

Communication Difficulties in A Young Child with Foetal Retinoid Syndrome: A Review

Tiara Febriati^{1*}, Aribawa Ajid Bhaskara², Altaria Erthafauziah Opaladu³, Mustika Ismayanti⁴, Tri Agustina⁵, Risti Dwi Ocktaviani⁶
Universitas Bengkulu

Corresponding Author: Tiara Febriati; febriatitiara@gmail.com

ARTICLE INFO

Keywords: Feotal Retinoid Syndrome; Isotretinoin; Communication Development; Hearing Impairment

Received : 4 June 2026

Revised : 19 July 2026

Accepted: 20 August 2026

©2026 Febriati, Bhaskara, Opaladu, Ismayanti, Agustina, Ocktaviani : This is an open-access article distributed under the terms of the [Creative Commons Atribusi 4.0 Internasional](https://creativecommons.org/licenses/by/4.0/).



ABSTRACT

Foetal Retinoid Syndrome (FRS) is an embryopathy caused by prenatal retinoid exposure, resulting in craniofacial abnormalities and neurological deficits. FRS carries a risk of hindering a child's communication development. Scientific literature specifically addressing this aspect remains highly limited. This literature review aims to summarize the latest evidence regarding the impact of prenatal retinoid exposure on communication development and the importance of early detection and intervention. This literature review evaluates literature such as systematic review, meta-analyses, and Randomized Controlled Trials (RCTs) from databases including PubMed, NCBI, and Google Scholar. The teratogenic effect of isotretinoin disrupts retinoic acids signaling and FOXP2 gene expression, which are essential for nervous system formation and auditory function. These deficits trigger communication development disorders in children with FRS, which include speech delay, receptive and expressive language barriers, pragmatic disorder, and difficulties in social interaction. Serial monitoring of hearing function accompanied by early multidisciplinary intervention and management are important to improve the child's communication outcomes

INTRODUCTION

Foetal Retinoid Syndrome (FRS) is a rare congenital syndrome that occurs due to retinoid exposure, particularly isotretinoin, during pregnancy and is recognized as one of the most well-known forms of drug-induced embryopathy (Draghici et al., 2021). Exposure to isotretinoin during the period of organogenesis can result in abnormalities involving the craniofacial structures, central nervous system, heart, thymus, ears, as well as various neurological developmental disorders that may persist throughout childhood (Choi et al., 2021). Although pregnancy prevention programs have reduced the incidence of exposure during pregnancy, isotretinoin remains classified as a high-risk teratogen, requiring continued clinical vigilance (Draghici et al., 2021). In addition to causing major congenital malformations, prenatal retinoid exposure has also been associated with long-term neurocognitive and developmental impairments that may affect the quality of life of affected children (Draghici et al., 2021; Choi et al., 2021).

Communication development is one of the primary indicators of a child's neurological development, involving receptive language abilities, expressive language skills, speech production, hearing function, cognitive abilities, and social interaction. Impairments affecting brain structures or the auditory system during the prenatal period may interfere with early language acquisition (Draghici et al., 2021). Children with Foetal Retinoid Syndrome frequently experience abnormalities of the external and middle ear, which increase the risk of hearing impairment and may subsequently contribute to delays in communication and language development (Draghici et al., 2021). Therefore, monitoring communication development from infancy is an essential component of the long-term management of children with FRS (Draghici et al., 2021).

Although the teratogenic effects of prenatal isotretinoin exposure and the congenital abnormalities associated with Foetal Retinoid Syndrome (FRS) have been widely reported, evidence on communication difficulties in affected children remains limited. Recent studies have mainly focused on pregnancy outcomes, congenital abnormalities, and clinical manifestations of retinoid embryopathy, with limited attention to speech, language, hearing, and social communication (Choi et al., 2021; Draghici et al., 2022). Kritzinger and Steenkamp (2006) reported mild to moderate communication delays and mild hearing impairment in a child with FRS; however, this was a single case published more than a decade ago. Thus, recent evidence specifically addressing communication difficulties in children with FRS remains scarce, highlighting the need for a literature review to synthesize the available evidence and identify factors associated with communication outcomes.

