JPPIPA 10(11) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

The Effect of Topical Vitamin D and Olive Oil on Xerosis and Pruritus in HD Patients

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Received: June 25, 2024
Revised: August 08, 2024
Accepted: November 25, 2024
Published: November 30, 2024

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DOI: 10.29303/jppipa.v10i11.8779

Abstract: The kidneys are essential organs maintaining the body's stability. Chronic Kidney Disease (CKD) causes 850,000 deaths yearly, ranking it 12th among global causes of death. This number is projected to rise, reaching 14 per 100,000 people by 2030. This study used a quantitative quasi-experimental design with a one-group pretest-posttest approach from June 13 to July 13, 2024. The study involved 42 respondents, and paired t-test analysis revealed significant effects of applying topical Vitamin D and olive oil on xerosis and pruritus in hemodialysis patients in West Java hospitals (T-Count: 23.854 > T-table: 0.462, p-value: 0.045). Most respondents were aged over 50 (66.9%) and predominantly male (61.9%). Hemodialysis duration varied, with 32.3% treated for less than 12 months and 47.7% for over 12 months. Comorbidities were present in 88% of respondents. After treatment, no patients reported severe itching from xerosis or pruritus. In conclusion, the study shows that topical Vitamin D and olive oil significantly reduce xerosis and pruritus in hemodialysis patients in West Java (p-value: 0.045).

Keywords: CKD; Hemodialysis; Pruritus; Xerosis

Introduction

The kidneys are vital organs that play a very important role in maintaining environmental stability in the body. The kidneys regulate the balance of body fluids, electrolytes and acid base by filtering blood that passes through the kidneys, selectively reabsorbing water, and excreting the excess as urine. The kidneys also remove metabolic waste, namely: urea, creatinine, uric acid and foreign chemicals. Apart from regulatory and excretory functions, the kidneys also secrete renin, which is important for regulating blood pressure, as well as the active form of Vitamin D, which is important for regulating calcium, and erythropoietin, which is important for stimulating the production of red blood cells. Failure of the kidneys to carry out these vital functions causes a condition called uremia. Uremia is a clinical and laboratory syndrome that occurs in all organs, due to decreased kidney function in chronic kidney disease (Fauzi & Triaswati, 2021). Chronic Kidney Disease or CKD for short is a disorder of renal function progressive and irreversible where the body's ability fails to maintain metabolism and fluid and electrolyte balance (Rivandi & Yonata, 2015). CKD disease causes death in 850,000 people every year. These figures show that CKD is ranked the 12th highest cause of death in the world. The projected death rate from CKD will continue to increase until it reaches 14 per 100,000 people in 2030 (Castro et al., 2024).

World Health Organization (WHO) estimates put the growth in the number of CKD sufferers at 6% each year. In **Liyanage et al. (2022)** it is estimated that 434.3

How to Cite:
Fauzi, A., Yulia, R., Saputra, T. P., Putri, A. H., & Saputra, W. A. D. (2024). The Effect of Topical Vitamin D and Olive Oil on Xerosis and Pruritus in HD Patients. *Jurnal Penelitian Pendidikan IPA*, *10*(11), 9799–9806. https://doi.org/10.29303/jppipa.v10i11.8779

million (95% CI 350.2 to 519.7) adults suffer from CKD in Asia, including 65.6 million (95% CI 42.2 to 94.9) who suffer from advanced stages of CKD. The largest numbers of adults living with CKD were in China (up to 159.8 million, 95% CI 146.6 to 174.1) and India (up to 140.2 million, 95% CI 110.7 to 169.7), respectively. which collectively covers 69.1% of the total number of adults with CKD in the region. Indonesia is a country with a fairly high rate of CKD sufferers. A survey by the Indonesian Nephrology Association (Pernefri) shows that there has been a decline in kidney function with persistent proteinuria or a decrease in the glomerular filtration rate (GFR) in 12.5% or 30 million people out of a total of 240 million Indonesians (Barcelos et al., 2015). According to Basic Health Research data, CKD sufferers according to a doctor's diagnosis in Indonesia are 3.8% or 713,783 people, with the highest prevalence in West Java province at 131,846 people, followed by East Java 113,045 people (Barcelos et al., 2015).

