it is necessary to read the entire content and edit if necessary. We used this AI to improve the language of the manuscript.

Results

Studies Description

Following an extensive review of the texts, a final selection of 21 articles (puberty:10, reproduction:9, menopause:3) with 1001 participants (35 crossbreed heifers, 10 mice, 40 rats, 60 rabbits, and 856 women) in the stage of puberty, reproduction, and menopausal age were included(Figure 1). The selected studies were conducted across diverse geographical locations, including Iran(n=7), Indonesia(n=7), Iraq(n=4), Egypt(n=2), and Jordan(n=1). Also, the study design was as below: Randomized Clinical Trial (n=11), Clinical Trial(n=5), Quasi-Experimental(n=3), Peri-experimental(n=2).

Puberty Stages

Three experimental studies examine the impact of date fruit on the levels of luteinizing hormone(LH), follicle-stimulating hormone(FSH), estrogen during puberty, and sexual maturity of crossbreed heifers. The interventions showed that adding two kilograms of date fruit to the daily diet of these animals had positive effects on the mentioned parameters. [26-28]

Seven studies have been conducted to examine the impact of consuming date fruit[1,11,17,29-31] or date fruit juice[32] on female adolescents who are anemic or prone to anemia due to puberty and menstruation. The findings from these studies suggest that consuming seven date fruits or 250 cc of date syrup daily for seven days, one month, or two months can lead to improvements in anemia-related indicators such as hemoglobin, ferritin, and hematocrit levels. It can be inferred that providing adolescents with a regular intake of dates can help in the prevention of anemia.

Accepted Article

Reproductive Stages

Fertility: The administration of 500 mg capsules containing date fruit extract three times daily, in conjunction with tamoxifen and letrozole (standard treatment for infertility), for 12 weeks exhibits a positive impact on the follicles parameters, endometrial thickness, and LH levels when compared to routine treatment. Notably, FSH levels did not demonstrate any significant changes.[33] Additionally, the intake of date fruit exhibited favorable effects on the ovarian histological finding of female mice offspring[18] and the ovarian function of rats.[34] The findings from another research study, which focused on rabbits, indicated that the oral administration of date palm pollen(DPP) could potentially enhance the reproductive efficiency of female rabbits. This improvement is achieved through the adjustment of hematological and metabolite levels in the blood, reduction of lipid profile and peroxidation, enhancement of antioxidant capacity and immunity, and improvement of ovarian activity and embryo quality.[35]

Sexual Function: The sexual function of infertile couples[36] and the female sexual function index(FSFI)[37] of women in various domains(desire, lubrication, and overall score) was enhanced by the daily intake of a 300 mg date extract capsule for 4 to 5 weeks.

PCOs: In women with PCOS, the hormonal profile (estrogen, progesterone, FSH, and LH) was enhanced by the daily intake of three grams of date fruit.[38]

Menstrual cycle: The consumption of seven date fruits daily has no significant impact on reducing the length of both the menstrual cycle and the duration of menstruation.[39]

The findings from studies conducted during the reproductive phase of women suggest that the intake of a specific amount of date fruits may positively influence several parameters, including hormonal balance, enhancement of ovulation and metabolic parameters, as well as the sexual health of both women and men improvements in the FSFI and erectile dysfunction).

Menopausal stages

Three studies examined the impact of date fruit or capsules containing date extract on menopausal symptoms. The findings from these studies revealed that consuming 7 dates daily for

Accepted Article

8 weeks can decrease the levels of anti-mullerian hormone during menopause.[40] However, when it comes to sexual disorders experienced during this phase, the effects of 300 mg date extract capsules yielded conflicting results. Consumption for 5 weeks proved to be effective (positive effect on vaginal lubrication and dyspareunia),[19] whereas consumption over 4 weeks did not demonstrate any significant effects.[41]

Consumption of dates during the menopausal period has been associated with enhanced vaginal lubrication and reduced dyspareunia, as well as a lesser reduction in anti-Müllerian hormone (AMH) levels, indicating better maintenance of ovarian reserves.

Discussion

The present study reviewed relevant studies to investigate the impact of date fruit products on female health at different stages of their life. Date fruits have beneficial effects on puberty, reproduction, and menopause. During puberty, the consumption of date fruits has been observed to enhance hemoglobin levels in adolescent girls. In the reproductive age, date fruits show positive effects on enhanced fertility(improving ovulation and hormonal and metabolic parameters), ovarian function, and sexual function(improving FSFI and erectile dysfunction). Furthermore, menopausal women who consume date fruits experience improvements in common sexual disorders associated with this phase of life(better vaginal lubrication).