LITERATURE REVIEW

Foetal Retinoid Syndrome (FRS) is a rare congenital disorder resulting from prenatal exposure to isotretinoin, a potent retinoid widely prescribed for severe acne. Although the teratogenic effects of isotretinoin on craniofacial, cardiovascular, and central nervous system development have been extensively documented, increasing attention has been directed toward its long-term consequences on neurodevelopment, particularly communication development.

The reviewed article highlights that communication impairment is an underexplored aspect of FRS despite its significant implications for children's cognitive, linguistic, and social functioning.

Foetal Retinoid Syndrome and Prenatal Isotretinoin Exposure

Isotretinoin is recognized as one of the strongest human teratogens. Maternal exposure during the first trimester, particularly during organogenesis, substantially increases the risk of congenital anomalies involving the craniofacial structures, ears, thymus, cardiovascular system, and central nervous system. Previous systematic reviews have demonstrated that prenatal isotretinoin exposure remains associated with major congenital malformations and neurodevelopmental disorders despite the implementation of pregnancy prevention programs (Choi et al., 2021; Draghici et al., 2021). The reviewed article further explains that abnormalities caused by retinoid embryopathy may persist throughout childhood, affecting hearing, cognition, and communication abilities.

Teratogenic Mechanisms Affecting Communication Development

Communication impairment in children with FRS originates from multiple biological mechanisms. Retinoic acid signaling regulates embryonic neural differentiation, neuronal migration, synaptic plasticity, and maturation of brain regions responsible for language and speech production. Excessive activation of retinoic acid receptors (RARs) and retinoid X receptors (RXRs) following isotretinoin exposure disrupts these developmental processes, resulting in permanent structural and functional neurological abnormalities. Furthermore, retinoic acid signaling closely interacts with the FOXP2 gene, a transcription factor essential for speech and language acquisition. Alteration of this pathway may impair cortico-striato-thalamo-cortical networks responsible for speech motor control, language processing, and communication development.

Hearing Impairment as a Contributing Factor

Communication development depends heavily on intact auditory function. Children with FRS frequently present with microtia, external auditory canal atresia, pinna deformities, and middle ear abnormalities that increase the likelihood of conductive hearing loss. Reduced auditory stimulation during early childhood limits language acquisition, receptive and expressive communication, and social interaction. The reviewed article emphasizes that communication impairment cannot be explained solely by hearing thresholds because deficits in auditory processing, attention to verbal information, and language comprehension may also contribute to delayed communication development.

Communication Difficulties in Children with Foetal Retinoid Syndrome

Existing evidence indicates that communication difficulties in FRS extend beyond delayed speech. Children may experience impairments in receptive language, expressive language, articulation, phonological development, pragmatic communication, play skills, attachment, and conversational abilities. These impairments reflect complex interactions between neurological

abnormalities, sensory deficits, cognitive limitations, and environmental influences. However, the current body of evidence remains limited because most available studies consist of case reports or small observational studies, making it difficult to establish definitive clinical patterns or prevalence estimates.

Early Intervention and Multidisciplinary Management

Early identification and multidisciplinary intervention are consistently recognized as the most effective strategies for improving communication outcomes in children with FRS. Serial hearing evaluations facilitate early detection of auditory impairment, while speech-language therapy enhances expressive and receptive communication skills. Occupational therapy supports functional development that contributes to communication, whereas active family participation provides continuous language stimulation within the child's daily environment. Evidence also suggests that intervention initiated during infancy, accompanied by supportive educational settings and consistent parental involvement, produces better developmental outcomes than delayed intervention.