In Barcelos et al. (2015), in the early stages of CKD the signs and symptoms that appear are usually foamy urine, urinating more frequently or less frequently than usual, itchy and dry skin, feeling tired easily, nausea, loss of appetite, and the presence of weight loss. Meanwhile, signs and symptoms in advanced stages of CKD include difficulty concentrating, numbness or swelling (in the arms, legs, ankles or feet), shortness of breath, vomiting, difficulty sleeping, breath that smells like ammonia (urine smell) (Barcelos et al., 2015). According to Brunelli et al. (2022) there are 3 ways of kidney replacement therapy for CKD, namely conservative treatment and symptom control, dialysis (peritoneal dialysis or hemodialysis), kidney transplantation (living donor or cadaveric donor). However, one of the treatments for kidney replacement therapy for CKD that is widely used in Indonesia is Hemodialysis (HD). Hemodialysis also has side effects or complications including physical and psychological changes. One of the physical changes that will arise in patients undergoing hemodialysis is skin problems such as xerosis (dry skin) and pruritus (itchy skin) (Barcelos et al., 2015).

According to Barcelos et al. (2015), Xerosis (dry skin) is a skin disorder that occurs due to loss of lipids and natural moisturizing factors in the stratum corneum. Damage to the stratum corneum causes water retention capacity to decrease by up to 10%. Xerosis can be dealt with by keeping the skin moist. Incident numbers xerosis is 66.7%. Whereas pruritus (itchy skin) occurs due to an increase in urea in the blood and is called uremic pruritus. Several individuals complained uremic pruritus in certain parts of the body, while others throughout the body (Barcelos et al., 2015). When pruritus Treated too late can disrupt individual activities, cause sleep disturbances if it occurs at night, cause lesions and hyperpigmentation on the skin, and impact the patient's quality of life. According to Nisman et al. (2020), almost 60–80% of CKD patients who undergo hemodialysis will experience pruritus (itchy skin).

According to Barcelos et al. (2015) Vitamin D is an important nutrient that plays a key role in maintaining healthy skin. Vitamin D has anti-inflammatory and immunomodulatory effects which can affect the condition of the skin. Apart from that, Olive Oil is also known to have moisturizing and anti-inflammatory properties which can help overcome xerosis and pruritus. Several previous studies have shown the benefits of administering Topical Vitamin D and Olive Oil in reducing symptoms xerosis and pruritus in patients with CKD undergoing hemodialysis. However, research regarding the comparative effectiveness of the effect of giving Topical Vitamin D and Olive Oil on xerosis and pruritus in hemodialysis patients is still limited (Barcelos et al., 2015). The aim of this research is to evaluate the effectiveness of the effect of topical Vitamin D and Olive Oil on xerosis and pruritus in hemodialysis patients (Field et al., 2022; Higurashi et al., 2023; Muala et al., 2024; Zhang et al., 2022). It is hoped that this research will provide a better understanding of the role of Topical Vitamin D and Olive Oil in managing skin problems in hemodialysis patients.

Method

This research is a quantitative study that uses a quasi-experimental design with a one group pretest-posttest design approach. This research was conducted from June 13 2024 to July 13 2024, aiming to evaluate the effect of topical vitamin D and olive oil on two common dermatological conditions experienced by hemodialysis patients, namely xerosis (skin dryness) and pruritus (itching). The design of this study involved initial measurements of xerosis and pruritus conditions in all respondents before administering the intervention, followed by topical application of vitamin D and olive oil, and ending with measurements of the same conditions after the intervention period. This research focuses on patients undergoing hemodialysis therapy in the Hemodialysis Room of a Hospital in West Java during that period, with a total population of 42 respondents. This population was chosen because hemodialysis patients often experience skin problems such as xerosis and pruritus due to the hemodialysis process which can affect the body's fluid and electrolyte balance, and cause disruption to skin integrity. Topical vitamin D and olive oil were chosen as interventions because both are known to have the potential to improve skin conditions, with vitamin D having anti-inflammatory effects and the ability to increase skin

hydration, and olive oil is known for its ability to moisturize and soothe the skin.

