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IL-17: New Insights into Advances from Diagnostics to Therapeutics of Inflammatory Diseases

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Abstract

Interleukin 17 (IL-17) is a pro-inflammatory cytokine having 6 related cytokines ranging from IL-17A to IL-17F. Over the past few years, the roles of IL-17 go beyond not merely activating inflammation but also the progression of autoimmune or inflammatory diseases like Psoriasis, Inflammatory bowel disease, and Crohn's disease. Evidence is mounting that IL-17 has significant roles in causing and developing various inflammatory diseases. Studies have shown that IL-17 is produced by a subset of T cells known as Th17 which involves the initiation and maintenance of many autoimmune or inflammatory diseases. And recently, several therapeutic approaches have been developed for targeting IL-17 including monoclonal antibiotics which block the activity of IL-17, and specific inhibitors molecules have improved in the treatment of these diseases. This review aims to highlight the general trends of these inhibitor molecules as a treatment against these diseases as well as the various diseases related to IL-17 inflammatory actions, and interactions with other cytokines that perform similar functions. It also highlights the development of more targeted therapies and works as an identification of new biomarkers for disease diagnosis. However, further research is needed to fully elucidate the role of IL-17 biology in these inflammatory diseases and to develop more effective treatments.

Keywords: Interleukin 17; Psoriasis; Rheumatoid arthritis; Crohn's disease; Quercetin

1. Introduction

IL-17 is a pro-inflammatory cytokine, consisting of many other members ranging from IL-17A to IL-17F (Tayefinasrabadi et al., 2020). Out Which IL-17A was the first to be discovered and its binding receptor; was later recognized as IL-17RA (Ge et al., 2020). Researchers then tested for IL-17A homologous genes and identified IL-17B to IL-17F. According to various studies, IL-17B is a key player in both cancer and inflammation. Six 20–30 kDa molecular weight isoforms of the secreted and glycosylated IL-17 family of proteins make up this family. The sequence homology between IL-17A and the remaining members of the IL-17 family ranges from 20 to 55%, with IL-17E having the lowest homology. Four cysteine residues in the C-terminus of IL-17 family proteins, which are structurally conserved, create intramolecular disulfide bridges

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(Kostareva et al., 2019). IL-17 was thought to be the cause of $CD4^+$ T helper 17 (Th17) cell production, but recently many studies have shown that IL-17 is produced by various kinds of immune cells; both adaptive and innate (Akitsu et al., 2018; Berry et al., 2022). IL-17 mostly arises from Th17 cells which produce the cytokines such as IL-17, IL-22, and IL-26 (Packi et al., 2022). Th17 lymphocytes can produce IL-17 by IL-23 maintaining the phenotype. In many cases, IL-17 production may also be the result of genetic polymorphism due to certain diseases (Bugaut et al., 2021). Even under stressed situations certain cells may produce IL-17, as in the incident of stroke astrocytes produce IL-17 (Brigas et al., 2021). IL-17 was initially cloned from a rodent-activated T cell hybridoma, where it was also discovered that it showed a strong variation in sequences of other known cytokines, of mammalian nature. This would later suggest a strong relation to evolutionary linkages (Brembilla et al., 2018; McGeachy et al., 2019). With its recent surge in modern technology, IL-17 is linked to numerous inflammatory diseases, and therefore, an elevated amount is an indicator or serves as an important biomarker. IL-17D possesses a unique C-terminal domain that mediates a unique receptor interaction (Liu et al., 2020). IL-17 communicates its function via IL-17RA and IL-17RC receptor subunits. Although IL-17RA is expressed everywhere, fibroblasts and endothelial cells have been identified to be the primary recipients of IL17A responses. Depending on the stimuli that cells are exposed to, their broad expression of IL17RA is dynamically altered. The IL-17A-IL-17F heterodimer both bind to this receptor complex (Molina et al., 2019). IL-17 has an essential role in tissue repairs, and although there is not much on its complete mechanisms. Every member of the family of cytokines functions as a homodimer or heterodimer and interacts with certain dimeric receptors. The cytokines also play vital roles in signaling pathways (Brevi et al., 2020). One of the key players in the host's fight against microbial diseases is IL-17. In both humans and mice, the IL-17 pathway controls antifungal immunity by increasing levels of proinflammatory cytokines, antimicrobial peptides, and neutrophil-recruiting chemokines, which prevent fungal overgrowth (Schinocca et al., 2021). IL-17A is by far the most examined member (Chen et al., 2018; Zhao et al., 2019). Hematopoietic cells such as Th17, CD8+ cytotoxic T cell (Tc17), T cell, natural killer cell, group 3 innate lymphoid cells (ILC3), and Th17 cell all generate IL-17A. It has been demonstrated that IL-17A has a role in the formation of tumors, neovascularization, and immunological inflammation (Chen et al., 2020; Furue et al., 2020; Shibabaw, 2020). The common SEFIR (SEF/IL-17R) cytoplasmic motif is activated when IL-17 cytokines bind to the corresponding IL-17 receptors. Additionally, the IL-17RA molecule functions as a subunit of the IL-17C, IL-17E, and IL-17F receptors. Early research employed animals lacking the IL-17RA (or IL-17R) gene on a mouse model for the absence of IL-17A function; however, IL-17RA loss also impairs the capacity to respond to IL-17C, IL-17E, and IL-17F (Matsuzaki et al., 2018).

