



Article Type: Review Article

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## BIOLOGICAL ACTIVITIES ON THIAZOLIDINE DERIVATIVES

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### ABSTRACT

The aim of this review article is to provide a systematic approach on synthesis and various biological activities associated with thiazolidine derivatives. The thiazolidine derivatives. thiazolidine derivatives may be useful in cancer therapy. Article is based on the different pharmacological aspects of thiazolidine ring. From the last decade a lot of work is going on the thiazolidine ring. Scientist had developed a lot of new compound related to this moiety. The biological activity of some preparation compound were studied against two types of bacteria one of them were gram negative (E. coil) and other were gram positive (S. aureus ).synthesis and biologically active compounds of thiazolidine (TZD) derivatives containing pyrazole ring system, several new pyrazole–TZD derivatives.

**Keywords:** *Thiazolidine , Thiazolidine derivatives, Anti-cancer, Anti-inflammatory, Antimicrobial , Antidiabetic, Antitubercu-lar.*

### INTRODUCTION:

Heterocyclic compounds are considered an important branch of organic compounds due to their application in drugs, agricultural fertilizers and industrial studies <sup>[1]</sup>.Diverse biological activities such as bactericidal, pesticidal, fungicidal, insecticidal, anticonvulsant, tu- berculostatic, anti inflammatory, anti thyroidal, poten- tiation of pentobarbital-induced sleeping time <sup>[2]</sup>. It is a reversible reaction. Therefore many thiazolidines are labile towards hydrolysis in aqueous solution <sup>[3]</sup>. Thiazolidin ones are thiazolidine derivatives which belongs to the important group of heterocyclic compound <sup>[4]</sup>. Thiazolidine, is one of these five-membered ring heterocycles<sup>[5]</sup>. The tetrahydro derivative of thiazole and its oxo counterpart, thiazolidine one, is thiazolidine <sup>[6]</sup>.Thiazolidinedione compounds are biologically active. It is essential because it contains a sulfur atom and a nitrogen atom <sup>[7]</sup>. They have found uses as anti tubercu-lar,

antimicrobial, anti-inflammatory and as antiviral agents, especially as anti-HIV agents. [8]. Thiazolidine - 2,4-dione inhibits corrosion of mild steels in acidic solution [9].

## **MECHANISMS OF ACTION:**

TZDs act by binding to PPAR $\gamma$  and can improve different insulin-resistant states in both human and animal studies<sup>[10]</sup>. Independent effect like Metabolism of carbohydrate, lipid and protein, regulation of cell differentiation, development as well as tumor genesis<sup>[11]</sup>. TZDs are insulin sensitizers that act on intracellular metabolic pathways to enhance insulin action and increase insulin sensitivity in critical tissues<sup>[12]</sup>. TZDs produce their biological response by stimulating the PPAR $\gamma$  receptor (antidiabetic activity) and cytoplasmic Mur ligase enzyme (antimicrobial activity), and by scavenging ROS (antioxidant activity) <sup>[13]</sup>.