Micronutrient deficiencies result mainly from insufficient consumption of foods rich in nutrients and nutrient depletion caused by unhealthy diets, infections, and blood loss during menstruation in women.[42] In the same direction, the World Health Organization (WHO) and the United Nations Food and Agriculture Organization (FAO) have implemented four primary approaches to enhance dietary intake: fortification of food, provision of micronutrient supplements, dissemination of nutrition education, and implementation of disease control interventions.[43]

Date fruits are rich in iron and calcium, both of which are crucial for blood formation and bone marrow. Within the bone marrow, iron is utilized in the production of hemoglobin, while the remaining iron is transported to the body tissues that require it.[44] The iron content in date fruits aids in meeting the iron requirements during adolescent periods the iron lost during

Accepted Article

menstruation.[45] The correlation between iron and hemoglobin levels can be explained by the fact that iron is a vital component in the synthesis of blood, specifically in the formation of hemoglobin.[46] Sufficient iron stores ensure that the demand for blood cell production in the bone marrow is consistently met. By regularly consuming date fruits, that contain iron, the iron needed for the process of hemopoiesis can be adequately fulfilled.[47] About this matter, the findings from research studies examining the impact of consuming date fruits on enhancing indicators associated with anemia have demonstrated noteworthy outcomes. Specifically, the overall consumption of date fruit by adolescent girls has been shown to effectively improve hemoglobin level.[17,30]

Date fruits contains steroidal compounds, including estradiol, estrone, estriol, and triterpenes. These compounds serve as structural precursors, such as a-amyrin, and immature gonadotropic structures.[48] Additionally, date fruits extracts contain a non-crystalline estrogenic component.[49] Also, DPPs produce gonadotrophic hormones like LH and follicle-FSH.[50] Estrogen plays a crucial role in adult females by regulating the estrous cycle and influencing pregnancy, lactation, and libido. Progesterone, on the other hand, is recognized as the primary progestin hormone. It is synthesized by the ovaries during the middle of the estrous cycle and is produced in significant amounts by the placenta during pregnancy.[51] In a research investigation, the efficacy of palm pollen was observed on various ovarian parameters in female mice. These parameters encompassed ovarian diameter, the count of primary and secondary follicles, as well as the levels of estrogen and progesterone, which exhibited a notable increase.[18] Furthermore, phytoestrogen, found in date palm pollen, acts as a weak estrogen antagonist and exhibits a potent effect at low estrogen levels, particularly in cases of PCOS.[52] El-Wahed and colleagues (2022) demonstrated that the hormonal profile of women with PCOS can be positively influenced by the consumption of date fruit.[38] Premenstrual syndrome(PMS) manifests concurrently with hormonal changes in the menstrual cycle, with theories suggesting hormonal imbalances such as excess estrogen and insufficient progesterone.[53] Additionally, there is an association between symptoms and serotonin levels, which is considered a significant etiological factor.[54] During this period, it was observed that the incorporation of red Chinese date fruits into the diet of women had a significant impact on their emotional well-being. The hormonal properties of the date fruits played a crucial role in this regard, as it was found to effectively alleviate negative moods.[55]

Accepted Article

Currently, scientists are actively investigating natural solutions for the prevention and treatment of infertility. Date fruits are considered an effective remedy for infertility owing to their antioxidative characteristics. In males, the date palm exerts a significant influence on reproductive factors such as hormone levels, seminal vesicle parameters, sperm motility, count, and viability. In females, it exhibits beneficial impacts on reproductive factors encompassing the process of oogenesis, fortification of oocytes, regulation of hormones, support during pregnancy, decreased requirement for labor augmentation, and prevention of postpartum hemorrhage.[56] The positive effects of date fruit or capsules containing its extract on improving fertility and improving ovarian function are also seen in studies.[18,36]

The onset of menopause in females marks a phase distinguished by various alterations resulting from a physiological insufficiency of estrogens. The vaginal epithelium experiences a decrease in thickness, with cells becoming more flattened, a reduction in glycogen content, and the disappearance of epithelial-connective papillae.[57] Also, date fruits contain a variety of flavonoids, alkaloids, sterols, and steroids that have the potential to improve and control sexual activity.[50,58] Alkaloids present in date fruits exhibit ergogenic properties that can trigger vasodilation in blood vessels, a phenomenon that is associated with erection and sexual response.[59] Date palm pollen has been shown to enhance vaginal lubrication and reduce dyspareunia, possibly attributed to its impact on increasing sex hormones like estradiol, progesterone, and testosterone.[60] Phytochemical analysis reveals that date palm pollen is rich in natural antioxidants such as flavonoids and glycosides, saponin, estrone, vitamins A and E, various minerals like bromine, zinc, cadmium, manganese, and copper, as well as fatty acids including palmitic acid, stearic acid, and linoleic acid.[61] Also, Sadeghi et al. (2018) in their intervention showed that consuming date extract capsules for 5 weeks without side effects has a positive effect on women's sexual performance.[62]

The strength of this study was the collection of studies related to the impact of date fruit on different stages of female life. In this study, a comprehensive view of the potential effects of this fruit on the female reproductive system was provided. The limitations of the study, include a limited number of research articles, as well as studies with small sample sizes or lacking a

Accepted Article

control group, and review animal studies posing a challenge to the generalizability of the findings. To enhance the robustness of research outcomes, it is advisable to conduct additional human interventions at various stages of women's lives.