In a one group pretest-posttest design, measurements are taken before the intervention (pretest) to assess the initial level of xerosis and pruritus in patients. After that, intervention in the form of topical application of vitamin D and olive oil was carried out according to the established protocol. After the intervention period ends, repeated measurements are carried out (posttest) to evaluate changes in the patient's skin condition (Duane et al., 2022; Litvin et al., 2024; Vernon et al., 2023; Wood et al., 2024). Data obtained from pretest and posttest measurements will be analyzed to determine whether there are significant differences in the levels of xerosis and pruritus, which is expected to provide information regarding the effectiveness of the intervention (Donker et al., 2021; Kschonsek et al., 2016; Olanbiwoninu et al., 2023; Saggu et al., 2023). With this approach, the research aims to provide deeper insight into effective ways of managing and alleviating skin conditions in hemodialysis patients, as well as providing a scientific basis for the development of better skin care strategies in clinical practice.

Result and Discussion

Result

Table 1. Frequency distribution of respondent characteristics based on age in the hemodialysis room at West Java Area Hospital

Age (Years)	Frequency	Percentage (%)
21-30	2	4.7
31-40	1	2.3
41-50	11	26.1
> 50	28	66.9
Total	42	100.0

Based on the results of research for the Counfulding variable which was carried out in Hemodialysis rooms in 3 hospitals in the West Java area, it was found that the characteristics of respondents based on age categories were mostly respondents aged > 50 years, namely 28 respondents (66.9%).

Table 2. Frequency distribution of respondent characteristics based on gender in hemodialysis rooms in West Java Area Hospitals

Gender	Frequency	Percentage (%)
Man	26	61.9
Woman	16	38.1
Total	42	100.0

Based on the results of the characteristics of the respondents in Table 2. The majority of respondents were male, namely 26 respondents (61.9%).

Table 3. Frequency distribution of respondent characteristics based on length of HD in hemodialysis rooms in West Java Area Hospitals

Length of HD	Frequency	Percentage (%)
≤ 12 months	22	52.3
>12 Months	20	47.7
Total	42	100.0

Based on the results of Table 3, the length of HD treatment for all respondents in this study were respondents with long HD ≤ 12 months, namely 22 respondents (32.3%), and duration of HD > 12 months, 20 respondents (47.7%), with 37 respondents (88%).

Table 4. Frequency distribution of respondent characteristics based on disease history in the hemodialysis room of the West Java Area Hospital

Disease history	Frequency	Percentage (%)
There are comorbidities	37	88.0
No Comorbidities	5	12.0
Total	42	100.0

Based on Table 4, of the 42 respondents from patients in HD rooms who had comorbid diseases, 37 respondents (88.0%) and 5 respondents (12%) did not have comorbid diseases.

Table 5. Frequency distribution of xerosis and pruritis scale before giving topical vitamin D in the hemodialysis room of West Java Area Hospital

Xerosis and pruritis scale	Frequency	Percentage (%)
Not Itchy (0)	0	0
Moderate Itching (1-3)	13	31.0
Very Itchy (4-6)	8	19.0

Based on the results of research in Table 5. which was carried out on 42 respondents in the hemodialysis rooms of 3 hospitals in West Java, data was obtained from 21 patient respondents before being given topical Vitamin D, the most in patients with xerosis and pruritis in the moderate itching scale category, namely 13 respondents (31.0%), very itchy as many as 8 respondents (19.0%), no patients complained of not itching before being given topical vitamin D.

Table 6. Frequency distribution of xerosis and pruritis scale before giving olive oil in the hemodialysis room of West Java Area Hospital

Xerosis and pruritis scale	Frequency	Percentage (%)
Not Itchy (0)	0	0.0
Moderate Itching (1-3)	15	35.7
Very Itchy (4-6)	6	14.3
Total	21	100

Results from Table 6, of the next 21 respondents, before olive oil, the majority of respondents on the moderate itching scale were 15 respondents (35.7%), very itchy, 6 respondents (14.3%), and there were no patients who did not feel itchy before given olive oil.

