[CLAIMS]

[Claim 1]

A peptide having activities for a glucagon-like peptide-1 (GLP-1) receptor, a glucose-dependent insulinotropic polypeptide (GIP) receptor, and a glucagon receptor, the peptide comprising an amino acid sequence represented by General Formula 1 below:

X1-Aib-X3-G-T-F-T-S-D-Y-S-X12-X13-L-D-E-X17-X18-A-K-X21-F-V-Q-W-L-L-D-X29-H-P-S-S-G-Q-P-P-P-S (General Formula 1, SEQ ID NO: 29)

in General Formula 1 above,

X1 is histidine or tyrosine;

X3 is glutamine or histidine;

X12 is lysine or an acylated lysine;

X13 is α-methyl-leucine, tyrosine, or alanine;

X17 is lysine or an acylated lysine;

X18 is alanine or arginine;

X21 is aspartic acid or glutamic acid; and

X29 is histidine or glutamine;

wherein – represents a peptide bond, and the peptide does not contain cysteine, and the peptide has higher relative activities for the GIP receptor and GLP-1 receptor relative to native GIP and GLP-1, respectively, compared to the relative activity for the glucagon receptor relative to native glucagon.

[Claim 2]

The peptide of claim 1, wherein the peptide has 4 times or higher relative activities for the GIP receptor and GLP-1 receptor relative to native GIP and GLP-1,

respectively, compared to the relative activity for the glucagon receptor relative to native glucagon.

[Claim 3]

The peptide of claim 1, wherein, in General Formula 1 above, X3 is histidine.

[Claim 4]

The peptide of claim 1, wherein, in General Formula 1 above, X13 is tyrosine; and X18 is alanine.

[Claim 5]

The peptide of claim 1, wherein, in General Formula 1 above, X1 is tyrosine; X3 is glutamine; X13 is tyrosine; and X18 is arginine.

[Claim 6]

The peptide of claim 1, wherein, in General Formula 1 above, X29 is glutamine.

[Claim 7]

The peptide of claim 1, wherein an acyl group is attached to one or more amino acids of the peptide through a linker selected from a group consisting of (2-(2-aminoethoxy)ethoxy)acetic acid (AEEA), 4-aminobutyric acid (GABA), 5-aminovaleric acid (Ava), aminohexanoic acid (Ahx), triazole, and polyethylene glycol (PEG).

[Claim 8]

The peptide of claim 7, wherein the linker comprises AEEA.

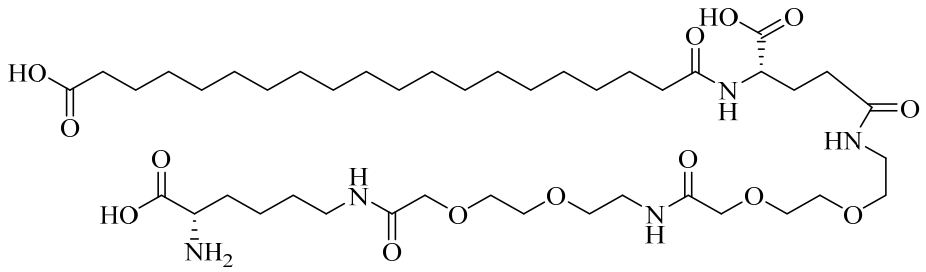
[Claim 9]

The peptide of claim 7, wherein the linker comprises 0 to 3 AEEA.

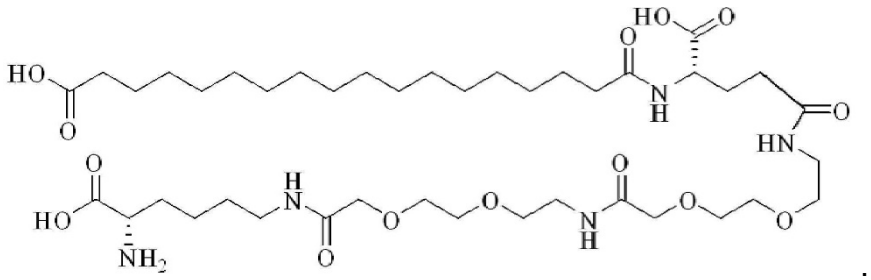
[Claim 10]

The peptide of claim 1, wherein the acylated lysine is an amino acid represented by K(1) or K(2) below:

[K(1)] C_{20} diacid–gammaGlu–$(AEEA)_2$–Lys



[K(2)] C_{18} diacid–gammaGlu–$(AEEA)_2$–Lys



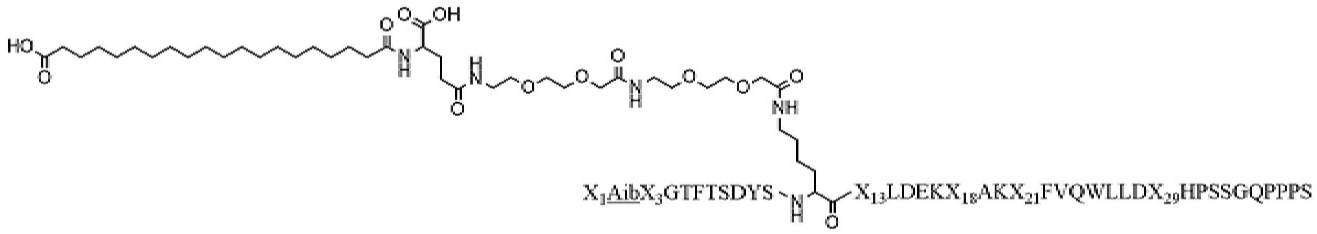
[Claim 11]

The peptide of claim 1, wherein the peptide is amidated at the C-terminus.

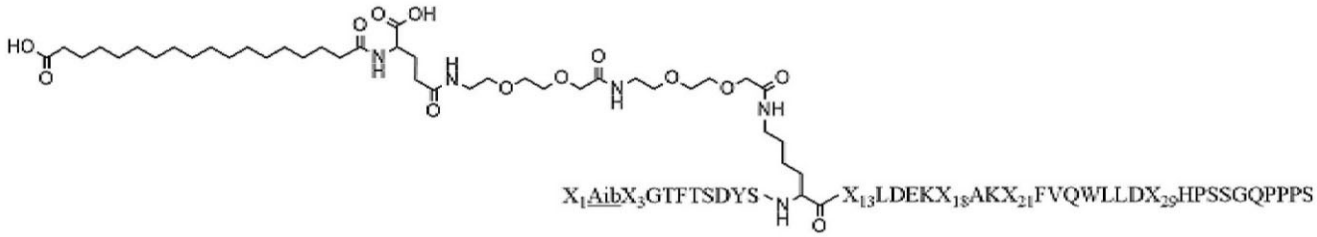
[Claim 12]

The peptide of claim 1, wherein the peptide has any one structure from (i) to (iv) below:

(i)



(ii)



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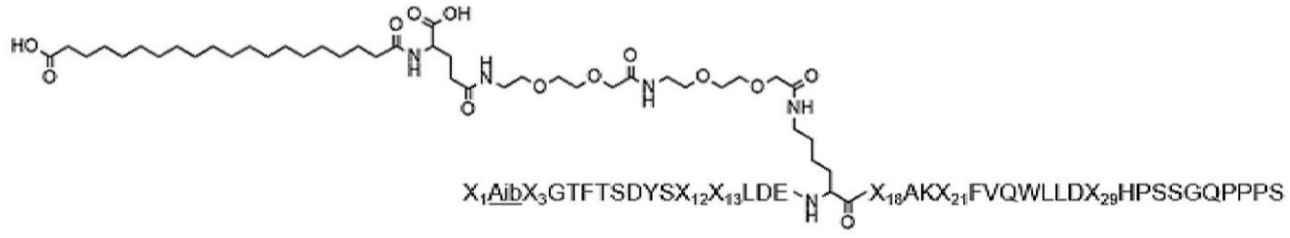
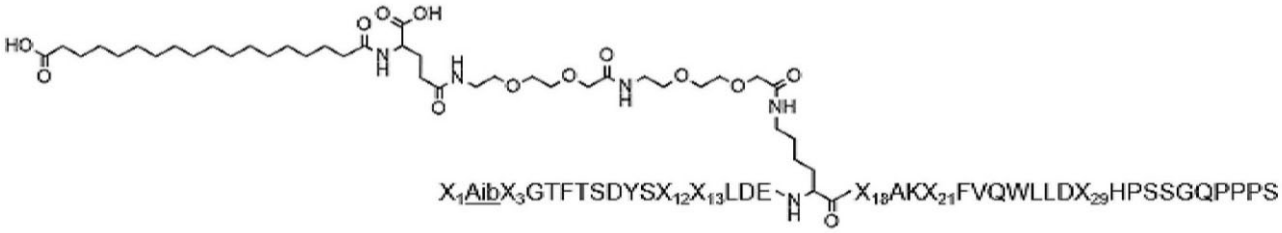


(iv)



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[Claim 13]

The peptide of claim 1, wherein the peptide comprises any one sequence selected from the group consisting of amino acid sequences of SEQ ID NOS: 1 to 28.