Conclusion

The findings from the examination of various studies indicate that the consumption of date fruits in women's diet can effectively alleviate the problems encountered throughout various stages of their lives. The consumption of date fruits has been shown to enhance the levels of anemia and improve reproductive age issues(hormonal balance, improving ovulation and metabolic parameters in PCOS, enhancing men's and women's sexual function), and sexual performance in postmenopausal women. Supporting women with proper nutrition and enhancing their diet can lead to cost savings compared to medical interventions, and is considered a key preventive measure for improving women's health. By offering simple advice, women can enhance their quality of life and better cope with life's challenges. Every society must prioritize the enrichment of women's nutrition and education regarding this matter throughout various life stages.

Authors' Contribution

FA and ESH conceived, designed and drafted the manuscript. FR, MJ and FA reviewed and interpreted the data. All authors approved the final version of the manuscript.

Declaration

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request. All authors approved the final version of the manuscript.

References

1. Fathimah F, Aprilia VI, Pibriyanti K, et al: The Effect of Date Fruits (Phoenix dactylifera L) Intervention to Increase Hemoglobin Levels in Female Adolescents. Media Gizi Mikro Indonesia 13:97-104, 2022.
2. Krueger RR: Date palm (Phoenix dactylifera L.) biology and utilization, in The Date Palm Genome, Vol. 1: Phylogeny, Biodivers and Mapp, Vol Springer, 2021, pp 3-28.

Accepted Article

3. El Hadrami A, Al-Khayri JM: Socioeconomic and traditional importance of date palm. Emirates J of food and Agric 24:371, 2012.
4. Rahman H, Vikram P, Hammami Z, et al: Recent advances in date palm genomics: A comprehensive review. Frontiers in Genetics 13:959266, 2022. https://doi.org/10.3389/fgene.2022.959266
5. M Abo-El-Saad M, MS Shawir S: Nutritional and Medicinal Value of Mineral Elements in Dates. The Egyptian Sci Mag 11:43-51, 2024.
6. Salomon-Torres R, Krueger R, Garcia-Vazquez JP, et al: Date palm pollen: Features, production, extraction and pollination methods. Agron 11:504, 2021. https://doi.org/10.3390/agronomy11030504
7. Aljaloud S, Colleran HL, Ibrahim SA: Nutritional value of date fruits and potential use in nutritional bars for athletes. Food and Nut Sci 11:463-480, 2020. https://doi.org/10.4236/fns.2020.116034
8. Rahnemaei FA, Kashani ZA, Jandaghian-Bidgoli M, et al: The Impact of the Fruit and Seed of Date on Childbirth Stages and Pregnancy Complications. Sultan Qaboos Univ Med J 1, 2023. https://doi.org/10.18295/squmj.12.2023.094
9. Horstmann S, Schmechel C, Palm K, et al: The operationalisation of sex and gender in quantitative health–related research: a scoping review. Int J of Environ Res and Pub Health 19:7493, 2022. https://doi.org/10.3390/ijerph19127493
10. Ndugga N, Artiga S: Disparities in health and health care: 5 key questions and answers. Kaiser Fam Found 11, 2021.
11. Husnah R, As'ad S, Sinrang W, et al: Addition Of Sukkari Dates (Phoenix Dactylifera L) And Fe Supplementation In Increasing Ferritin Levels To Young Women With Anemia. Annals of the Romanian Soci for Cell Biol:17377-17389, 2021.
12. Cheung YT, Chan DFY, Lee CK, et al: Iron Deficiency among School-Aged Adolescents in Hong Kong: Prevalence, Predictors, and Effects on Health-Related Quality of Life. Int J of Environ Res and Public Health 20:2578, 2023. https://doi.org/10.3390/ijerph20032578
13. Obeagu EI, Njar VE, Obeagu GU: Infertility: Prevalence and consequences. Int J Curr Res Chem Pharm Sci 10:43-50, 2023. https://doi.org/10.22192/ijcrcps