2. IL-17 Signaling

The cytokine receptors (IL-17Rs) are no different from other pro-inflammatory cytokines, communications between their respective IL-17 prompt different response, expressions, cellular processes, and more. Two extracellular domains that resemble fibronectin III and an intracellular SEFIR domain are present on each IL-17R, coupled with two subunits. Out of which one is necessary for identifying different ligands. When IL-17 binds to the IL-17RA-IL-17RC complex, the ubiquitin ligase adaptor protein Act1 is generated. Act1 then binds tumor necrosis factor receptor-associated factor 6 (TRAF6) to activate the nuclear factor-B (NF-B) and mitogen-activated protein kinase (MAPK) pathways, as well as increase the expression of several proinflammatory cytokines and chemokines (Swaidani et al., 2019). Transcription of the genes encoding pro-inflammatory and neutrophil-mobilizing cytokines and chemokines is caused by IL-

17-Act1-mediated signaling (Herjan et al., 2018). Under chronic conditions, IL-17 activation leads to the stimulation of Lys48-linked polyubiquitination followed by degrading Act1. Testing the deficiency of Act1 on experimental mice, yielded a decrease in IL-25-dependent gene expression which resulted in the animal being more impervious to IL-25-mediated allergic airway inflammation (Swaidani et al., 2019). These IL-17 homologs are believed to constitute a distinctive ligand-receptor signaling pathway that appears to have been well preserved throughout evolution due to its exceptional structural characteristics and limited similarity to other known cytokines and receptors. Comprehensive studies have revealed that IL-17 is a key immunological stimulator of an inflammatory network that powerfully synergizes with other cytokines. IL-17 has been linked to the development of inflammation, autoimmunity, and host defense against certain infections, according to studies in mice and human models (Lv et al., 2022). And hence this is the reason why many inflammatory diseases are profoundly linked to IL-17 expressions and or amount.

3. Inflammatory diseases and IL-17

As mentioned previously, IL-17 has been the target of numerous studies indicating its role in inflammatory diseases. IL-17 has since become a notable biomarker in these inflammatory diseases. This has facilitated many researchers better evaluate the pathogenic nature of particular diseases, in addition to all this, IL-17 has allowed for more accurate therapies. Many studies have revealed that only IL-23, not IL-12, caused activated memory T cells to secrete IL-17. In light of this, it was postulated that IL-23 stimulates the growth of a specific fraction of effector CD4+ T cells that are distinguished by the release of IL-17, which leads to the development of inflammatory diseases (Bianchi et al., 2019).

3.1 Rheumatoid Arthritis

Rheumatoid arthritis (RA) is characterized by a symmetrical increasing inflammation of the afflicted joints that causes bone erosion, cartilage damage, and impairment, therefore RA is another chronic inflammatory disease that affects the joints (Ruiz de Morales et al., 2020). In addition to stimulating proinflammatory pathways such as inflammatory cytokine production, pannus development, and synovial neo angiogenesis, IL-17 also triggers negative feedback regulation through the activation of prostaglandin E2 (PGE2). This leads to structural deterioration of rheumatic joints. According to recent studies, individuals with early RA who have not yet started therapy had dramatically higher levels of IL-17 in their synovium, blood, and synovial fluid (Wu et al., 2019). Several studies have identified dysregulated amounts of IL-17A in the serum of patients. Mast cells make up the majority of IL-17A+ cells in the synovial tissue in the case of RA, while neutrophils and T cells are much less common (Ruiz de Morales et al., 2020). Another study showed how the IL-17Rs were able to bind to the same receptor; IL-17RA and IL-17RC subunits that caused inflammation and granulopoiesis. The same study showed in an in vitro experiment that the production of IL-6 and IL-8 is stimulated by IL-17A leading to migration and invasion that result in cartilage destruction. Moreover, the receptor activator of NF-κB ligand (RANKL) binds to RANK and stimulates osteoclastogenesis before causing osteoclasts to damage bone, which is expressed more often on osteoblasts as a result of IL-17 (Robert et al., 2019). The IL-17A and IL-17F and their receptor genes have functional polymorphisms that may influence their expressions' quality and or quantity, which may affect how susceptible they are to developing autoimmune disorders. In fact, several research has looked at the possible significance of IL-17 levels and IL-17 gene polymorphisms in RA susceptibility. Therefore, polymorphic association analysis has also been studied, such as a study done on the Tunisian population suffering from RA; linking any association between the disease and IL-17A. This