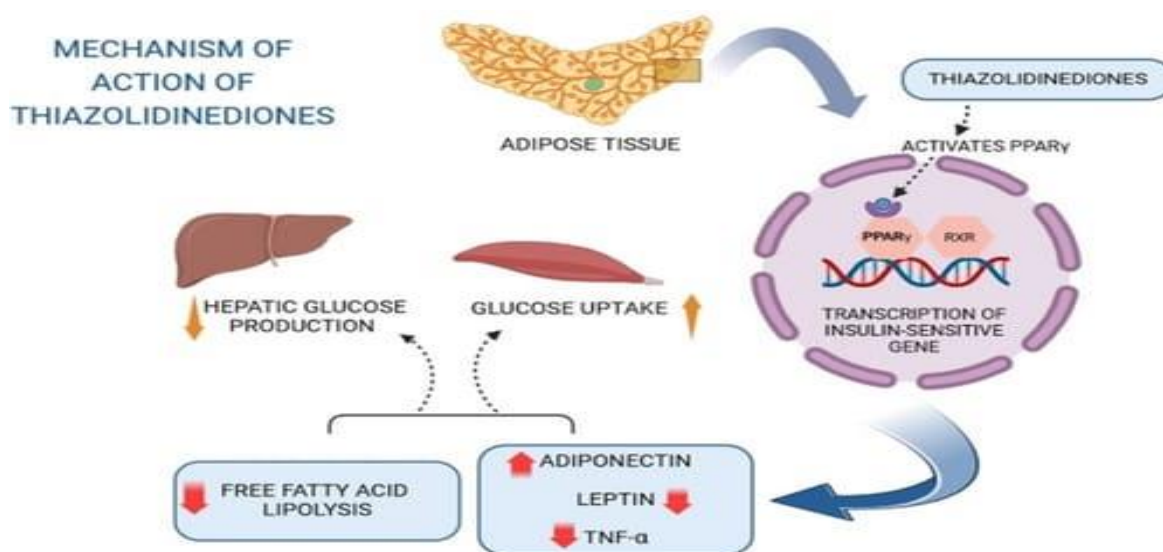
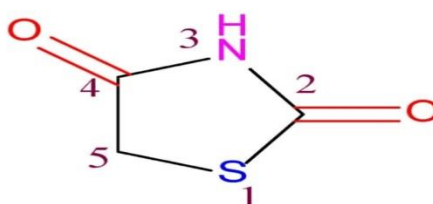


Figure: 1 Mechanisms of action

## **Thiazolidine Types:**

1. Thiazolidine 2,4 Dione
2. Thiazolidine 4 carboxylic acid
3. Thiazolidine 4 one
4. Oxothiazolidine

## **Thiazolidine 2,4 Dione:**



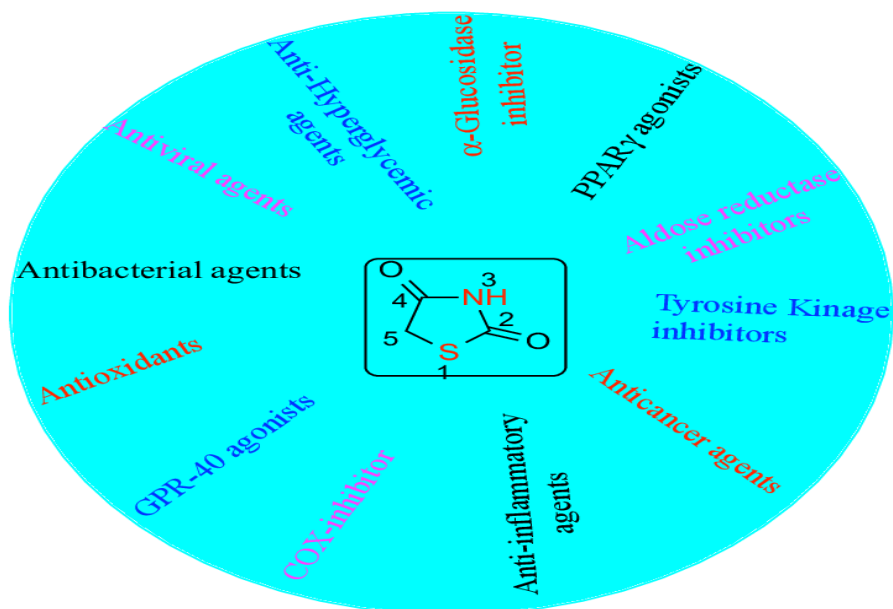
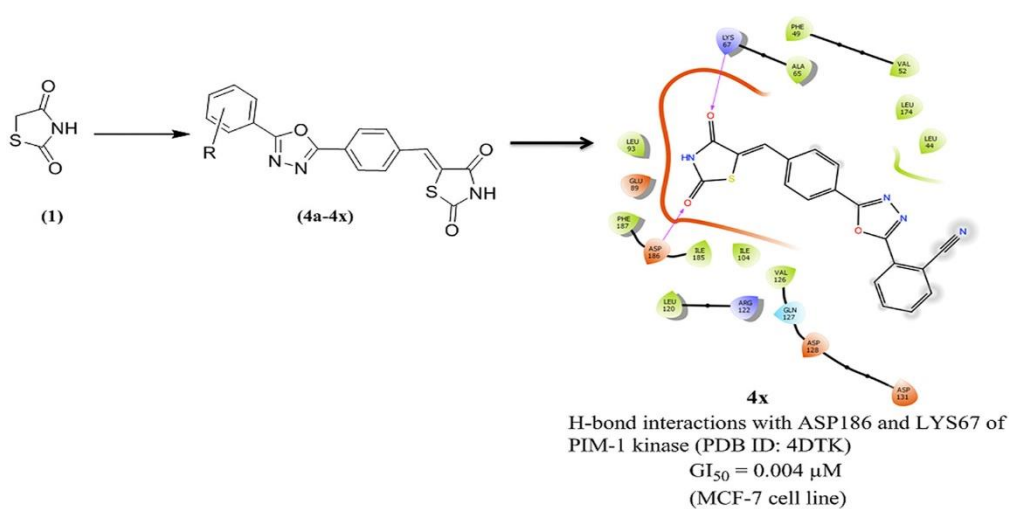