Accepted Article

14. Santoro N, Roeca C, Peters BA, et al: The menopause transition: signs, symptoms, and management options. The J of Clin Endocrinol & Metab 106:1-15, 2021. https://doi.org/10.1210/clinem/dgaa764
15. Fernández-López J, Viuda-Martos M, Sayas-Barberá E, et al: Biological, nutritive, functional and healthy potential of date palm fruit (Phoenix dactylifera L.): Current research and future prospects. Agron 12:876, 2022. https://doi.org/10.3390/agronomy12040876
16. Chen H, Wang P, Han Y, et al: Evaluation of dietary intake of lactating women in China and its potential impact on the health of mothers and infants. BMC women's health 12:1-10, 2012. https://doi.org/10.1186/1472-6874-12-18
17. Irandegani F, Arbabisarjou A, Ghaljaei F, et al: The effect of a date consumption-based nutritional program on iron deficiency anemia in primary school girls aged 8 to 10 years old in Zahedan (Iran). Pediatri health, med and therap:183-188, 2019. https://doi.org/10.2147/PHMT.S225816
18. Moshfegh F, Baharara J, Namvar F, et al: Effects of date palm pollen on fertility and development of reproductive system in female Balb/C mice. J of herb pharm 5:23-28, 2015.
19. Sadeghi S, Yosefzadeh S, Mahrozadeh S, et al: The effect of date palm pollen capsule on female sexual interest/arousal disorder in menopausal woman. J of Islamic and Iranian Tradit Med 9:287-296, 2019.
20. Hall HG, Griffiths DL, McKenna LG: The use of complementary and alternative medicine by pregnant women: a literature review. Midwifery 27:817-824, 2011. https://doi.org/10.1016/j.midw.2010.08.007
21. Alt KW, Al-Ahmad A, Woelber JP: Nutrition and health in human evolution–past to present. Nutrients 14:3594, 2022. **https://doi.org/10.3390/nu14173594**
22. Zaher E, Khedr N, Eman E: Effect of Date fruit on Labor Outcomes among Primi Parous Woman. Mansoura Nurs J 9:17-24, 2022. https://doi.org/10.21608/mnj.2022.292866
23. Sagi-Dain L, Sagi S: The effect of late pregnancy date fruit consumption on delivery progress–a meta-analysis. Explore 17:569-573, 2021. https://doi.org/10.1016/j.explore.2020.05.014

Accepted Article

24. Page MJ, McKenzie JE, Bossuyt PM, et al: The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. bmj 372, 2021. https://doi.org/10.1136/bmj.n71
25. Flemyng E, Moore TH, Boutron I, et al: Using Risk of Bias 2 to assess results from randomised controlled trials: guidance from Cochrane. BMJ Evid-Based Med 28:260-266, 2023. https://doi.org/10.1136/bmjebm-2022-112102
26. Al-Abbasi H, Al-Wazeer A: Role of Date Palm Pollen on Heifer's Puberty and Maturity in Iraq. Arch of Razi Inst 78:241, 2023. https://doi.org/10.22092/ARI.2022.358951.2339
27. Alabbasi HHH, Hatif SA: The effect of date fruit on puberty and sexual maturity in heifers. Kufa J for Agricul Sci 11, 2019.
28. Hammod HH, Hatif SA: Effect of dates (Phoenix dactylifera) supplement on puberty in heifers and association with follicle stimulating hormone receptor gene genotypes. Online J of Vet Res 23:214-219, 2019.
29. Armi Y, Felina M: The Effect of Giving Dates (Phoenix dactylifera) on Hemoglobin Levels in Anemic Adolescent Girls at Prima Nusantara Vocational School, Bukittinggi, Indonesia. Eureka Herba Indonesia 5:429-431, 2024. https://doi.org/10.37275/ehi.v5i1.115
30. Aulia S, Nasution WM, Utami NS: The Effect of Giving Dates (Phoenix dactylivera) on Increasing Hemoglobin Levels in Adolescent Girl. Int J of Health, Edu & Soc (IJHES) 5:1-10, 2022.
31. Ali S, Alam G: Ajwa date fruit (Phoenix dactylifera L.) in increasing hemoglobin (Hb) level to teenage girl. Enfermería Clínica 30:77-79, 2020. https://doi.org/10.1016/j.enfcli.2019.07.036
32. Wati YS, Hasibuan LS: The Effect of Giving Date Palm Juice (Phoenix Dactykiferal.) and Mung Beans (Vigna Radiata) on The Increasing Hemoglobin of Young Woman in Class XI Students at SMA Negeri 10 Pekanbaru. Sci Midwifery 9:331-337, 2021.
33. Rasekhjahromi A, Ansari A, Zareibabaarabi Z, et al: The effect of palm pollen and letrozole + tamoxifen regimen in the treatment of infertile women: A double-blind randomized clinical trial. The Iranian J of Obstet, Gynecol and Infertil 25:9-17, 2022. https://doi.org/10.22038/ijogi.2022.20707