resulted in high levels of IL-17A plasma contents but no specific statistical association, but results predicted RA occurrence due to elevated amount of IL-17A (Dhaouadi et al., 2018). Similarly, another systematic review is based on the polymorphism of IL-17A and IL-17F to RA. Fifteen different studies were reviewed out of which five depicted a positive association between IL-17 and RA, however, one of them showed an inferior association with RA (Agonia et al., 2020). Likewise, another study is based on Fibroblast-like synoviocytes (FLS) which are cells that invade bone and cartilage and are relatively immune to apoptosis, a key feature of RA. These cells were treated with IL-17 to examine the behavior of the mitochondrial dysfunction and autophagy, which yielded that IL-17 caused mitochondrial malfunction and the development of autophagosomes in RA FLS, indicating that they were resistant to apoptosis. Autophagy-related antiapoptosis elicited by IL-17 was reversed by autophagy suppression, implying a link between mitochondrial malfunction and cell survival in RA FLS (Kim et al., 2018). Studies have concluded that patients with RA had a higher IL-17 circulating in them as compared to healthy individuals (El-Maghraby et al., 2019). All of these studies direct a strong relation to IL-17 and RA.

3.2 Inflammatory Bowel Disease and Crohn's Disease

Inflammatory Bowel Disease (IBD) is a collection of gastrointestinal tract inflammation conditions, which significantly reduce the quality of life. Abdominal discomfort, more frequent stools, and rectal bleeding are symptoms associated with these disorders (Gracie et al., 2019). Three primary manifestations of IBD are Crohn's disease (CD), ulcerative colitis (UC), and IBD unclassified (IBDU). The causes of these diseases are multifaceted. IBD is characterized by periods of remission interspersed with persistent recurrent disease activity. The long-term effects of chronic intestinal inflammation include tissue destruction, fistulizing and structuring inflammation in CD, and potentially fatal bouts of acute severe UC. Anti-inflammatory, immunomodulatory, and immunosuppressive medications, as well as biological therapy that targets inflammatory cytokines, are all used to treat individuals with IBD (Vries et al., 2019; Uhlig et al., 2018). As with any other inflammatory and cytokine-driven disease, IBD is linked to IL-17 expressions. A study concluded that stabilizing and or inhibiting IL-17 suggested finer effects to treat IBD (Li et al., 2019). Another study aimed a similar approach; to assess if inhibiting IL-17 would benefit IBD treatment. The study determined that anti-IL-17 drugs have been linked to IBD exacerbation. Thus, for individuals with IBD; these drugs should be prescribed with caution (Hohenberger et al., 2018). However, the exact role of IL-17 in IBD is currently being debated in the literature. A study showed that mice lacking in IL-17 or treated with anti-IL-17 had significant epithelial damage in the colon, implying that IL-17 has a protective effect (Bunte et al., 2019).

A part of IBD, the CD is a progressive and destructive inflammatory bowel disease defined by persistent inflammation of any portion of the gastrointestinal system. In most cases, the illness's development at a young age demands immediate but long-term therapy to prevent disease flares and disease progression with intestinal consequences. Inflammation can develop everywhere from the mouth to the anus. CD and UC are distinguished by certain clinical and diagnostic features. Diarrhea, stomach discomfort, rectal bleeding, fever, weight loss, and exhaustion are all common symptoms (Roda et al., 2020; Veauthier et al., 2018). Numerous studies have associated IL-17 with the pathogenesis of CD. As IL-17 signaling results in pro-inflammatory production resulting in the expression of inflammatory genes. IL23R signaling stimulates various pathways in CD, resulting in the production of many effector cytokine genes such as IL17A and IL17F. Studies have also shown that the submucosa and muscularis propria of CD patients had amassed cells able to produce IL-17 (Schmitt et al., 2021). Studies have also indicated amplified amounts of IL-17A and IL-17F expressions (Verstockt et al., 2018). Many studies have concluded

diverse outcomes on the use of anti-IL-17 drugs and or agents, relatedly Yamada et. al. (2019) conducted the effects on 16,690 patients with anti-IL-17 drugs, which showed no such difference in the onset of IBD (and CD), which made them conclude that onset of IBD is rare in the case of using anti-IL-17 agents.