Figure No 2 : Activities Of thiazolidine 2-4 Dione

### Antimicrobial activity:

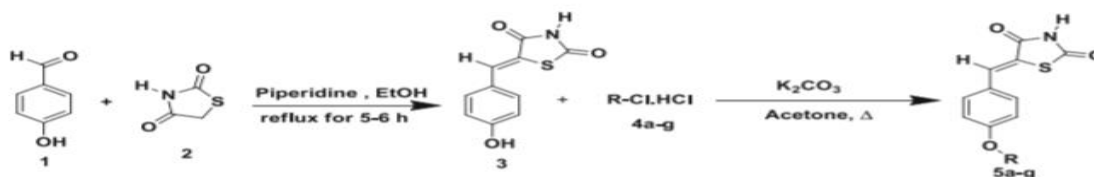
The newly synthesized compounds were evaluated for their in vitro antibacterial activity against two Gram-positive bacteria namely, *Staphylococcus aureus* [14]. Gram -negative bacteria such as *Escherichia coli*, *Vibrio cholera*, *Klebsiella pneumoniae*, *Salmonella typhi*, and *Candida albicans* fungus. Ampicillin and kanamycin were used as positive controls for bacteria and ketoconazole for fungi [15].



Synthesis of Compound for antibacterial activity

### Anti-cancer activity:

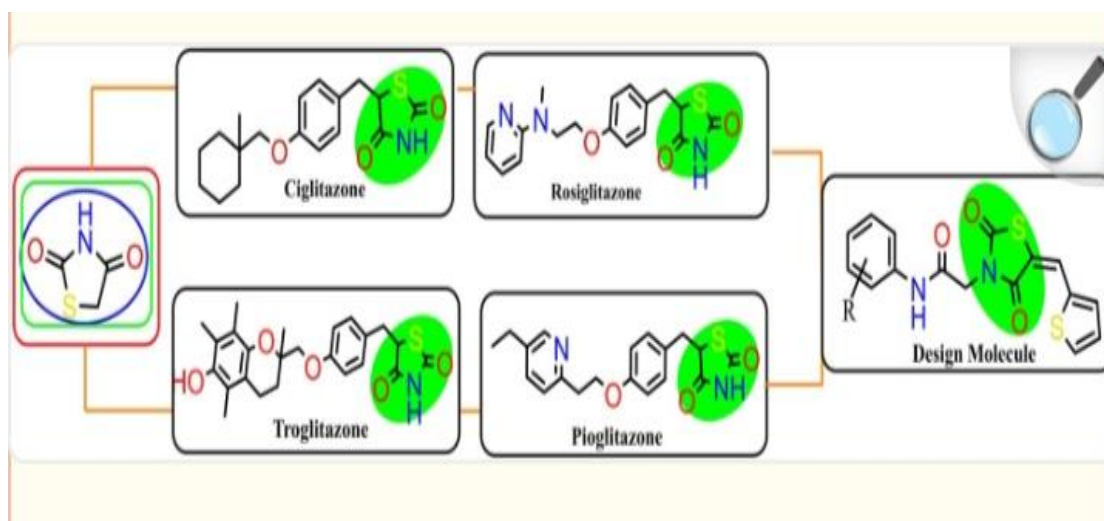
thiazolidine-2,4-dione analogs as potential anti-cancer agents. The mechanism that is responsible mainly related to a PPAR  $\gamma$ -independent manner. The PPAR  $\gamma$ -independent changes including ionic changes (intracellular pH and  $\text{Ca}^{2+}$ ), reactive oxygen species (ROS) production, Mitogen Activated Protein Kinases (MAPK) activation, endoplasmic reticulum stress and proteasomal degradation. [16]. The anticancer activity of compound against four cancer cell lines (A549, K562, MCF-7 and MOLT-4) and one non-malignant cell line (NIH/3T3) in comparison with cisplatin taken as standard [17].