Accepted Article

34. Hammed MS, Arrak JK, Al-Khafaji NJ, et al: Effect of date palm pollen suspension on ovarian function and fertility in adult female rats exposed to lead acetate. Diyala J of Med 3:90-96, 2012.
35. Baagar M, Sherif KE, Fouda SF: Influence of Date Palm Pollen Administration on Reproductive Performance, Ovulatory Response, Antioxidants Capacity and Immunity of Rabbit Does. J of Anim and Poult Product 13:185-191, 2022. https://doi.org/10.21608/jappmu.2023.158664.1053
36. Jahromi AR, Mosallanezhad Z, Hosini FS, et al: The effect of date palm on sexual function in infertile couples: a double-blind controlled clinical trial. BMC Res Notes 15:1-7, 2022. https://doi.org/10.1186/s13104-022-05945-0
37. Salmani R, Nasiri K, Javadzadeh Y, et al: Effect of date palm pollen supplementation on female sexual function in non-menopausal women: A double blind randomized clinical trial. Chinese Herb Med 14:643-648, 2022. https://doi.org/10.1016/j.chmed.2022.02.004
38. El-Wahed A, Mahfouz R, Nasr AAA: Effects of Date Palm Pollen on Women with the Polycystic Ovarian Syndrome. The Egypt J of Hosp Med 89:4622-4625, 2022.
39. Al-Sayyed HF, Takruri HR, Bakir NA, et al: The effect of feeding date palm fruit (Phoeix dactylifera L.) on energy, macronutrient, and fiber intakes of a convenient sample of females. Current Nutr & Food Sci 16:1270-1277, 2020. https://doi.org/10.2174/1573401316666200326110555
40. Kurniawan L: The effect of ajwa dates (Phoenix dactylifera L) consumption to anti-Mullerian hormone level of perimenopausal woman. Food Res 7:105-110, 2023. http://dx.doi.org/10.31344/ijhhs.v8i20.712
41. Loripoor M, Esmaeili F, Vazirinejad R, et al: The Effect of Palm Pollen Extract on Sexual Disorders in Postmenopausal Women: A Randomized Clinical Trial. Int J Community Based Nurs Midwifery 11:14, 2023. https://doi.org/10.30476/IJCBNM.2022.95809.2086
42. Olson R, Gavin-Smith B, Ferraboschi C, et al: Food fortification: The advantages, disadvantages and lessons from sight and life programs. Nutr 13:1118, 2021. https://doi.org/10.3390/nu13041118
43. Wagman JD, Lukas KE, Dennis PM, et al: A work-for-food enrichment program increases exploration and decreases stereotypies in four species of bears. Zoo biol 37:3-15, 2018. https://doi.org/10.1002/zoo.21391