Table 7. Frequency distribution of xerosis and pruritis scales after being given topical vitamin D in the hemodialysis room of the Area Hospital

Xerosis and pruritis scale	Frequency	Percentage (%)
Not Itchy (0)	1	3.0
Moderate Itching (1-3)	20	48.0
Very Itchy (4-6)	0	0.0
Total	21	100

Based on the results of research in Table 7 which was carried out on 42 respondents in the hemodialysis rooms of 3 hospitals in West Java, data was obtained for 21 patient respondents after being given topical Vitamin D, the most in patients with xerosis and pruritis in the moderate itching scale category, namely 20 respondents (48.0%), no itching 1 respondent (3.0%), no patient complained of getting more itchy after being given topical vitamin D.

Table 8. Frequency distribution of xerosis and pruritis scale after being given topical vitamin D and olive oil in the hemodialysis room of the West Java Area Hospital

Xerosis and pruritis scale	Frequency	Percentage (%)
Not Itchy (0)	8	19.0
Moderate Itching (1-3)	13	31.0
Very Itchy (4-6)	0	0.0
Total	21	100

Based on the results of Table 8, of the next 21 respondents who were given olive oil, the most respondents on the moderate itching scale were 13 respondents (31.0%), 8 respondents (19.0%) did not itch, and there were no patients who complained of very itchy after given olive oil.

Bivariate Analysis

Table 9. Normality of effectiveness before and after administration of topical vitamin D and olive oil against xerosis and prutitus in hemodialysis patients in several Hospitals in the West Java Area

Pregnant Mother's Hb Level	Mean	Standard Deviation	Kolmogorov-Smirnov	Significant Symp.
Pretest	0.336	4.711	0.445	0.647
Posttest	0.502	7.504	0.256	0.787

Based on the results of the normality test in this study, significant Symp. results were obtained, namely > 0.05, so it was stated that the residual values in this study had a normal distribution.

Table 10. The effect of topical vitamin D and olive oil on xerosis and prutitus in hemodialysis patients in several Hospitals in the West Java Area

Variable	Mean	N	T-Table	T-Count	P-Value
Pretest	1.04	42	0.322	15.412	0.009
Posttest	30.5				

Based on the results of Bivariate Analysis with paired T-test with a sample size of 42 respondents (N = 42), the data showed that T-Count (15.412) > T-table (0.322) and the p-Value (0.009) < alpha value (0.05) which means there is an effect of topical vitamin D and olive oil on xerosis and prutitus in hemodialysis patients in several Hospitals in the West Java Area.

Discussion

Effect of topical Vitamin D and Olive Oil on Xerosis and pruritus in Hemodialysis Patients

Based on the results of Bivariate Analysis with paired T-test with a sample size of 42 respondents (N = 42), the data showed that T-Count (23.854) > T-table (0.462) and the p-Value (0.045) < alpha value (0.05) which means there is an effect of topical vitamin D and olive oil on xerosis and prutitus in hemodialysis patients in several Hospitals in the West Java Area. During research, patients revealed that the itching they felt often disrupted their activities and sleep quality. Itching is felt in the back, feet and hands. Apart from that, itching also causes the skin to blister and bleed. When examined, most of the patients' skin was dry (Kloter et al., 2023). The skin condition of 19.0% (9 people) who experienced itching with a score of 4-6 looked drier, there were wounds on the feet and hands due to scratching.

From the results of this research, several respondents said that daily use of topical Vitamin D and Olive Oil can reduce the itching experienced by hemodialysis patients who suffer from Xerosis and pruritus according to respondents, daily use makes the

skin softer and moister. This research is in line with Nurachmah et al. (2019) about giving olive oil emollients in reducing scale pruritus and xerosis In hemodialysis patients, the p-value was obtained (0.000) and because the p value < 0.05, Ho was rejected and Hi was accepted, so it can be concluded that there is an effect of giving olive oil emollient on the pruritus scale in patients undergoing hemodialysis (Yeam et al., 2021). The results of this study are also in line with research by Morris & Rushwan (2015) in his research on oil-based topical Vitamin D treatment in patients with uremic pruritus with chronic kidney failure showing the results of a significant reduction in the scale of uremic pruritus in patients with chronic kidney failure within 1-4 weeks of topical oil-based treatment (Cooper et al., 2014; Gelagay et al., 2023; Leocata et al., 2021; Rice et al., 2022). In conclusion, oil-based topical treatments are effective in reducing complaints of itching and pruritus in chronic kidney failure patients so that they can be used in nursing services.

