respectively or simultaneously act on GLP-1 receptors, GIP receptors, and glucagon receptors is being carried out (US 10,370,426, US 10,400,020).

Although various studies on lung diseases have been conducted so far, the development of practical and effective therapeutic agents is still insufficient, and accordingly, there is a need for continuous development of therapeutic agents.

[Disclosure]

[Technical Problem]

An object of the present invention is to provide a pharmaceutical composition for the prevention or treatment of lung disease, which includes a peptide having activities to a glucagon receptor, GLP-1 receptor, and GIP receptor, or a long-acting conjugate of the peptide.

Another object of the present invention is to provide a method for the prevention or treatment of lung disease, which includes administering a composition containing the peptide or a long-acting conjugate of the peptide to a subject in need thereof.

Still another object of the present invention is to provide a use of a composition containing the peptide or a long-acting conjugate of the peptide in the preparation of a medicament for the prevention or treatment of lung disease.

[Summary]

In one aspect, the present disclosure refers to a use of a pharmaceutical composition in the manufacture of a medicament for preventing or treating a lung disease, wherein the pharmaceutical composition comprises:

a pharmaceutically acceptable excipient; and

a peptide comprising an amino acid sequence of any one of SEQ ID 21, 22, 27, 30, 31, 32, 34, 36, 37, 42, 43, 50, 51, 52, 53, 54, 55, 56, 58, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 83, 86, 91, 93, 96, 97, 98, 99, 100, 101, and 102 in a pharmaceutically effective amount, wherein the lung disease is interstitial lung disease (ILD), progressive fibrosing interstitial lung disease (PF-ILD), idiopathic interstitial pneumonias (IIP), non-specific interstitial pneumonia (NSIP), pulmonary fibrosis, fibrosing interstitial lung diseases (FILD), idiopathic pulmonary fibrosis (IPF), alveolitis, pneumonia, emphysema, bronchitis, chronic obstructive pulmonary disease, combined pulmonary fibrosis and emphysema (CPFE), asthma, or respiratory infectious disease.

[Technical Solution]

One aspect for implementing the present invention provides a pharmaceutical composition for the prevention or treatment of lung disease, which includes a peptide having activities to a glucagon receptor, a glucagon-like peptide-1 (GLP-1) receptor, and a glucose-dependent insulinotropic polypeptide (GIP) receptor.

In a specific embodiment, the pharmaceutical composition for the prevention or treatment of lung disease contains a pharmaceutically acceptable excipient; and a peptide including an amino acid sequence of any one of SEQ ID NOS: 1 to 102 in a pharmaceutically effective amount.

[CLAIMS]

[Claim 1]

Use of a pharmaceutical composition in the manufacture of a medicament for treating a lung disease, wherein the pharmaceutical composition comprises:

a pharmaceutically acceptable excipient; and

a peptide comprising an amino acid sequence of any one of SEQ ID NOS: 21, 22, 27, 30, 31, 32, 34, 36, 37, 42, 43, 50, 51, 52, 53, 54, 55, 56, 58, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 83, 86, 91, 93, 96, 97, 98, 99, 100, 101, and 102 in a pharmaceutically effective amount,

wherein the lung disease is interstitial lung disease (ILD), progressive fibrosing interstitial lung disease (PF-ILD), idiopathic interstitial pneumonias (IIP), non-specific interstitial pneumonia (NSIP), pulmonary fibrosis, fibrosing interstitial lung diseases (FILD), idiopathic pulmonary fibrosis (IPF), alveolitis, pneumonia, emphysema, bronchitis, chronic obstructive pulmonary disease, combined pulmonary fibrosis and emphysema (CPFE), asthma, or respiratory infectious disease.