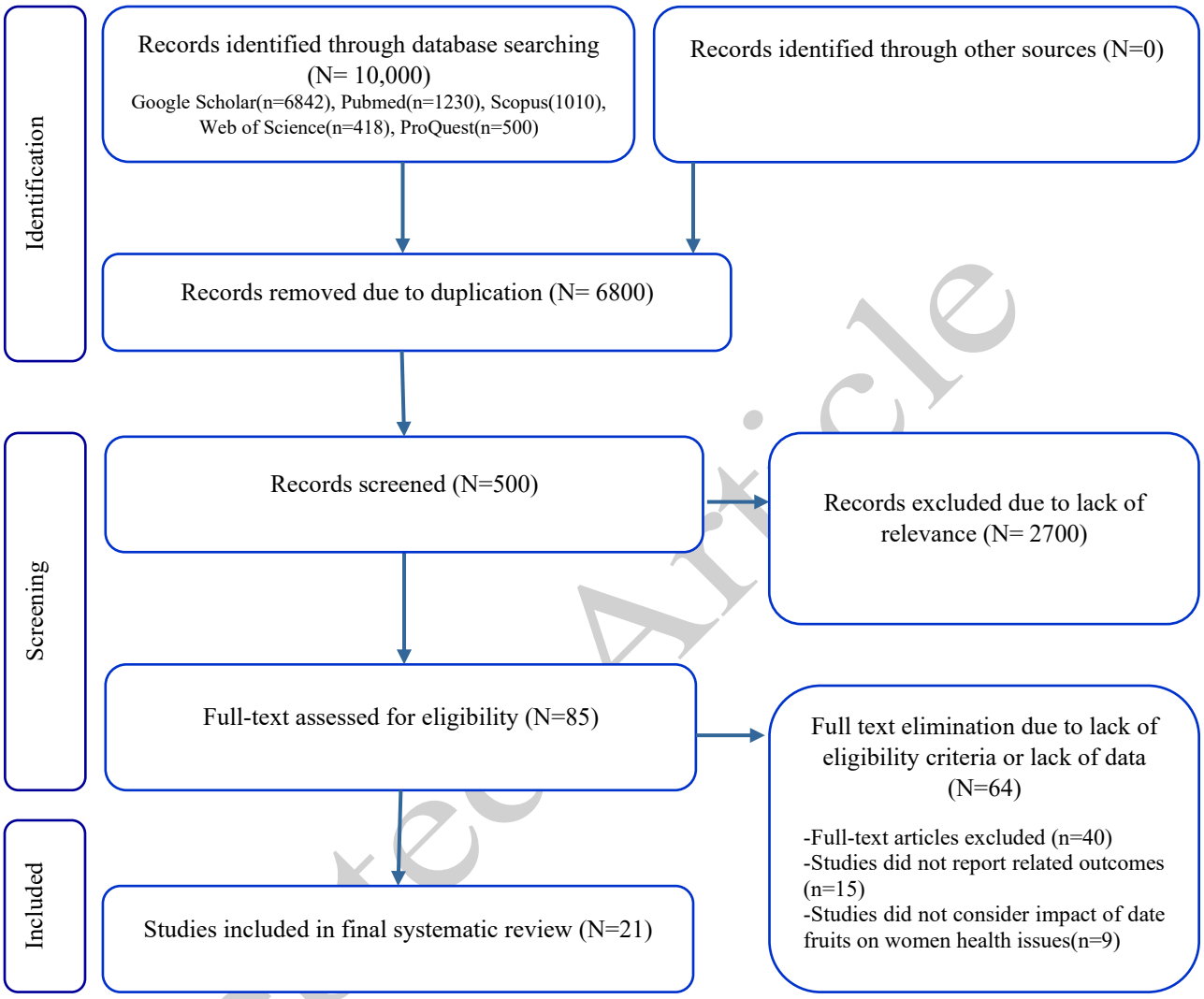
Accepted Article

458 44. Nadir A, Atris SA, Hassanin SO: Date Supplement and Iron Salts Plus Physical Activity on
459 Efficiency of Iron Absorption. Int J of Pharm Res and Allied Sci 8:80-90, 2019.
460 45. Khalid S, Khalid N, Khan RS, et al: A review on chemistry and pharmacology of Ajwa date
461 fruit and pit. Trends in food sci & technol 63:60-69, 2017.
462 https://doi.org/10.1016/j.tifs.2017.02.009
463 46. Vogt A-CS, Arsiwala T, Mohsen M, et al: On iron metabolism and its regulation. Int J of
464 Mol Sci 22:4591, 2021. https://doi.org/10.3390/ijms22094591
465 47. Sivaraj KK, Adams RH: Blood vessel formation and function in bone. Dev 143:2706-2715,
466 2016. https://doi.org/10.1242/dev.136861
467 48. Abbas FA, Ateya A-M: Estradiol, esteriol, estrone and novel flavonoids from date palm
468 pollen. Aust J Basic Appl Sci 5:606-614, 2011.
469 49. Al–Samarrai A-MH, Al–Samarrai RRH: Biochemical and experimental Study for the effect
470 of Date Palm Pollen grains and isolated flavonoids on the levels of steroid hormones in
471 sera of Adult females Rabbits. Tikrit J of Pure Sci 22:106-110, 2017.
472 50. Tahvilzadeh M, Hajimahmoodi M, Rahimi R: The role of date palm (Phoenix dactylifera L)
473 pollen in fertility: a comprehensive review of current evidence. J of evid -based
474 complement & alternat med 21:320-324, 2016.
475 https://doi.org/10.1177/2156587215609851
476 51. Khoshniat MT, Towhidi A, Rezayazdi K, et al: Dietary omega-3 fatty acids from linseed oil
477 improve quality of post-thaw but not fresh sperm in Holstein bulls. Cryobiol 93:102-108,
478 2020. https://doi.org/10.1016/j.cryobiol.2020.02.002
479 52. Bardei K: The effects of hydro-alcoholic extract of raspberry fruit on ovarian follicles and
480 serum parameters in poly cystic ovary syndrome-induced rat. Armaghane danesh 19:955-
481 968, 2015.
482 53. Tiranini L, Nappi RE: Recent advances in understanding/management of premenstrual
483 dysphoric disorder/premenstrual syndrome. Facult Rev 11, 2022.
484 https://doi.org/10.12703/r/11-11
485 54. Dilbaz B, Aksan A: Premenstrual syndrome, a common but underrated entity: review of the
486 clinical literature. J of the Turkish German Gynecol Assoc 22:139, 2021.
487 https://doi.org/10.4274/jtgga.galenos.2021.2020.0133

Accepted Article

55. Bu L, Lai Y, Deng Y, et al: Negative mood is associated with diet and dietary antioxidants in university students during the menstrual cycle: a cross-sectional study from Guangzhou, China. Antioxid 9:23, 2019. https://doi.org/10.3390/antiox9010023
56. Shehzad M, Rasheed H, Naqvi SA, et al: Therapeutic potential of date palm against human infertility: A review. Metab 11:408, 2021. https://doi.org/10.3390/metabo11060408
57. Sawczuk B, Gołębiewska M, Mazurek A, et al: Immunohistochemical evaluation of oestrogen receptors α and β in epithelium of the vaginal mucous membrane in women after oestrogen therapy. Menopause Rev/Przegląd Menopauzalny 16:12-18, 2017. https://doi.org/10.5114/pm.2017.66178
58. Abedi A, Karimian SM, Parviz M, et al: Effect of aqueous extract of Phoenix dactylifera pollen on dopamine system of nucleus accumbens in male rats. Neurosci and med 5:49-59, 2014. https://doi.org/10.4236/nm.2014.51008.
59. Gauthaman K, Ganesan AP: The hormonal effects of Tribulus terrestris and its role in the management of male erectile dysfunction–an evaluation using primates, rabbit and rat. Phytomed 15:44-54, 2008. https://doi.org/10.1016/j.phymed.2007.11.011
60. Hassan HM: Chemical composition and nutritional value of palm pollen grains. Global J Biotechnol Biochem 6:1-7, 2011.
61. Shariati M, Sharifi E, Kaveh M: The effect of phoenix dactylifera (date-palm) pit powder on testosterone level and germ cells in adult male rats. J of Adv in Med and Biomed Res 15:21-28, 2007.
62. Sadeghi S, Yosefzadeh S, Rakhshandeh H, et al: The impact of Date Palm Pollen Capsule on Vaginal Lubrication and Dyspareunia In Menopausal Woman. J of Midwifery & Reprod Health 6, 2018.