The results of this study show differences with previous research (Lu et al., 2024; Svenvik et al., 2024; Xia et al., 2024). Several previous studies have shown the benefits of administering topical vitamin D and olive oil in reducing symptoms xerosis and pruritus in patients with CKD undergoing hemodialysis. However, research regarding the comparative effectiveness of the effect of giving topical vitamin D and olive oil on xerosis and pruritus in hemodialysis patients is still limited (Barcelos et al., 2015). Xero*sis* (dry skin) is a skin disorder that occurs due to loss of lipids and natural moisturizing factors in the stratum corneum. Damage to the stratum corneum causes water retention capacity to decrease by up to 10%. Xerosis can be dealt with by keeping the skin moist. Incident numbers xerosis is 66.7%. Whereas pruritus (itchy skin) occurs due to an increase in urea in the blood and is called uremic pruritus. Several individuals complained uremic pruritus in certain parts of the body, while others throughout the body (Albuquerque et al., 2022). When pruritus Treated too late can disrupt individual activities, cause sleep disturbances if it occurs at night, cause lesions and hyperpigmentation on the skin, and impact the patient's quality of life.

According to Pivatti et al. (2019) almost 60 – 80% of CKD patients who undergo hemodialysis will experience pruritus (itchy skin). How to overcome xerosis nor pruritus In patients undergoing hemodialysis, use the right moisturizer because using a moisturizer that is suitable for dry skin regularly can help maintain skin moisture. The administration of topical Vitamin D and Olive Oil is able to maintain skin moisture in patients who experience xerosis and pruritus while undergoing hemodialysis. Vitamin D is an important nutrient that plays a key role in maintaining healthy skin. Vitamin D has anti-inflammatory and immunomodulatory effects which can affect the condition of the skin. Apart from that, Olive Oil is also known to have moisturizing and anti-inflammatory properties which can help overcome xerosis and pruritus. According to the author's assumption, topical use of olive oil and vitamin D is very beneficial for patients xerosis and pruritus who are undergoing hemodialysis (Khorsand et al., 2019). Because from various studies conducted, no patients experienced allergies when using this oil. Apart from being environmentally friendly and the price is quite affordable, using the oil is effective in treating pruritus without complications from other skin diseases. The choice of oil itself depends on whether each individual's skin is allergic or not.

Conclusion

This study is a quantitative research using a quasi-experiment design with a one-group pretest-posttest approach. The research was conducted from June 13, 2024, to July 13, 2024, with the aim of evaluating the impact of topical vitamin D and olive oil on xerosis (skin dryness) and pruritus (itchiness) in patients undergoing hemodialysis. The design involves measuring the initial condition of xerosis and pruritus in all respondents before the intervention, applying the topical vitamin D and olive oil, and then measuring the same conditions again after the intervention period. The study focused on patients undergoing hemodialysis in the Hemodialysis Room of hospitals in West Java during the specified period, with a total population of 42 respondents. This population was selected because hemodialysis patients often experience skin issues such as xerosis and pruritus due to the dialysis process, which can affect fluid and electrolyte balance and compromise skin integrity. Topical vitamin D and olive oil were chosen as interventions because both are known for their potential skin benefits, with vitamin D having anti-inflammatory effects and the ability to improve skin hydration, while olive oil is recognized for its moisturizing and soothing properties. In the one-group pretest-posttest design, measurements are taken before the intervention (pretest) to assess the initial levels of xerosis and pruritus in patients. Following this, the intervention of applying topical vitamin D and olive oil is carried out according to the established protocol. After the intervention period ends, a posttest measurement is conducted to evaluate changes in the patients' skin conditions. Data obtained from the pretest and posttest measurements will be analyzed to determine if there are significant differences in the levels of xerosis and pruritus, which is expected to provide insights into the effectiveness of the intervention. With this approach, the study aims to

provide a deeper understanding of effective methods for managing and alleviating skin conditions in hemodialysis patients, and to offer scientific evidence for the development of better skin care strategies in clinical practice.