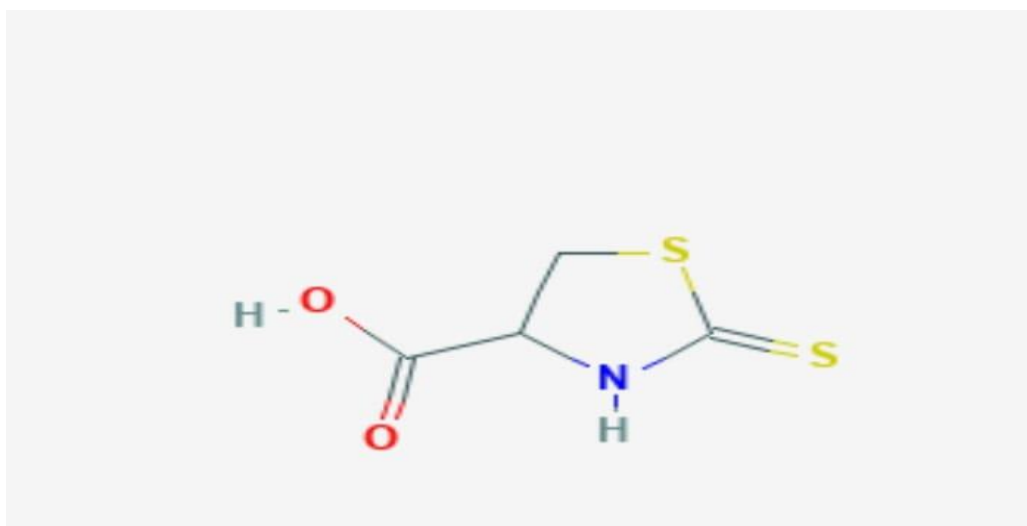
Synthesis of Compound for anti-cancer activity

### Antidiabetic activity:

Recently, thiazolidine-2,4-dione scaffold has been introduced in the design of  $\alpha$ -glucosidase inhibitors, like thiazolidinedione-isatin hybrid compound [18]. Meglitinides, biguanides, sulphonylurea and  $\alpha$ -glucosidase inhibit are among them. Thiazolidinediones (TZDs) or glitazone are antihyper glycemic agents that de-crease insulin resistance and improve insulin action, thereby improving glycemic control to normal values<sup>[19]</sup>. inhibit the expression of a variety of proteins with proinflammatory properties, including cyclooxygenase-2 (COX-2), inducible nitric-oxide synthase [20]. The FDA-approved drugs acarbose, voglibose, and miglitol are associated with severe side effects for a longer period of treatment<sup>[21]</sup>.