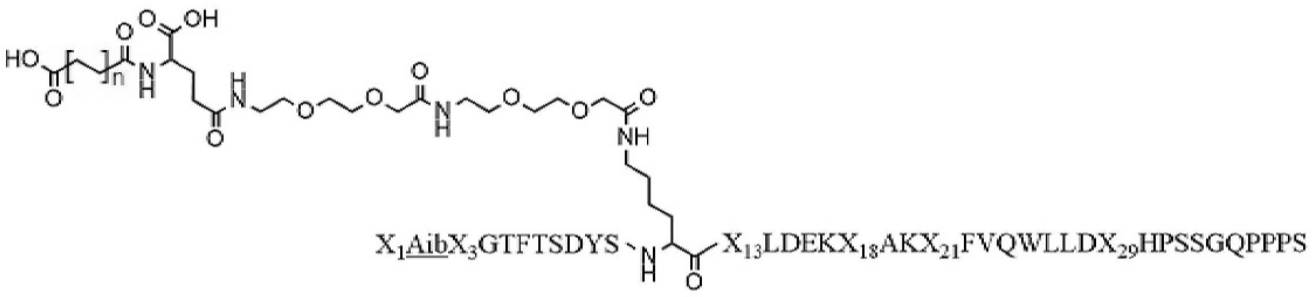
[Claim 14]

The peptide of claim 1, wherein the amino acids at positions 16 and 20 from the N-terminus of General Formula 1 form a ring with each other.

[Claim 15]

The peptide of claim 1, wherein the peptide has the structure of General Formula 2 below:

[General Formula 2]



in General Formula 2 above,

n is 16 or 18;

X1 is histidine or tyrosine;

X3 is glutamine or histidine;

X13 is α-methyl-leucine, tyrosine, or alanine;

X18 is alanine or arginine;

X21 is aspartic acid or glutamic acid; and

X29 is histidine or glutamine.

[Claim 16]

A pharmaceutical composition for preventing or treating obesity, comprising the peptide of any one of claims 1 to 15 in a pharmaceutically effective amount.

[Claim 17]

The pharmaceutical composition of claim 16, wherein the pharmaceutical composition further comprises a pharmaceutically acceptable carrier.

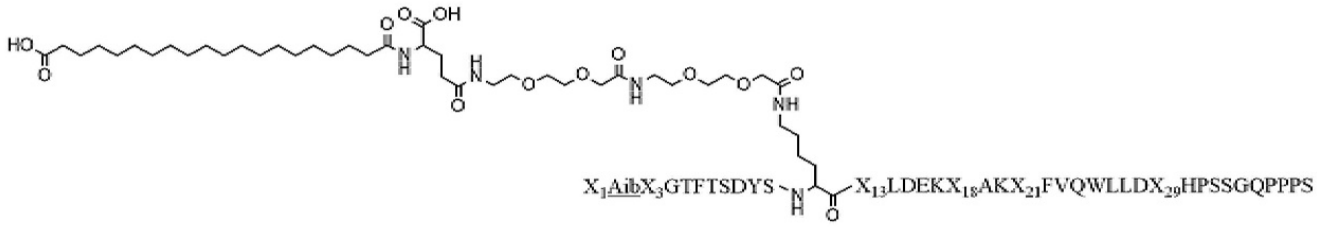
[Claim 18]

The pharmaceutical composition of claim 16, wherein the pharmaceutical composition has an effect of reducing the body weight of an individual upon administration.

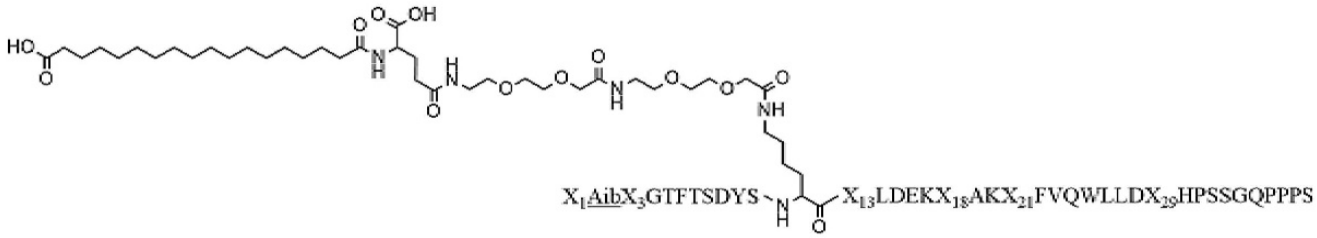
[Claim 19]

