RECOMBINANT INSULIN-LIKE GROWTH FACTOR 1 (IGF-1)

Insulin-like Growth Factor 1 (IGF-1) is a protein that is encoded by the IGF1 gene. It is a hormone that is structurally homologous to proinsulin[1]. Mature IGFs are generated by proteolytic processing of inactive precursor proteins that contains the N and C terminal propeptide regions.

IGF-1 is the principal mediator of growth hormone that stimulates mitosis and inhibits apoptosis[2]. It is synthesized by almost all tissues and plays an important role in promoting cell growth and differentiation in childhood and continues to have an anabolic effect in adults[3]. IGF-1 is required for embryonic development, and it is produced mainly in the liver in response to a hepatocyte growth hormone. In the absence of insulin, IGF-I is necessary for the maintenance of human pluripotent stem cells. IGF-1 stimulates differentiation and proliferation of myeloid cells and has been shown to regulate lymphopoiesis by stimulating proliferation and differentiation of T and B cells in lymphoid organs. IGF-1, among other growth factors are key players in the cellular agriculture industry that produces cell cultured meat. This cell culture is dependent on growth factors present in serum supplements that raise concerns when used in cultivating meat. Hence serum-free media containing recombinant growth factors replace growth factors

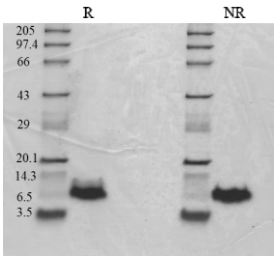
present in serum. These recombinant growth factors such as IGF-1 bind to cell surface receptors activating several downstream pathways to result in cell proliferation, cell migration, differentiation and aid in the production of cell cultured meat.

IGF-1 has multiple diverse applications in culturing of primary cells, cellular agriculture etc. Recombinant IGF-1 from Resolve Biotech is a biologically active 7.6 kDa protein, expressed in *E. coli* and purified using conventional affinity chromatography techniques.

Technical Specifications

A. Purity:

Resolve's Recombinant IGF-1 is >95% pure as determined by reducing and non-reducing SDS-PAGE (Figure 1).



*R - Reduced
**NR - Non Reduced

Figure 1. SDS-PAGE gel image of Resolve's Recombinant IGF-1 Lane 1: Ladder, Lane 2: IGF-1 in reducing conditions, Lane 3: Ladder, Lane 4: IGF-1 in non-reducing conditions

B. Western Blot

Resolve's Recombinant IGF-1 has been validated using anti-IGF1 antibody as shown in figure 2.

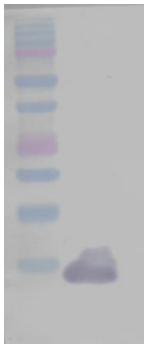


Figure 2. Western blot image of Resolve's Recombinant IGF-1 Lane 1: Ladder, Lane 2: IGF-1

C. Biological Activity

Insulin-like growth factor 1 (IGF-1) is a peptide that binds to a tyrosine kinase receptor (IGF1R) and promotes the phosphorylation of intracellular substrates, including PI3KCA, AKT-PKB, RAS/RAF/MAPK and p70S6 kinase, which triggers the nuclear translocation of transcription factors (such as FOXO, GSK3β, MDM2 and mTOR) that regulate cell growth, differentiation and proliferation of fibroblast cell lines such as NIH-3T3[4]. In the tumor microenvironment, IGF-1 drives migration, invasion and proliferation, promotes angiogenesis and maintains cancer stemness. IGF-1 mediated proliferation can be demonstrated using different cells such as NIH-3T3 or MCF-7 cells. The latter is regulated by direct or indirect mechanisms and by interaction with other embryonic signaling pathways, such as the hedgehog pathway.

Resolve's Recombinant IGF-1 is a biologically active protein as measured in a cell proliferation assay using NIH-3T3 cells (Figure 3). The ED_{50} for this effect is <2 ng/mL.

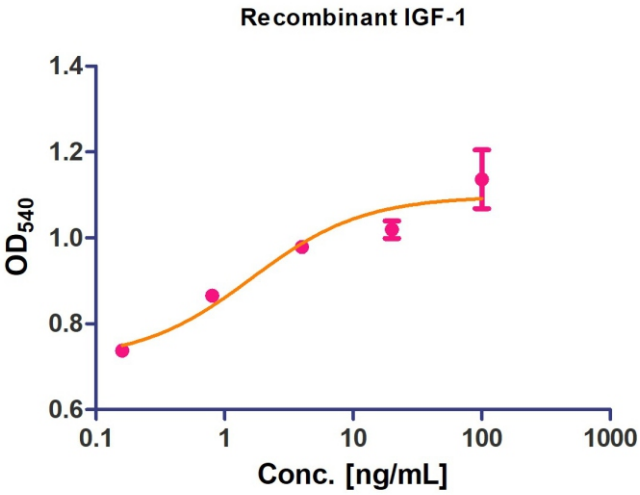


Figure 3: Results: IGF-1 mediated proliferation assay using NIH-3T3 cells

References

[1]Höppener JW, de Pagter-Holthuizen P, Geurts van Kessel AH, Jansen M, Kittur SD, Antonarakis SE. "The human gene encoding insulin-like growth factor I is located on chromosome 12". Human Genetics 1985; 69 (2): 157–160

[2]Bailes J, Soloviev M (2021). "Insulin-Like Growth Factor-1 (IGF-1) and Its Monitoring in Medical Diagnostic and in Sports". Biomolecules. 2021 Feb 4;11(2):217

[3]Venkateshan M, et. al. (2022) "Recombinant production of growth factors for application in cell culture". iScience Volume 25, Issue 10 (21)105054

[4]Yin Y, Han Y, Shi C, Xia Z. "IGF-1 regulates the growth of fibroblasts and extracellular matrix deposition in pelvic organ prolapse". Open Medicine 2020;15(1)pp. 833-840.