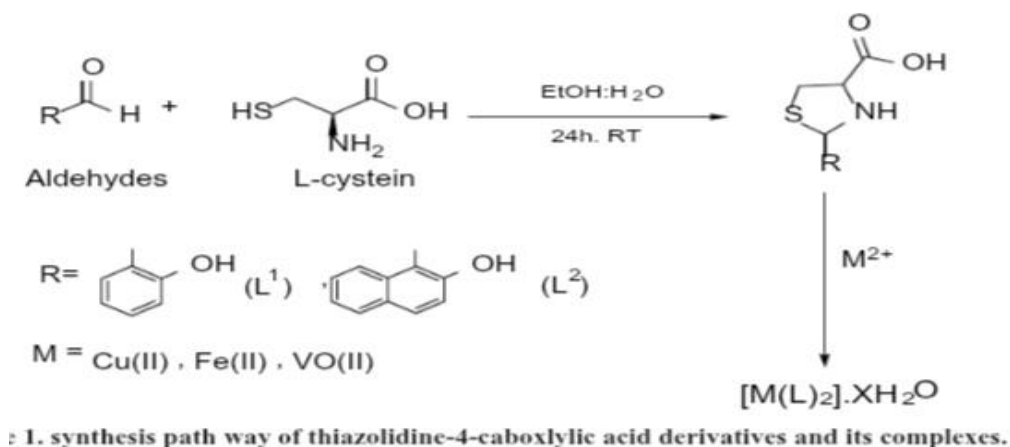


### Thiazolidine 4 carboxylic acid



**Anti-bacterial activity:**

thiazolidine-4-carboxylic acid derivatives were synthesized and evaluated for their ability to inhibit neuraminidase (NA) of influenza A virus [22]. The antibacterial test was performed according to the disc diffusion method. antibacterial activity in vitro against two strains of bacteria *K. Pneumonia*, Ampicillin, cephalixin, were used as references antibiotic drugs [23].



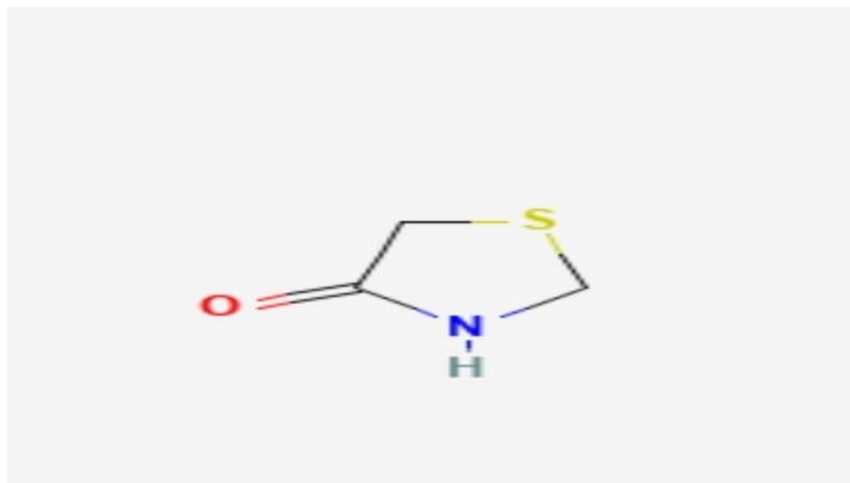
synthesis of Thiazolidine 4 carboxylic acid

**Anti diabetic activity:**

the pharmaceutical drugs pioglitazone and benzylpenicillin serve along with other heterocyclic compounds including thiazolidines in treating diabetes and epilepsy and diuresis along with infection through drugs such as etozoline and rosiglitazone and teneligliptin and ralitoline<sup>[24]</sup>. Biological evaluation demonstrated that these compounds exhibit promising  $\alpha$ -amylase inhibitory activity standard drug Acarbose<sup>[25]</sup>.

**Anticancer activity:**

To analyze the impact of the phenyl moiety present at the second position of the heterocycle on the bioactivity of ALC67, we generated in this study 3-propionyl-thiazolidine-4-carboxylic acid ethyl esters presenting a series of aromatic and aliphatic moieties at this very position. We then tested the synthesized compounds for their biological activity to check if the cytotoxicity<sup>[26]</sup>. The diastereomeric mixtures of compounds were used to evaluate their in vitro inhibitory activity and toxicity against two human melanoma cell lines, one mouse melanoma cell line, four human prostate cancer cell lines. The standard sulforhodamine B (SRB) assay was used<sup>[27]</sup>.