METHODS

This study employed a narrative literature review approach to identify, collect, and analyze scientific evidence regarding communication developmental difficulties in children with Foetal Retinoid Syndrome (FRS). A literature search was conducted using several electronic databases, including PubMed, NCBI, and Google Scholar. The search strategy employed a combination of keywords related to the research topic, including "Foetal Retinoid Syndrome," "Fetal Retinoid Syndrome," "communication development," "communication difficulties," "speech and language development," and "hearing impairment," combined using the Boolean operators AND and OR. The inclusion and exclusion criteria were as follows:

Inclusion criteria:

1. Studies discussing Foetal Retinoid Syndrome, retinoid embryopathy, or prenatal retinoid exposure
2. Studies addressing aspects of child development related to communication, including speech, language, hearing, or social communication development;
3. Research articles, case reports, case series, systematic reviews, or meta-analyses relevant to the research topic;
4. Studies published between 2016 and 2026;
5. Articles available in English or Indonesian and accessible in full text.
6. Exclusion criteria:
7. Studies that did not discuss Foetal Retinoid Syndrome or prenatal retinoid exposure;
8. Studies that did not provide information related to communication development or factors associated with communication;
9. Duplicate articles.

Articles that met the inclusion criteria were analyzed narratively by identifying study characteristics, participant characteristics, clinical

manifestations of FRS, hearing impairment, speech and language development, and neurological, cognitive, and environmental factors that may influence communication skills. Findings from the included studies were compared and synthesized to provide an overview of the patterns of communication difficulties in children with FRS and their implications for early detection and intervention. As this study used secondary data from previously published studies and did not involve human participants or primary data collection, ethical approval was not required. Assessment of instrument validity and reliability was not applicable to this study.

RESULTS AND DISCUSSION

Isotretinoin

Isotretinoin (ISO), also known as 13-cis-retinoic acid, is a synthetic compound derived from vitamin A that belongs to the first generation of retinoids. Isotretinoin was first approved by the U.S. Food and Drug Administration (FDA) in 1982 for the treatment of severe acne. A year later, in 1983, its use was also approved in Europe (Panda et al., 2021; Feszak et al., 2025).

Isotretinoin is primarily used to treat severe acne vulgaris, and its therapeutic efficacy is maintained even after patients have been in remission for a long period of time. (Lai & Barbieri, 2025; Feszak et al., 2025). Isotretinoin can also be used to treat a number of other skin conditions, such as rosacea, seborrheic dermatitis, hidradenitis suppurativa, lichen planus, dyshidrotic cellulite, ichthyosis, pityriasis rubra pilaris, psoriasis, and folliculitis decalvans. Additionally, it has been used in the management of precancerous and skin cancer conditions, such as keratoacanthoma and squamous cell carcinoma (Feszak et al., 2025). The elimination of isotretinoin may take approximately two weeks after the final dose; however, in some individuals, the elimination half-life may reach 167.4 hours, requiring up to 35 days for drug levels to decrease to a safe concentration (Pop et al., 2021).

The commonly prescribed dosage of isotretinoin is 0.5–1.0 mg/kg/day, administered once or twice daily depending on the patient's body weight and disease severity. Treatment generally lasts for four to six months, with a cumulative dose of 120–150 mg/kg (Panda et al., 2021; Pop et al., 2021). Isotretinoin is widely used among individuals experiencing puberty, adolescents, and women of reproductive age; however, its teratogenic potential limits its use, and isotretinoin administration during pregnancy is contraindicated (Mondal et al., 2017; Alay et al., 2023).

Foetal Retinoid Syndrome (FRS)

Foetal Retinoid Syndrome (FRS) is a congenital disorder caused by isotretinoin exposure during embryogenesis. Maternal use of isotretinoin during pregnancy is the primary risk factor for FRS, which has been recognized since early life as increasing the risk of central nervous system disorders, sensory

impairments, and developmental delays, including communication development difficulties (Kritzinger & Steenkamp, 2006).

Exposure to any teratogenic substance from the day of conception until day 17 is associated with either normal fetal development or fetal death, whereas serious and permanent malformations may occur during the embryonic phase. One increasingly supported theory regarding isotretinoin toxicity involves hypervitaminosis A. Retinoids are involved in HOX gene signaling pathways, which play an important role in the development of the pharyngeal arches during the fourth week of pregnancy. Therefore, structures derived from the pharyngeal arches are particularly vulnerable to isotretinoin-induced abnormalities during pregnancy (Pop et al., 2021).