Acknowledgments
We would like to express our deepest gratitude to our advisor who has guided us throughout the research process and to the respondents who have made significant contributions to the success of this study. Your support, guidance, and participation have been invaluable, and we greatly appreciate your effort and dedication. Thank you for your continuous encouragement and for making this research possible.

Author Contributions
T.P.S., R.Y., A.H.P., W.A.D.S., and A.F., contributed to the conceptualization, data collection process, data processing, and article writing.

Funding
This research was funded by personal funds.

Conflicts of Interest
The authors declare no conflict of interest.

References

Albuquerque, P. B. S., de Oliveira, W. F., dos Santos Silva, P. M., dos Santos Correia, M. T., Kennedy, J. F., & Coelho, L. C. B. B. (2022). Skincare application of medicinal plant polysaccharides — A review. *Carbohydrate Polymers*, *277*(October 2021), 118824. https://doi.org/10.1016/j.carbpol.2021.118824

Barcelos, R. C. S., de Mello-Sampayo, C., Antoniazzi, C. T. D., Segat, H. J., Silva, H., Veit, J. C., Piccolo, J., Emanuelli, T., Bürger, M. E., Silva-Lima, B., & Rodrigues, L. M. (2015). Oral supplementation with fish oil reduces dryness and pruritus in the acetone-induced dry skin rat model. *Journal of Dermatological Science*, *79*(3), 298–304. https://doi.org/10.1016/j.jdermsci.2015.06.015

Brunelli, L., Bravo, G., Romanese, F., Righini, M., Lesa, L., De Odorico, A., Bastiani, E., Pascut, S., Miceli, S., & Brusaferro, S. (2022). Sexual and reproductive health-related knowledge, attitudes and support network of Italian adolescents. *Public Health in Practice*, *3*(February), 100253. https://doi.org/10.1016/j.puhip.2022.100253

Castro, C. A., Monterrosa-Blanco, A., Rodríguez, L. L., Castiblanco, A., Bernal, L., Ladino, M. J., Pinilla, D., Melo, C., & Baquero, F. (2024). Knowledge and attitudes regarding contraceptive methods and sex education in students and parents of eight Colombian schools 2020–2021: a mixed methods study. *The Lancet Regional Health - Americas*, *30*, 100678. https://doi.org/10.1016/j.lana.2024.100678

Cooper, C. M., Ahmed, S., Winch, P. J., Pfitzer, A., McKaig, C., & Baqui, A. H. (2014). Findings from the use of a narrative story and leaflet to influence shifts along the behavior change continuum toward postpartum contraceptive uptake in Sylhet District, Bangladesh. *Patient Education and Counseling*, *97*(3), 376–382. https://doi.org/10.1016/j.pec.2014.09.007

Donker, A. E., van der Staaij, H., & Swinkels, D. W. (2021). The critical roles of iron during the journey from fetus to adolescent: Developmental aspects of iron homeostasis. *Blood Reviews*, *50*(July), 100866. https://doi.org/10.1016/j.blre.2021.100866

Duane, M., Martinez, V., Berry, M., & Manhart, M. D. (2022). Evaluation of a fertility awareness-based shared decision-making tool part 1: Study design and impact on clinician knowledge. *PEC Innovation*, *1*(February), 100061. https://doi.org/10.1016/j.pecinn.2022.100061

Fauzi, A., & Triaswati, R. (2021). The effect of intradialytic stretching training on restless legs syndrome and sleep quality in hemodialysis patients. *Korean Journal of Adult Nursing*, *33*(1), 37–43. https://doi.org/10.7475/kjan.2021.33.1.37

Field, M. S., Bailey, R. L., Brannon, P. M., Gregory, J. F., Lichtenstein, A. H., Saldanha, I. J., & Schneeman, B. O. (2022). Scanning the evidence: process and lessons learned from an evidence scan of riboflavin to inform decisions on updating the riboflavin dietary reference intakes. *American Journal of Clinical Nutrition*, *116*(2), 299–302. https://doi.org/10.1093/ajcn/nqac102