[Claim 2]

The use according to claim 1, wherein the peptide is in the form of a long-acting conjugate, and the long-acting conjugate is represented by Formula 1 below:

[Formula 1]

X–L–F

wherein in Formula 1 above,

X is a peptide of an amino acid sequence of any one of SEQ ID NOS: 21, 22, 27, 30, 31, 32, 34, 36, 37, 42, 43, 50, 51, 52, 53, 54, 55, 56, 58, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 83, 86, 91, 93, 96, 97, 98, 99, 100, 101, and 102;

L is a linker comprising an ethylene glycol repeat unit;

F is an immunoglobulin Fc region; and

“–” represents a covalent bond between X and L and between L and F.

[Claim 3]

The use according to claim 1 or 2, wherein the C-terminus of the peptide is amidated.

[Claim 4]

The use according to claim 1 or 2, wherein the peptide comprises an amino acid sequence selected from the group consisting of SEQ ID NOS: 21, 22, 42, 43, 50, 64, 66, 67, 70, 71, 76, 77, 96, 97, and 100.

[Claim 5]

The use according to claim 4, wherein the peptide comprises an amino acid sequence selected from the group consisting of SEQ ID NOS: 21, 22, 42, 43, 50, 77, and 96.

[Claim 6]

The use according to claim 1 or 2, wherein the amino acids at positions 16 and 20 from the N-terminus form a ring with each other in the peptide sequence.

[Claim 7]

The use according to claim 2, wherein the formula weight of the ethylene glycol repeat unit portion in the L is in the range of 1 kDa to 100 kDa.

[Claim 8]

The use according to claim 2, wherein the F is an IgG Fc region.

[Claim 9]

The use according to claim 1, wherein the respiratory infectious disease is an infectious disease caused by respiratory viruses, bacteria, mycoplasma, or fungi.

[Claim 10]

The use according to claim 9, wherein the respiratory virus is any one selected from the group consisting of adenovirus, vaccinia virus, herpes simplex virus, parainfluenza virus, rhinovirus, varicella zoster virus, measles virus, respiratory syncytial virus, Dengue virus, HIV (human immunodeficiency virus), influenza virus, coronavirus, severe acute respiratory syndrome associated virus (SARS-associated virus), and middle east respiratory syndrome coronavirus (MERS-CoV).

[Claim 11]

The use according to claim 10, wherein the coronavirus is SARS-CoV-2.

[Claim 12]

The use according to claim 1 or 2, wherein the pharmaceutical composition (i) inhibits the activity of macrophages; or (ii) reduces the expression of IL-1β, IL-6, IL-12, or TNF-α when administered.

[Claim 13]

The use according to claim 1 or 2, wherein the pharmaceutical composition has one or more features when administered:

(i) inhibits myofibroblast differentiation;

(ii) reduces the expression of α-SMA, collagen 1α1, or fibronectin;

(iii) inhibits epithelial mesenchymal transition (EMT) of alveolar epithelial cells; and

(iv) reduces the expression of collagen 1α1 or collagen 1α3.

[Claim 14]

The use according to claim 1 or 2, wherein the pharmaceutical is to be further

administered with a mucolytic agent or a pharmaceutically acceptable salt thereof.

[Claim 15]

The use according to claim 14, wherein the mucolytic agent is one or more selected from the group consisting of ambroxol, *N*-acetylcysteine, *N*-acetylin, carbocysteine, domiodol, fudosteine, bromhexine, erdosteine, letostine, lysozyme, mesna, sobrerol, stepronin, tiopronin, tyloxapol, carbocisteine, dornase alfa, eprazinone, letosteine, neltenexine, and mecysteine.

[Claim 16]

The use according to claim 13, wherein the peptide and mucolytic agent or a pharmaceutically acceptable salt thereof are to be administered simultaneously, sequentially, or in reverse order.

[Claim 17]

The use according to claim 1, wherein the lung disease is pneumonia (pulmonary inflammation) or pulmonary fibrosis caused by coronavirus disease-19 (COVID-19).

[Claim 18]

The use according to claim 2, wherein the F is a dimer consisting of two polypeptide chains, and one end of L is linked to only one of the two polypeptide chains.