Anotia, microtia, and narrowing of the external auditory canal are recognized consequences of systemic retinoid exposure, and cases of limb reduction defects have also been reported (Panda et al., 2021). Up to 60% of children who appear normal at birth may later develop neurological deficits, intellectual disability (<30%), and behavioral dysfunction. Among fetuses exposed to retinoids, the risk of fetal malformations is estimated at 20–35%, accompanied by a spontaneous miscarriage rate of approximately 20–35% (Pop et al., 2021).

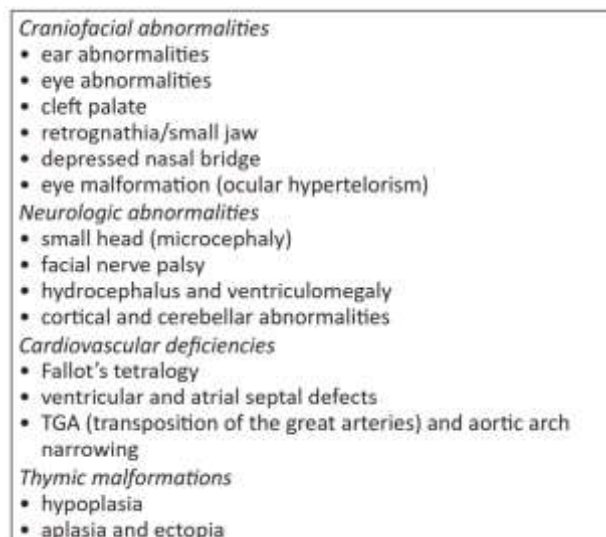


Figure 1. The Effects of Isotretinoin Use on The Fetus (Pop et al., 2021)

Teratogenic Mechanism of Isotretinoin in Foetal Retinoid Syndrome

Isotretinoin is highly effective and widely used to treat various dermatological conditions; however, its use can also cause serious side effects. This medication is known to be a potent teratogen, so exposure to isotretinoin during pregnancy can increase the risk of severe, permanent, and irreversible birth defects. The teratogenic effects of isotretinoin are primarily associated with the hyperactivation of retinoic acid receptors (RAR) and retinoid X receptors (RXR) in the embryo. This activation can disrupt various critical processes during embryogenesis and lead to differentiation abnormalities in neural, mesenchymal, and epithelial tissues (Feszak et al., 2025). According to current estimates, approximately 20–35% of fetuses exposed to isotretinoin are at risk of major

congenital anomalies, while another 30–60% may experience developmental abnormalities. (Feszak et al., 2025; Choi et al., 2021).

Isotretinoin can exert teratogenic effects even though its placental transfer is not always as efficient as that of all-trans retinoic acid. Isotretinoin can undergo isomerization into all-trans retinoic acid, the active form capable of activating RAR pathways and disrupting embryonic development. Therefore, the teratogenicity of isotretinoin is determined not only by the amount of drug crossing the placenta but also by metabolic processes, chemical transformation, receptor activity, and timing of exposure. The first trimester represents the period of highest risk because organogenesis occurs during this phase, and retinoid exposure during this critical period may result in miscarriage and congenital abnormalities, particularly affecting craniofacial structures, the central nervous system, the cardiovascular system, and other developing organs. These abnormalities are known as retinoic acid embryopathy or Foetal Retinoid Syndrome (Comptour et al., 2016).

