CLAIMS

1. A recombinant human alpha1-antitrysin (rhAAT) glycoprotein or fragment thereof, with one or more N-linked glycosylations.

2. The rhAAT glycoprotein or fragment thereof according to claim 1, wherein the rhAAT protein or fragment thereof is expressed in *Pichia pastoris*.

3. The rhAAT glycoprotein or fragment thereof according claim 1, comprising at least one Hex9HexNAc2, Hex10HexNAc2, Hex11HexNAc2, Hex12HexNAc2, Hex13HexNAc2, Hex14HexNAc2, Hex15HexNAc2 and/or Hex16HexNAc2 glycosylation.

4. The rhAAT glycoprotein or fragment thereof according to claim 3, comprising additionally at least one Hex17HexNAc2, and/or Hex18HexNAc2 glycosylation.

5. The rhAAT glycoprotein or fragment thereof according to claim 1, comprising at least one HexNAc1 glycosylation.

6. The rhAAT glycoprotein or fragment thereof according to claim 1, wherein

   a. Hex10HexNAc2 glycosylation comprises 0.1-45% of total N-glycans, and/or

   b. Hex11HexNAc2 glycosylation comprises 0.1-40% of total N-glycans.

7. The rhAAT glycoprotein or fragment thereof according to claim 1, comprising an amino acid sequence according to SEQ ID NO 4 or fragment thereof and at least one N-linked glycosylation at N46, N83 or N247, at least two N-linked glycosylations at N46 and N83, N46 and N247, or N83 und N247, or three N-linked glycosylations at N46, N83 and N247.

8. The rhAAT glycoprotein or fragment thereof according to claim 1, comprising an amino acid sequence according to SEQ ID NO 4 or fragment thereof and comprising:

   a. at least one N-linked glycosylation comprising Hex10HexNAc2, Hex11HexNAc2, Hex12HexNAc2, Hex13HexNAc2, Hex14HexNAc2, Hex15HexNAc2 or Hex16HexNAc2 at N83, and/or

   b. at least one N-linked glycosylation comprising Hex9HexNAc2, Hex10HexNAc2, Hex11HexNAc2, Hex12HexNAc2, Hex13HexNAc2, Hex14HexNAc2, Hex15HexNAc2 or Hex16HexNAc2 at N247.

9. The rhAAT glycoprotein or fragment thereof according to claim 1, comprising an amino acid sequence according to SEQ ID NO 4 or fragment thereof and comprising: at least one N-linked glycosylation comprising Hex9HexNAc2, Hex10HexNAc2, Hex11HexNAc2, Hex12HexNAc2, Hex13HexNAc2, and/or Hex14HexNAc2 at N46.

10. A protein preparation comprising recombinant human alpha1-antitrysin (rhAAT) glycoproteins or fragments thereof according to claim 1, with heterologous N-linked glycosylations.

11. The protein preparation according to claim 10, comprising a rhAAT glycoprotein with an amino acid sequence according to SEQ ID NO 4 or fragment thereof and at least one N-linked glycosylation:

a. at N46 in more than 80% of said glycoproteins in the preparation,

b. at N83 in more than 80% of said glycoproteins, and/or

c. at N247 in more than 1% of said glycoproteins.

12. The protein preparation according to claim 10, comprising a rhAAT glycoprotein with an amino acid sequence according to SEQ ID NO 4 or fragment thereof and at least one N-linked glycosylation comprising:

a. Hex9HexNAc2, Hex10HexNAc2, Hex11HexNAc2, Hex12HexNAc2, Hex13HexNAc2, Hex14HexNAc2, and/or Hex15HexNAc2 at N46, wherein said Hex9HexNAc2, Hex10HexNAc2, Hex11HexNAc2, Hex12HexNAc2, Hex13HexNAc2, Hex14HexNAc2, and/or Hex15HexNAc2 at N46 are present in more than 50% of said glycoproteins in the preparation,

b. Hex9HexNAc2, Hex10HexNAc2, Hex11HexNAc2, Hex12HexNAc2, Hex13HexNAc2, Hex14HexNAc2, and/or Hex15HexNAc2 at N83, wherein said Hex9HexNAc2, Hex10HexNAc2, Hex11HexNAc2, Hex12HexNAc2, Hex13HexNAc2, Hex14HexNAc2, and/or Hex15HexNAc2 at N83 are present in more than 60% of said glycoproteins in the preparation, and/or

c. Hex9HexNAc2 and/or Hex10HexNAc2 at N247, wherein said Hex9HexNAc2 and/or Hex10HexNAc2 at N247 are present in more than 1% of said glycoproteins in the preparation.