3.3 Psoriasis

Psoriasis is a chronic inflammatory and autoimmune skin condition that is distinguished by erythematous plaques with a white scale. One of the most common chronic inflammatory skin illnesses is psoriasis. More than 80% of occurrences of psoriasis are caused by the most prevalent kind, plaque psoriasis (Armstrong et al., 2020; Kamiya et al., 2019). Psoriasis is associated with many factors and comorbidities. However, there are abundant reports and extensive studies that indicate IL-17 as a mediator for psoriasis. The Th17 pathway and its significance in psoriasis inflammation were discovered as a result of advancements in the understanding of the pathophysiology of psoriasis (Loft et al., 2020). Analogous to the aforementioned studies on inhibiting IL-17 to infer the function of IL-17 in various diseases – studies conducting the same tests were done on psoriasis. That gave comparable results. Psoriasis can be treated by targeting IL-17, as the IL-17 signature is more highly expressed in the skin of psoriatic patients (Furue et al., 2018; Furue et al., 2019). According to a study, dermal dendritic cells that produce IL23 stimulate the production of IL17, which then prompts keratinocytes to produce an inflammatory response by activating the CCAAT enhancer-binding protein. The progression of psoriasis is accelerated by this feed-forward reaction. TNF and IL17 work together to enhance the transcription of several proinflammatory genes. Which finally results in the promotion and the development of Th17 cells in draining lymph nodes and the skin (Tokuyama et al., 2020). IL-17 and IL-23 have been identified as important pathogenesis-promoting factors in psoriasis by immunological and genetic research (Griffiths et al., 2021). When exposed to IL-17A and tumor necrosis factor, keratinocytes can become activated and release secondary cytokines and chemokines in inflamed skin (Moos et al., 2019). Certain cells are activated by IL-17-producing lymphocytes, which increases their cytokine output and pathogenicity. The majority of the time, IL-17 works in tandem with other cytokines to massively activate immune pathways and other cytokines notably IL-22, IL-20, and IL-24, which promote epidermal alterations (Ghoreschi et al., 2021). In vitro studies in addition to clinical studies specify IL-17A to be the chief cytokine that alters the biological processes of dermal tissues which are affected. The same study also depicted that, IL-17A triggered more transcriptional activity than IL-22 in an in vitro investigation utilizing reconstituted human epidermal sheets, aligning with the psoriasis transcriptome (Blauvelt et al., 2018). In a recent study, researchers observed the mutations of a gene; CARD14, that encoded CARD-containing MAGUK protein 2 (CARMA2) under psoriatic conditions. A mice model was examined with the same conditions, provided with the constant activation by the IL-17A cytokine axis. The results determined that CARMA2 is a crucial modulator of IL-17A signaling, and the development of psoriasis is caused by its constitutive activation in keratinocytes (Wang et al., 2018). Another study carried out on experimental mice; compared the skin and arteries of mice with psoriasis with healthy mice since psoriasis increases the risk of cardiovascular disease in humans. According to the investigation, skin lesions caused by psoriasis induce IL-17-producing T cells in draining lymph nodes to migrate to proximal skin and then to arteries (Huang et al., 2019). Thus, keratinocyte proliferation, neo-angiogenesis, mast cell recruitment and activation, neutrophil and macrophage activation, and the expression of adhesion molecules can all be increased by IL-17 stimulation, which favors the breakdown

of the epidermal barrier (Boutet et al., 2018). In one report, the authors speculated that psoriasis, obesity, and depression may indeed be connected manifestations of a state of immune dysregulation, of IL-17 and its related cells (Zafiriou et al., 2021). Studies have also shown that Innate Lymphoid Cells (ILC) 3 and Mucosal-Associated Invariant T (MAIT) cells are additional significant producers of IL17 in the skin in response to inflammatory stimuli. Given that chronic mucocutaneous candidiasis in humans is characterized by inborn deficits in IL17 or IL17R, IL17 certainly appears to play a significant role in skin local immunity (Bugaut et al., 2021).