Accepted Article



511 **Figure 1**: Study Flowchart

Accepted Article

Table 1: Details of Included Studies

Study details				Participants Characteristics				Trial Details				Outcome
Ref	Study Design	Region	Sample Size	Species	Stage	Age(years)	Parameters	Intervention	Control	Period	Date Product	Results
Al-Abbasi,2023[26]	RCT	Iraq	10	Crossbred heifers	Puberty	6 mth	-LH -FSH -E	2kg DPP+ main ration	main ration	24 wks	Date fruit	Sig for FSH & E(sexual maturity)
Hammod,2019[28]	CT	Iraq	10	Crossbred heifers	Puberty	5 mth	Puberty age	20% date supplement/ Daily	Control	~40 wks	Phoenix dactylifera	In intervention group puberty at 7.8+1.5 mth, & in controls at 11.4+1.2 mth
Alabbasi,2019[27]	CT	Iraq	15	Crossbreed heifers	Puberty	5 mth	Puberty age	2kg/daily	main ration	8 wks	Date fruit	7.8 & 9.8 mth Vs. 11.4 & 16.2 mth
Armi,2024[29]	RCT	Indonesia	30	female adolescent	Puberty	NR	Hb level	3 date fruits /daily	Without intervention	4 wks	Date fruit	Sig increased(m 11.8 g/dL to 13.2 g/dL)
Aulia, 2022[30]	quasi-experimental	Indonesia	50	female adolescent	Puberty	12-14	Hb level	NR	NR	NR	Date fruit	Giving dates affects increasing hemoglobin levels in young women
Fathimah,2022[1]	pre-experimental	Indonesia	30	female adolescent	Puberty	15–18	Hb level	7 date fruits/ daily	-	1 wk	Date fruit	10.8±0.79 Vs. 11.9±1.5 g/dL

Accepted Article

Wati, 2021[32]	quasi-experimental	Indonesia	13	female adolescent	Puberty	10-19	Hb level	15cc Date juice/daily	250 cc green bean extract/ BD	1 wk	Dates palm juice	Hb levels above 12gr /dl after being given date palm juice increased to 46.1%
Husnah,2021[11]	RCT	Indonesia	42	female adolescent	Puberty	13-15	Ferritin level	G1: Fe 60 mg supplements twice in a week and every day during menstruation G2: Sukkari dates 50 grams daily in combination with Fe 60 mg supplements twice in a week and every day during menstruation	Without intervention	4 wks	Sukkari dates fruites	G1: 8.38 +3.41 Vs. 33.00 + 17.12 G2:5.00 +1.31 Vs. 34.45 + 10.06
Ali,2020[31]	pre-experimental	Indonesia	35	female adolescent	Puberty	15-18	Hb level	10 date fruite/daily	-	NR	Ajwa date fruit	10.786 g/dl Vs. s 11.143 g/dl

Accepted Article

Irandegani,2019[17]	Quasi-experimental	Iran	31	female adolescent	Puberty	5–11	-Hb level -Hct level -Ferritin level	7 dates(100 g)/daily	-	8 wks	Mazafati date fruit	Hgb: 11.19 ± 0.38 Vs. 12.05 ± 0.81 g/dL -Hct: 34.24 ± 0.41% Vs.37.17 ±2.36%, -Ferritin: 47.07 ± 21.89 µg/dL Vs.53.98 ± 19.77 µg/dL
Baagar ,2022[35]	RCT	Egypt	60	Rabbit	Reproduction	6 mth	-Reproductive efficiency -Parameters of blood -Ovarian activity -Reproductive hormonal profiles	Oral dose of DPP dissolved in 2 ml distilled water at levels of 250 and 500mg per animal	2 ml oral dose of distilled water	5 wks	DPP	-Improvement of estrogen, progesterone and prolactin. -Increased ovulation and embryo quality and quality. -Improving the reproductive efficiency, and hematological and metabolite parameters.
Rasekhjahromi,2022[33]	RCT	Iran	128	infertile women	Reproduction	27.37±6.86	-Number of follicles -Follicle size -Endometrial thickness	letrozole + tamoxifen + palm pollen(500 mg capsules 3 times/daily/	letrozole + tamoxifen	12 wks	DPP extract capsule	Sig increased in both control and intervention groups. But these increases were greater in the control group.