**Thiazolidine 4-one****Antimicrobial activity:**

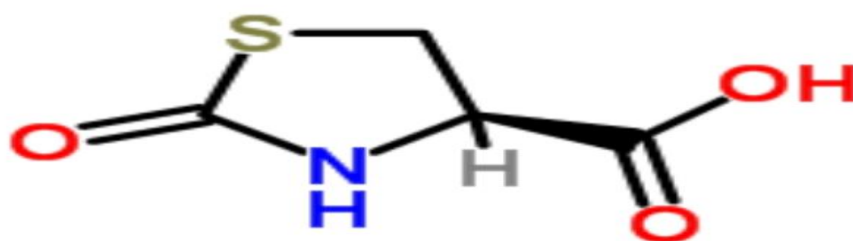
synthesis of Thiazolidine-4-one derivatives. The compound test against *S. aureus*, *B. subtilis*, *E. coli* and *P. aeruginosa* microbes. Ciprofloxacin taken as a standard <sup>[28]</sup>. synthesis of Thiazolidine-4-one derivatives. The compound test agents to *S. aureus*, *E. coli*, *B. subtilis* and *P. aeruginosa* microbes. Ampicillin taken as a standard <sup>[29]</sup>. Thiazolidine-4-one derivatives. The compound test against *S. aureus*, *B. subtilis*, *E. coli*, *S. typhi*, *P. vulgaris* microbes. Ciprofloxacin and Ampicillin taken as a standard <sup>[30]</sup>.

**Anticancer activity:**

synthesis of Thiazolidine-4-one derivatives, which were evaluated for their anticancer activity against the MCF-7 breast cancer cell line. Doxorubicin was used as the standard drug <sup>[31]</sup>. synthesis of Thiazolidine-4-one derivatives, which were evaluated for their anticancer activity against the SKGT-4 esophageal cancer cell line. Doxorubicin was used as the standard drug <sup>[32]</sup>. synthesis of Thiazolidine-4-one derivatives, which were evaluated for their anticancer activity against the MCF-7 breast cell line. Doxorubicin was used as the standard drug <sup>[33]</sup>.

**Anti tubercular activity:**

synthesis of Thiazolidine-4-one derivatives, and evaluated their anti-tubercular activity against *Mycobacterium tuberculosis* using the In vitro Assay. The compounds showed moderate to significant inhibition, with Isoniazid taken as the standard drug <sup>[34]</sup>. Thiazolidine-4-one derivatives, and evaluated their anti-tubercular activity against *Mycobacterium tuberculosis* using the MIC value of reference drug Pyrazinamide and Streptomycin <sup>[35]</sup>. Thiazolidine-4-one derivatives, and evaluated anti-tubercular activity against *Mycobacterium tuberculosis*. Isoniazid taken as a standard drug <sup>[36]</sup>.

**Oxathiazolidine****Antimicrobial activity:**

The compounds 4a-n and 5a-n were screened for their antibacterial activity against *Bacillus subtilis*, *Salmonella typhimurium* and *Escherichia coli* [37]. antibacterial activity in vitro against two strains of bacteria (*S. paucimobilis*, *S. lentus*). it was prepared agar and petridishes were sterilized by autoclaving for 15 min [38].

**Antioxidant activity:**

Antioxidant activity. DPPH is a stable nonphysiological radical which could provide a relative figure of the radical scavenging activity of the tested compounds [39]. According to the disc diffusion method the antibacterial test was performed. The antimicrobial activity in vitro against two strains of Gram negative and positive bacteria *Escherichia coli*, and *Staphylococcus aureus* [40].

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**CONCLUSION**

High cytotoxicity, predominantly on colon carcinoma and glioblast tumour cell lines, whereas no activity on leukemia breast carcinoma, or normal lymphoblast cells was observed antidiabetic, antimicrobial, anti-inflammatory, anticancer, antioxidant and antitubercular, antiviral, anti-malarial, anti-HIV and anti-convulsant activities etc. which created immense interest among researchers to synthesized variety of thiazolidinediones The compounds show moderate antibacterial activities against *Staphylococcus aureus*, *Bacillus*, *Escherichia coli* and *Pseudomonas aeruginosa* The compound binds to DNA through partial intercalation at the minor groove that, interestingly, causes kinks in the DNA helix, This article is an endeavor to find potential future directions in the design of novel potent analogs of thiazolidine based compounds for different biological targets The main significance and rationale of the work, focuses on exploring the biological activity studies of thiazolidine derivatives which will help the reviewers to perform the research within the field.

**Acknowledgement- None**

**Conflict of Interest- None**

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