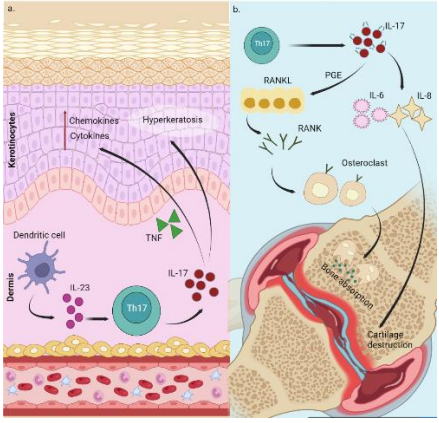

Figure 1 IL-17 release is related to many inflammatory diseases. **a.** In Psoriasis, dermal dendritic cells synthesize IL-23 which stimulates the Th17 which releases IL-17. IL-17 promotes inflammatory action and causes hyperkeratosis (thinking of the outer layer of skin) and TNF increases the chemokines and cytokines in inflammated skin. **b.** In Rheumatoid Arthritis, IL-6, IL-8, and Th-17 release the IL-17 which activates the PGE and RANKL. The RANKL release RANK which binds to the osteoclast and starts bone absorption. In addition, IL-17 causes cartilage destruction in rheumatoid arthritis.

4. IL-17 based therapeutics

There have been many therapies, clinical trials, and treatment methods to target IL-17 by inhibiting its expression or pathways. There is a multitude of experimental data that indicate the progressive conclusion, as previously mentioned. In most inflammatory diseases inhibiting the key cytokine has been documented to be successful, however certain drugs or agents may pose adverse aftereffects (Kany et al., 2019). Monoclonal antibodies against IL-23, IL-17, and TNF are now being used to treat patients with psoriasis, atopic dermatitis, and hidradenitis suppurativa, according to emerging data from clinical trials (Liu et al., 2020). Some of the more common IL-17 targeting agents, mostly for treating psoriasis are Secukinumab, Ixekizumab, Bimekizumab, and Brodalumab (Table 1).

Table 1 Different Monoclonal Antibodies against IL-17 for the treatment of different diseases

Name	Compound	Target	Dosage	Disease	References
Secukinumab	Immunoglobin G1 monoclonal antibody	IL-17A	300mg, 150mg	Moderate to severe Psoriasis	(Augustin et al., 2020)
Ixekizumab	Immunoglobin G4 monoclonal antibody	IL-17A	160mg, 80mg	Ankylosing spondylitis, Psoriasis arthritis, Plague Psoriasis	(Craig et al., 2020; J.-X. Huang et al., 2020)
Brodalumab	Immunoglobin G2 monoclonal antibody	IL-17RA	210mg, 140mg	Moderate to severe chronic Psoriasis	(Galluzzo et al., 2021)
Bimekizumab	Immunoglobin G1 monoclonal antibody	IL-17A, IL-17F	320mg	Plague Psoriasis	(Andrew Blauvelt et al., 2020; Oliver et al., 2021)
Netakimab	Immunoglobin G1 monoclonal antibody	Anti-IL-17A	120mg	Ankylosing spondylitis, Plague psoriasis, and Psoriasis arthritis	(Erdes et al., 2020; Puig et al., 2021)

Secukinumab is a human immunoglobulin G1 monoclonal antibody against IL-17A; a potent and secure biologic treatment for psoriasis. It can selectively bind to and neutralize IL-17A. The European Medicines Agency (EMA) has approved and recommended its use in treating psoriasis (Wcisło-Dziadecka et al., 2019). A humanized immunoglobulin G4 monoclonal antibody called Ixekizumab specifically inhibits IL-17A (Liu et al., 2020) and much like Secukinumab, functions to target IL-17A. Whereas Brodalumab is another complete human immunoglobulin G2 IL-17RA antagonist or inhibitor (Tomalin et al., 2020) and Bimekizumab is a humanized monoclonal immunoglobulin G1 antagonist that can inhibit IL-17A and IL-17F (Blauvelt et al., 2020).