The pharmaceutical composition of claim 16, wherein the peptide has any one structure from (i) to (iv) below:

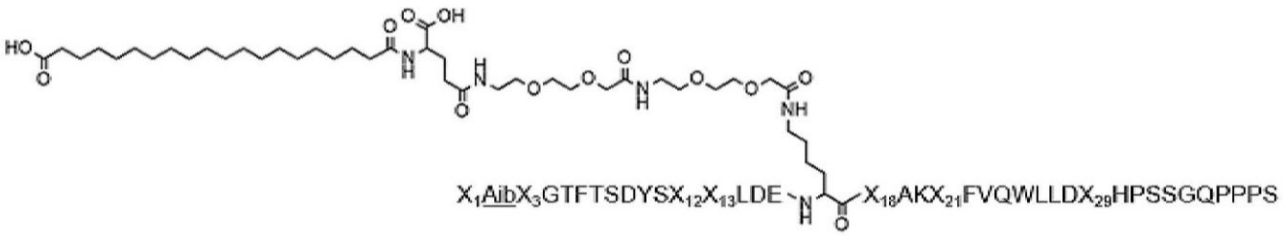
(i)


HO
OH
NH
X1AibX3GTFTSDYS
X13LDEKX18AKX21FVQWLLDX29HPSSGQPPPS

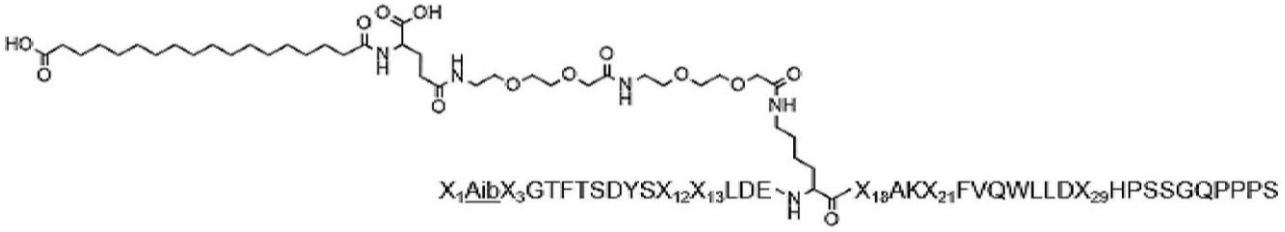
(ii)


HO
OH
NH
X1AibX3GTFTSDYS
X13LDEKX18AKX21FVQWLLDX29HPSSGQPPPS

(iii)


HO
OH
NH
X1AibX3GTFTSDYSX12X13LDE
X18AKX21FVQWLLDX29HPSSGQPPPS

(iv)


HO
OH
NH
X1AibX3GTFTSDYSX12X13LDE
X18AKX21FVQWLLDX29HPSSGQPPPS

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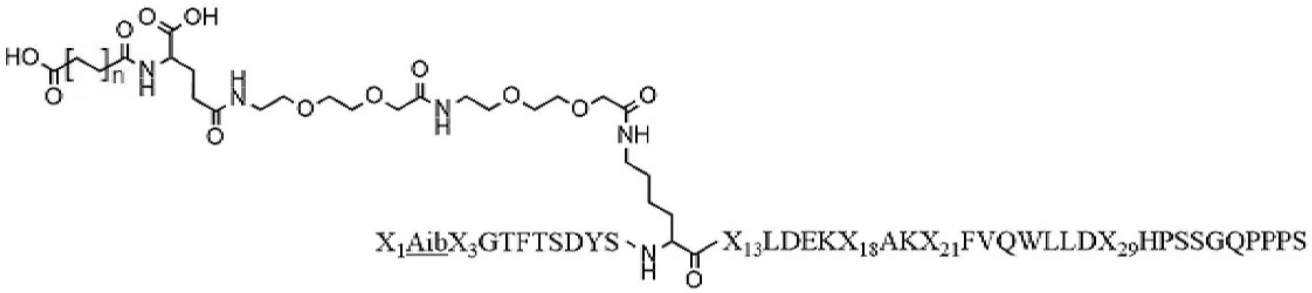
[Claim 20]

The pharmaceutical composition of claim 16, wherein the peptide has the structure of General Formula 2 below:

[General Formula 2]



in General Formula 2 above,

n is 16 or 18;

X1 is histidine or tyrosine;

X3 is glutamine or histidine;

X13 is α-methyl-leucine, tyrosine, or alanine;

X18 is alanine or arginine;

X21 is aspartic acid or glutamic acid; and

X29 is histidine or glutamine.