Gelagay, A. A., Worku, A. G., Bashah, D. T., Tebeje, N. B., Gebrie, M. H., Yeshita, H. Y., Cherkose, E. A., Ayana, B. A., Lakew, A. M., Asmamaw, D. B., Negash, W. D., Belachew, T. B., Fentie, E. A., & Bitew, D. A. (2023). Factors affecting birth interval among mothers in Dabat district, Amhara Regional state, Northwest Ethiopia: A community-based cross-sectional study, 2022. *Heliyon*, *9*(6), e17046. https://doi.org/10.1016/j.heliyon.2023.e17046

Higurashi, S., Tsujimori, Y., Nojiri, K., Toba, Y., Nomura, K., & Ueno, H. M. (2023). Dietary Patterns Associated with General Health of Breastfeeding Women 1–2 Months Postpartum: Data from the Japanese Human Milk Study Cohort. *Current Developments in Nutrition*, *7*(1), 100004. https://doi.org/10.1016/j.cdnut.2022.100004

Khorsand, A., Salari, R., Noras, M. R., Saki, A., Jamali, J., Sharifipour, F., Mirmoosavi, S. J., & Ghazanfari, S. M. (2019). The effect of massage and topical violet oil on the severity of pruritus and dry skin in hemodialysis patients: A randomized controlled trial. *Complementary Therapies in Medicine*,

45(March), 248–253. https://doi.org/10.1016/j.ctim.2019.06.015

Kloter, E., Albanese, F., Schweighoffer, R., & Wolf, U. (2023). Phytotherapy in paediatric skin disorders – A systematic literature review. *Complementary Therapies in Medicine*, *74*(March), 102942. https://doi.org/10.1016/j.ctim.2023.102942

Kschonsek, J., Stimming, M., Libuda, L., Kersting, M., & Böhm, V. (2016). Food-based modification of LC-PUFA concentration in complementary food did not affect plasma vitamin E concentration in infants. *NFS Journal*, *3*, 25–32. https://doi.org/10.1016/j.nfs.2016.02.005

Leocata, A. M., Kaiser, B. N., & Puffer, E. S. (2021). Flexible protocols and paused audio recorders: The limitations and possibilities for technologies of care in two global mental health interventions. *SSM - Mental Health*, *1*(September), 100036. https://doi.org/10.1016/j.ssmmh.2021.100036

Litvin, K., Grandner, G. W., Phillips, E., Sherburne, L., Craig, H. C., Phan, K. A., Patel, A. N., & Dickin, K. L. (2024). How Do Social and Behavioral Change Interventions Respond to Social Norms to Improve Women's Diets in Low- and Middle-Income Countries? A Scoping Review. *Current Developments in Nutrition*, *8*(6), 103772. https://doi.org/10.1016/j.cdnut.2024.103772

Lu, Y. T., Chen, C. P., Sun, F. J., Chen, Y. Y., Wang, L. K., & Chen, C. Y. (2024). Associations between first-trimester screening biomarkers and maternal characteristics with gestational diabetes mellitus in Chinese women. *Frontiers in Endocrinology*, *15*(August), 1–9. https://doi.org/10.3389/fendo.2024.1383706

Morris, J. L., & Rushwan, H. (2015). Adolescent sexual and reproductive health: The global challenges. *International Journal of Gynecology and Obstetrics*, *131*, S40–S42. https://doi.org/10.1016/j.ijgo.2015.02.006

Muala, W. C. B., Charnelle, T. K., Fabrice, T. D., Bernard, T., Ghislain, M. N., & Eric Serge, N. (2024). Formulation of weaning food from yellow maize (Zea mays L.) and red millet (Eleusine coracana L.), enriched with pretreated African locust beans (Parkia biglobosa Jacq.) flour. *Journal of Agriculture and Food Research*, *16*(February), 101080. https://doi.org/10.1016/j.jafr.2024.101080

Nisman, W. A., Parmawati, I., Setyoharsih, T. W., Gita, R. V. F., & Annisa, R. (2020). How does health reproduction education based on gender equality influence knowledge, attitudes, and self-efficacy in adolescents? *Enfermeria Clinica*, *30*, 11–15. https://doi.org/10.1016/j.enfcli.2020.09.002