Among pregnant women who use isotretinoin before and during pregnancy, the risk of congenital abnormalities has been reported to reach 20–35%, with a risk of neurocognitive impairment of approximately 30% and a miscarriage risk of up to 20% when the drug is used during the critical period, particularly between the second and fifth weeks after conception (Alay et al., 2023). Interestingly, a 2024 study from South Korea demonstrated that oral retinoid exposure during pregnancy did not significantly increase the risk of congenital malformations statistically. This finding may be explained by the implementation of pregnancy prevention programs for retinoid users (Pregnancy Prevention Program/Risk Management Program), improved prenatal diagnosis allowing termination of some pregnancies with severe abnormalities before birth, and increased awareness among physicians and patients regarding retinoid-related risks, resulting in FRS becoming a rare condition (You et al., 2024).

Although recent studies have not demonstrated a statistically significant increase in risk, the potential effects of FRS on neurological development should still be considered. Retinoic acid plays an essential role in neural plate formation, neuronal differentiation, neural tube development, and central nervous system maturation. Therefore, retinoid exposure during embryogenesis may biologically contribute to neurodevelopmental disorders, including autism spectrum disorder and intellectual disability. Several case reports continue to demonstrate the presence of autism spectrum disorder (ASD) and intellectual disability among children exposed to retinoids during pregnancy (You et al., 2024).

Isotretinoin acts through the retinoic acid signaling pathway, which plays a critical role in regulating embryonic development, including cellular differentiation, central nervous system formation, and brain tissue maturation. Retinoic acid signaling contributes significantly to the development of the cortico-striato-thalamo-cortical network, a neural pathway responsible for coordinating planning, learning, and execution of fine motor movements, including movements involved in speech production. The formation and function of this network are influenced by the FOXP2 gene, a transcription factor that regulates the expression of various genes involved in neurogenesis, neuronal

differentiation, neurite growth, synapse formation, and synaptic plasticity. FOXP2 also regulates the expression of Retinoic Acid Receptor β (RAR β), suggesting a close relationship between FOXP2 and retinoid signaling pathways in speech development (Van Rhijn & Vernes, 2015; Panda et al., 2021).

The Relationship Between Foetal Retinoid Syndrome and Child Communication Development

Disruption of the retinoic acid signaling pathway during fetal development may interfere with the formation and function of neural structures required for communication development (Van Rhijn & Vernes, 2015). In addition to causing structural abnormalities affecting the face, ears, heart, and central nervous system, FRS is also known to influence communication development in children. Communication difficulties in FRS are not caused by a single factor but result from interactions among various biological abnormalities affecting neurological, sensory, cognitive, and social development from the prenatal period (Kritzinger & Steenkamp, 2006).

Communication development is a complex process that depends on the integrity of the central nervous system, adequate hearing function, cognitive abilities, oral motor skills, and social interaction with the environment. In children with FRS, several of these components may be impaired simultaneously. Disruption of retinoic acid signaling during critical embryonic developmental periods may affect neural systems involved in speech motor control and language function through alterations in neuronal differentiation, formation of the cortico-striato-thalamo-cortical network, and mechanisms of synaptic plasticity. Therefore, theoretically, FRS may be associated with an increased risk of communication difficulties, including speech delay, receptive and expressive language impairments, and speech motor disorders, based on the central role of retinoic acid signaling and its interaction with the FOXP2 gene (Van Rhijn & Vernes, 2015; Kritzinger & Steenkamp, 2006).

In addition to neurological abnormalities, craniofacial and ear abnormalities are frequently observed characteristics of FRS, including microtia, pinna deformities, external auditory canal atresia, and other anatomical abnormalities that may contribute to hearing impairment. Suboptimal hearing function can reduce a child's ability to receive auditory stimuli from the environment, despite auditory stimulation being a fundamental component of communication development because it enables children to recognize sounds, understand messages, imitate sounds, and develop effective social interactions (Kritzinger & Steenkamp, 2006).

Communication developmental difficulties in children with FRS may involve various domains, including attachment, play skills, pragmatic abilities, receptive language, expressive language, communication functions, articulation, and phonology. Impairments in these domains may affect a child's ability to understand received messages, express needs and desires, initiate and maintain conversations, use language appropriately in social contexts, and establish relationships with others. Therefore, communication difficulties in children with FRS are not limited to speech production but also involve the broader process of interpersonal communication (Kritzinger & Steenkamp, 2006).