Secukinumab at dosages of 300 to 150 mg is effective and safe for the treatment of moderate-to-severe psoriasis, according to evidence from randomized trailed studies (Reich et al., 2021). Inhibiting IL-17 comes

at a cost, as it halts its function. For instance, Individuals suffering from psoriasis may have an increased risk of contracting Candida spp. Infection; IL-17 prevents such infections. Consequently, anti-IL-17 antibodies, which are known to be effective in the treatment of psoriasis, may be linked to a rise in Candida spp. infections (Papini et al., 2018). However, according to that study, there were no such incidents of an amplified infection, this may be due to the limited number of patients that were examined. In another trailed study Secukinumab was administered to patients with Netherton syndrome, hence anti-IL-17 therapy may be a potential treatment choice. There have been various other studies demonstrating Secukinumab as a positive anti-IL-17 therapy (Bilal et al., 2018; Caldarola et al., 2020; Gasslitter et al., 2019; van der Heijde et al., 2020; Yin et al., 2020). According to one study, Ixekizumab is more persistent and had a lower rate of drug discontinuation as compared to others (Lockshin et al., 2021). However, paradoxical reactions due to the use of Ixekizumab have been indicated by a study, nevertheless, the treatment was effective (Marasca et al., 2021). One study determined the safety and efficiency of Bimekizumab which turned out to be greater in response to and efficiency than even Secukinumab (Ruggiero et al., 2022). Allying Bimekizumab is another novel inhibitor of IL-17A, Netakimab (Mosca et al., 2021), both are still under phase III clinical trials before approval. However both are quite resilient as anti-IL17 agents (Li et al., 2021).

Another rather unorthodox approach is the use of the novel Quercetin, a plant-based polyphenol inhibitor that lowered IL-17-induced RANKL protein levels. The study also observed that the extracellular signal-regulated kinase, mammalian target of rapamycin, and inhibitor of kappa B-alpha were all activated by IL-17 less when quercetin was present (Kim et al., 2018). Quercetin is even able to block the pathway of MAPK, this is possible since Quercetin can inhibit the nuclear protein known as high mobility group box 1 (HMGB1), a non-histone protein, that is connected to inflammation, thus reducing the production of Th17 cells, and decreasing procytokine and IL-17 production (Hashemi et al., 2018). Quercetin has also been examined in vitro and in vivo environments of RA manifestations, Quercetin generally reduced inflammatory cytokines and mediators, decreased oxidative stress, inhibited proliferation, migration, and invasion, and promoted apoptosis to prevent synovial membrane inflammation (Tang et al., 2022). In one study Quercetin's therapeutic outcomes were tested on mice immunized with type II collagen (CII); inflammatory mediator levels in the knee joint were found to have significantly decreased (Haleagrahara et al., 2018). Hence, quercetin may be utilized as an additional treatment for RA patients and may have the ability to prevent joint inflammation.

As described earlier IL-17 serves as an important component of the immune system, to defend the host against various foreign threats. Particularly in epithelial barrier locations, IL-17 is essential for the preservation of tissue integrity and the induction of immunological defenses against pathogenic microbes. The proinflammatory characteristics of IL-17 also make it an important immunopathology and mediator of inflammation. One of the most promising immunotherapeutic target options for the treatment of a wide range of disorders, including malignancies, autoimmune diseases, and infectious diseases, is IL-17 due to its remarkably diversified roles (Brembilla et al., 2018; Carney, 2018; Ma et al., 2019). Type 2 diabetes, insulin resistance, and inflammation have all been associated with IL-17 activity (Abdel-Moneim et al., 2018). However, genetic and environmental factors, mechanical stress, and dysbiosis can result in a pathological up-regulation of IL-17 and the emergence of inflammatory disorders. IL-17 is a protein that initially only functions during an immune response (Tsukazaki et al., 2020).

5. Conclusion

IL-17 has a significant role in immunity and several vital biochemical pathways, while also maintaining specific immune responses. IL-17 like all other cytokines IL-17 is highly responsible for the development of various inflammatory

diseases. Since the IL-17 responds by elevating certain other pro-inflammatory cytokines that it results often in autoimmune diseases as well. However, novel methods to treat such disorders or diseases are being tested and trailed, with many being approved and used. Most notably the use of IL-17 inhibitors, that either neutralizes IL-17 or its receptors. These treatment methods come with specific risks and may in turn have several unwanted effects. Nevertheless, these agents have yet caused any serious adverse effects; still, selective inhibition of IL-17 has yielded better outcomes. Soon, safer and more effective means to treat inflammatory diseases would be targeted. According to many findings these novel approaches, do require more tests and a greater understanding of IL-17.

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7. Declarations

7.1 Conflict of Interest

All authors declare that they have no conflict of interest.

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