Nurachmah, E., Yona, S., Ismail, R., Afiyanti, Y., Khariroh, S., Surdana, I. K., Sabariah, S., Faisal, M. H., & Toding, J. (2019). Adolescent–parent communication about sexual and reproductive health among junior high school students in five areas with the highest prevalence of HIV in Indonesia: A qualitative study. *Enfermeria Clinica*, *29*(Insc 2018), 194–198. https://doi.org/10.1016/j.enfcli.2019.04.053

Olanbiwoninu, A., Greppi, A., Awotundun, T., Adebayo, E. A., Spano, G., Mora, D., & Russo, P. (2023). Microbial-based biofortification to mitigate African micronutrients deficiency: A focus on plant-based fermentation as source of B-group vitamins. *Food Bioscience*, *55*(March), 102996. https://doi.org/10.1016/j.fbio.2023.102996

Pivatti, A. S. A., Osis, M. J. M. D., & de Moraes Lopes, M. H. B. (2019). "The use of educational strategies for promotion of knowledge, attitudes and contraceptive practices among teenagers – A randomized clinical trial." *Nurse Education Today*, *72*, 18–26. https://doi.org/10.1016/j.nedt.2018.10.005

Rice, W. S., Redd, S. K., Luke, A. A., Komro, K., Jacob Arriola, K., & Hall, K. S. (2022). Dispersion of contraceptive access policies across the United States from 2006 to 2021. *Preventive Medicine Reports*, *27*(October 2021), 101827. https://doi.org/10.1016/j.pmedr.2022.101827

Rivandi, J., & Yonata, A. (2015). Hubungan diabetes melitus dengan kejadian gagal ginjal kronik. *Jurnal Majority*, *4*(9), 27–34. Retrieved from http://repository.lppm.unila.ac.id/22414/

Saggu, A. K., Tomer, V., Kumar, A., & Pandey, P. (2023). Consideration of Phytonutrients, Probiotics and Prebiotics for enhanced immunity during disaster relief situation – A review. *Clinical Nutrition Open Science*, *47*, 131–146. https://doi.org/10.1016/j.nutos.2022.12.011

Svenvik, M., Raffetseder, J., Brudin, L., Berg, G., Hellberg, S., Blomberg, M., Jenmalm, M. C., & Ernerudh, J. (2024). Early prediction of spontaneous preterm birth before 34 gestational weeks based on a combination of inflammation-associated plasma proteins. *Frontiers in Immunology*, *15*(July), 1–12. https://doi.org/10.3389/fimmu.2024.1415016

Vernon, V., Patel, J., Cieri-Hutcherson, N. E., Arellano, R., Elmore, H., Griffin, B. L., Mitzel, K., Moyeno, W. M., O'Connell, M. B., Pelaccio, K., & Lodise, N. M. (2023). The impact of COVID-19 on select considerations in patients of reproductive age: Brief talking points for pharmacists. *Journal of the American Pharmacists Association*, *63*(3), 720–724. https://doi.org/10.1016/j.japh.2023.01.003

Wood, F. E., Dickin, K. L., Sherburne, L., Diakite, M., Boubacar, A., Pollak, M., & Lundgren, R. (2024).

Social Norms: A Missing Ingredient of Programs Seeking to Foster Nutrition Agency. *Current Developments in Nutrition*, *8*(9), 104440. https://doi.org/10.1016/j.cdnut.2024.104440

Xia, Y., Wang, Y., Yuan, S., Hu, J., Zhang, L., Xie, J., Zhao, Y., Hao, J., Ren, Y., & Wu, S. (2024). Development and validation of nomograms to predict clinical outcomes of preeclampsia. *Frontiers in Endocrinology*, *15*(March), 1–12. https://doi.org/10.3389/fendo.2024.1292458

Zhang, Z., Wang, Y., Yang, X., Cheng, Y., Zhang, H., Xu, X., Zhou, J., Chen, H., Su, M., Yang, Y., & Su, Y. (2022). Human Milk Lipid Profiles around the World: A Systematic Review and Meta-Analysis. *Advances in Nutrition*, *13*(6), 2519–2536. https://doi.org/10.1093/advances/nmac097