Communication difficulties in FRS are not only associated with language function but may also be accompanied by impaired listening skills. Although hearing examination results may remain within normal limits at certain times, children's ability to maintain attention to auditory stimuli, understand verbal information, and process received messages may still be impaired. This indicates that communication development is influenced not only by hearing thresholds but also by the ability to functionally process auditory information (Kritzinger & Steenkamp, 2006).

Although children with FRS are at increased risk of communication developmental difficulties, communication outcomes are influenced by various factors beyond biological abnormalities. Early diagnosis enables regular monitoring of communication development, allowing communication difficulties to be identified and managed promptly. Serial hearing evaluations are also necessary to detect potential hearing impairments that may emerge during growth and prevent their impact on communication development (Kritzinger & Steenkamp, 2006).

The development of communication abilities requires the integrity of brain structures and neural networks that support speech motor coordination and language processing. The retinoic acid pathway contributes to striatal neuronal differentiation, neural connectivity, and synaptic plasticity, which serve as the foundation for learning, memory, and acquisition of motor skills, including speech abilities. Disruption of this pathway may interfere with the formation of neural circuits responsible for orofacial motor coordination and language information processing, potentially affecting communication development in children (Van Rhijn & Vernes, 2015).

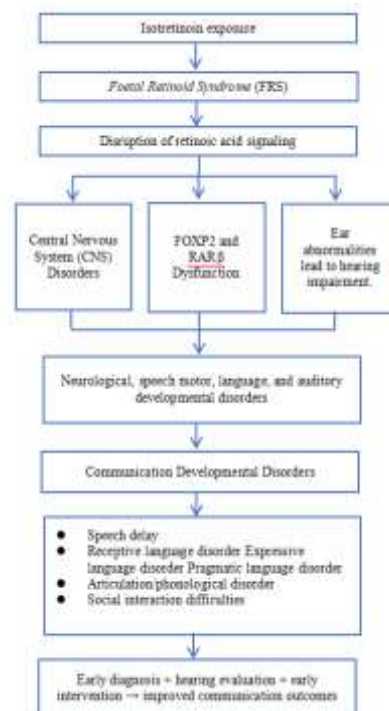


Figure 2. The Mechanism of The Effects of Isotretinoin Exposure on Communication Development in Foetal Retinoid Syndrome

This study is consistent with the findings of Kritzinger & Steenkamp (2006) and Van & Vernes (2015), which linked isotretinoin exposure during embryogenesis to difficulties in language and communication development in children. However, one of the studies cited by You et al. (2024) in South Korea showed that oral retinoid exposure during pregnancy did not significantly increase the risk of congenital malformations.

Previous studies have separately discussed the mechanisms by which isotretinoin affects communication development in children and the management interventions for Foetal Retinoid Syndrome (FRS). This study specifically integrates several aspects, including the underlying mechanisms, interventions, and other physical abnormalities that may accompany FRS, into a single study, an area that has thus far been limited in comprehensive discussion.

Intervention and Management of Foetal Retinoid Syndrome

Early intervention is an essential component in the management of children with FRS. Speech and language therapy aims to improve communication abilities according to the child's developmental stage, while occupational therapy supports the development of functional skills that contribute to communication processes. Family involvement, particularly consistent parent-child interaction, plays an important role in providing continuous language stimulation. A supportive family environment and an appropriate educational setting also contribute to optimizing children's communication development (Kritzinger & Steenkamp, 2006). Research indicates that several protective factors, including early diagnosis, initiation of therapeutic intervention from 6 months of age, supportive family involvement, and a stable educational environment, contribute to improving communication developmental outcomes in children with FRS (Kritzinger & Steenkamp, 2006).

Foetal Retinoid Syndrome is a condition that may increase the risk of communication difficulties through involvement of the central nervous system, anatomical abnormalities of the ear, hearing impairment, and overall developmental delays. Therefore, children with FRS require a multidisciplinary approach that includes communication development assessment, regular hearing evaluations, early therapeutic intervention, and support from family and the surrounding environment to optimize language development and reduce the impact of communication difficulties during childhood (Kritzinger & Steenkamp, 2006).