13. The protein preparation according to claim 10, comprising a rhAAT glycoprotein with an amino acid sequence according to SEQ ID NO 4 or fragment thereof and at least one N-linked glycosylation comprising:

a. Hex9HexNAc2, Hex10HexNAc2, Hex11HexNAc2, Hex12HexNAc2, Hex13HexNAc2, Hex14HexNAc2, and/or Hex15HexNAc2 at N46, wherein any one or more of said glycosylations, alone or in combination, is present in 0.1-100% of said glycoprotein in the preparation,

b. Hex9HexNAc2, Hex10HexNAc2, Hex11HexNAc2, Hex12HexNAc2, Hex13HexNAc2, Hex14HexNAc2 and/orHex15HexNAc2 at N83, wherein any one or more of said glycosylations, alone or in combination, is present in 0.1-90% of said glycoproteins in the preparation, and/or

c. Hex9HexNAc2 and/or Hex10HexNAc2 at N247, wherein any one or more of said glycosylations, alone or in combination, is present in 0.1-30% of said glycoproteins in the preparation.

14. The rhAAT glycoprotein or fragment thereof according to claim 1 or protein preparation according to claim 10, wherein an amount of said one or more N-linked glycosylations is determined using peptide mapping.

15. The rhAAT glycoprotein or fragment thereof or protein preparation according to claim 14, wherein the amount of said one or more N-linked glycosylations is determined using protease degradation of a sample comprising said glycoprotein or fragment thereof or protein preparation and subsequent mass spectrometric analysis of said sample.

16. A pharmaceutical composition comprising a pharmaceutically acceptable excipient and either the rhAAT glycoprotein or fragment thereof according to claim 1 or the protein preparation according to claim 10.

17. The pharmaceutical composition according to claim 16, wherein the composition is a solution, a soluble powder or a dry powder suitable for inhalation, nasal administration and/or injection.

18. Use of the rhAAT glycoprotein or fragment thereof according to claim 1, the protein preparation according to claim 10 or the pharmaceutical composition according to claim 16 in the manufacture of a medicament for the treatment of a viral respiratory infection.

19. The use according to claim 18, wherein the viral respiratory infection is an infection with an adenovirus, coronavirus (common cold viruses), influenza (flu), parainfluenza, parvovirus b19 (fifth disease), respiratory syncytial virus (RSV) or rhinovirus (common cold), a bocavirus HBoV), metapneumovirus (MPV), more preferably a severe acute respiratory syndrome virus (SARS virus), or a coronavirus associated with SARS (SARS-CoV, such as SARS-CoV-2).

20. A method for producing a recombinant human alpha1-antitrypsin (rhAAT) glycoprotein or fragment thereof, in a *Pichia pastoris*, comprising:

    i. Providing a genetically modified *Pichia pastoris* mut^{s} strain, comprising an exogenous hAAT-encoding nucleotide sequence under control of an AOX1 promoter (PAOX1),

    ii. Cultivating said strain in yeast growth medium, said cultivating comprising at least:

        a) a batch phase comprising cultivation in the presence of glycerol,

        b) a transition phase comprising cultivation in the presence of glycerol and methanol, and

c) an induction phase comprising cultivation in the presence of methanol, and

iii. obtaining secreted rhAAT protein or fragment thereof in a culture supernatant, and optionally isolating said rhAAT or fragment thereof from said supernatant.

21. The method according to claim 20, wherein said cultivating occurs in vessels comprising 500 mL-25,000 L of yeast growth medium in a bioreactor.

22. The method according to claim 20, wherein said supernatant comprising secreted rhAAT is subsequently processed using hydrophobic surface area chromatography selected from hydrophobic interaction chromatography and reverse phase chromatography, affinity chromatography, anion exchange chromatography and/or size exclusion chromatography to obtain isolated an rhAAT glycoprotein or protein preparation.