Accepted Article

							-FSH -LH	from the third day of menstruation)				
Rasekhjahromi,2022[36]	RCT	Iran	128	Infertile couples	Reproduction	15-49	-FSFI -International Index of Erectile Function	300 mg /daily	Placebo	4 wks	DPP extract capsule	Sig increase
Salmani,2022[37]	RCT	Iran	68	Non-menopausal women	Reproduction	37.24 ± 4.92	-Sexual disorder(FSFI)	300 mg /daily	Placebo	5 wks	DPP extract capsule	DPP supplementation significant increase in desire, lubrication, and the overall score
El-Wahed ,2022[38]	CT	Egypt	50	PCOS^{+} women	Reproduction	20.90±2.22	-FSH -LH -E -P	3 gr DPP /daily/	-	12 wks	DPP	-FSH(mIU/ml) before Vs. After: 4.69±0.44 Vs. 5.35±1.21 Sig -LH(mIU/ml) before Vs. After: 9.13± 2.28 Vs. 4.52± 0.51 Sig -E(pg/ml) before Vs. after: 59.02± 12.38 Vs. 29.10± 5.07 Sig -P (ng/ml) before Vs. after: 6.26± 1.83 Vs. 12.73± 1.80 Sig

Accepted Article

Al-Sayyed,2018[39]	CT	Jordan	37	Menses of women	Reproduction	20-30	-Menses length -Menstrual cycle length	7 date fruit/daily	Without intervention	4 menstrual cycle	Bahri date fruit	-NS for Menses length(days): 6.43±0.24 Vs. 5.97±0.27 -NS for Menstrual cycle length(days): 26.11±1.44 Vs. 24.83±1.59
Moshfegh,2015[18]	CT	Iran	10	Fertility of Balb/C mice	Reproduction	NR	-Histological parameter of offspring ovaries	100 and 200 mg/kg/daily	Without intervention	10 days /during gestation / until 21th day after birth	DPP	DPP can create an appropriate situation for oogenesis and maintain efficient fertility in female mice.
Hammed,2013[34]	RCT	Iraq	40	Ovary function and fertility in adult female rats	Reproduction	NR	-LH -FSH	150 mg / kg .B.W. DPP	1 ml distal water	6 wks	DPP	DPP has an obvious improvement effect on fertility hormones
Kurniawan,2023[40]	RCT	Indonesia	44	perimenopausal woman	Menopause	42-48	AMH	60-80 g/7 dates/daily	Without intervention	8 wks	Ajwa date fruit	Less reduction in AMH (y 0.37±0.36 Vs.0.55±0.19 ng/mL)

Accepted Article

Loripoor,2023[41]	RCT	Iran	110	Postmenopausal women	Menopause	40-65	-Sexual disorder(FSFI)	300 mg /daily	Placebo	4 wks	DPP extract capsule	NS
sadeghi,2018[19]	RCT	Iran	60	Postmenopausal women	Menopause	40-65	-Vaginal lubrication -Dyspareunia	300 mg/ daily	Placebo	5 wks	DPP extract capsule	Sig

RCT: randomized control trial, CT: clinical trial, G: group, mth: month, wk: week, DPP: date palm pollen, LH: Luteinizing hormone, FSH: Follicle-stimulating hormone, T: testosterone, P: progesterone, E: estrogen, Sig: significant, NS: not significant, CS: cross-sectional, FSHR: Follicle-stimulating hormone receptor, Hb: hemoglobin, BD: twice a day, AMH: anti-Mullerian hormone, NR: not reported, PCOs: polycystic ovarian syndrome, FSFI: Female Sexual Function Index.

Accepted Article

Table 2: Risk of bias assessment summary: authors' judgments about each risk of bias domain for each included study

Domain					
Ref	Randomization Process	Deviation from the intended interventions	Missing outcome data	Measurement of the outcome	Selection of the reported results
Al-Abbasi,2023[26]	+	+	+	+	+
Hammod,2019[28]	+	+	+	+	+
Alabbasi,2019[27]	+	+	+	+	+
Armi,2024[29]	+	?	+	+	+
Aulia,2022[30]	+	?	+	-	+
Fathimah,2022[1]	-	+	+	+	+
Wati, 2021[32]	?	+	+	+	+
Husnah,2021[11]	+	+	+	+	+
Ali,2020[31]	-	+	+	?	+
Irandegani,2019[17]	-	+	+	+	+
Baagar,2022[35]	+	+	+	+	+
Rasekhjahromi,2022[33]	+	+	+	+	+
Rasekhjahromi,2022[36]	+	+	+	+	+
Salmani,2022[37]	+	+	+	+	+
El-Wahed,2022[38]	-	+	+	+	+
Al-Sayyed,2018[39]	?	+	+	+	+
Moshfegh,2015[18]	?	+	+	+	+
Hammed,2013[34]	+	+	+	+	+
Kurniawan,2023[40]	+	+	+	+	+
Loripoor,2023[41]	+	+	+	+	+
sadeghi,2018[19]	+	+	+	+	+

+:Low risk; -: high risk; ?:some concerns

Accepted Article