CONCLUSIONS AND RECOMMENDATIONS

Based on the literature review conducted, early detection and regular monitoring of communication development, serial hearing evaluations, and multidisciplinary management involving speech and language therapy, occupational therapy, and active family participation represent important strategies for optimizing developmental outcomes in children with FRS. Scientific evidence regarding the communication development profile of this population remains very limited and is largely derived from case reports with small sample sizes.

FURTHER STUDY

Further research with stronger methodological designs, larger sample populations, and long-term follow-up periods is needed to strengthen evidence regarding the causal relationship between prenatal retinoid exposure and communication developmental disorders. Such research may also serve as a foundation for developing more standardized screening guidelines and early intervention strategies for children with Foetal Retinoid Syndrome.

REFERENCES

- Alay, M. T., Kalayci, A., & Seven, M. (2023). A new perspective on isotretinoin in pregnancy: Pregnancy outcomes, evaluation of complex phenotypes, and importance of teratological counselling. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*, 291, 148–155.
- Choi, E.J., Kim, N., Kwak, H.S., Han, H.J., Chun, K.C., Kim, Y.A., Koh, J.W., Han, J.Y., Joo, S.H., Lee, J.S. and Koren, G. (2021). The rates of major malformations after gestational exposure to isotretinoin: A systematic review and meta-analysis. *Obstetrics & Gynecology Science*, 64(4), pp.364–373.
- Comptour, A., Rouzaire, M., Belville, C., Bouvier, D., Gallot, D., Blanchon, L., & Sapin, V. (2016). Nuclear retinoid receptors and pregnancy: placental transfer, functions, and pharmacological aspects. *Cellular and Molecular Life Sciences*, 73(20), 3823–3837.
- Draghici, C.C., Miulescu, R.G., Petca, R.C., Petca, A., Dumitraşcu, M.C. and Şandru, F. (2021). Teratogenic effect of isotretinoin in both fertile females and males (Review). *Experimental and Therapeutic Medicine*, 21(5), p.534.
- Feszak, I. J., Brzeziński, P., Feszak, S., Kitowska, A., Waśkow, M., Kawczak, P., & Bączek, T. (2025). Isotretinoin treatment for acne vulgaris: A five-year retrospective analysis of clinical and biochemical adverse effects. *Journal of Clinical Medicine*, 14(18), 6473.
- Kritzinger, A. & Steenkamp, L. (2006). Communication development of a young child with Foetal Retinoid Syndrome: A seven year follow-up study. *South African Journal of Communication Disorders*, 53(1), 39–48.
- Lai, J. & Barbieri, J. S. (2025). Acne relapse and isotretinoin retreatment in patients with acne. *JAMA Dermatology*, 161(4), 367–374.
- Mondal, D., Shenoy, R. S., & Mishra, S. (2017). Retinoic acid embryopathy. *International Journal of Applied & Basic Medical Research*, 7(4), 264–265.

- Panda, P., Mohammad, S., & Dikshit, P. (2021). 13-cis-retinoic acid: Its therapeutic implications and adverse effects. *Journal of Skin Care Research and Reports*. <https://dx.doi.org/10.51521/JSCRR.2021.1101>
- Pop, L., et al. (2021). Retinoids and teratogenicity. *Romanian Journal of Pediatrics*, LXX(4), 219–220.
- Van Rhijn, J. R., & Vernes, S. C. (2015). Retinoic acid signaling: A new piece in the spoken language puzzle. *Frontiers in Psychology*, 6, 1816.
- You, W., Choi, A., Lee, H., Han, J. Y., Lee, J. H., & Shin, J. Y. (2024). Adverse pregnancy and child outcomes in oral retinoid-exposed pregnancies: A nationwide population-based study. *Journal of Korean Medical Science*, 39(26), e201.