azacytidine (Conconi et al., 2006) has been described; alternatively, cells have been transfected with myogenic genes (MyoD: Kocaefe et al., 2010). The differentiation of MSC into muscle cells was thus, performed chemically or by genetic manipulation to date. In adult muscle stem cells, the induction is achieved by the withdrawal or the reduction of fetal bovine calf serum (FBS), an essential component of cell culture media.

In spite of the existing knowledge, there is a high demand for improved means and methods for in vitro production of meat-like products, especially on a large scale. This problem is solved by the subject matter of the independent claims, optionally supplemented by the features of the dependent claims and the present specification.

Consequently, in an aspect, the present disclosure relates to a method for producing a composition which contains animal protein, comprising:

(a) isolating mesenchymal stem cells from an umbilical cord of an agricultural animal, preferably from the family Suidae, more preferably from the genus Sus, most preferably from the species Sus scrofa;

(b) incubating the mesenchymal stem cells under conditions which lead to a myogenic differentiation of the mesenchymal stem cells, wherein the conditions which lead to a myogenic differentiation comprise incubation in a nutrient medium, which in comparison to the standard medium has a reduced content of methionine of at most 5 µM; and

(c) harvesting the myogenically differentiated cells.

In another aspect, the present disclosure provides the use of a nutrient medium which in comparison to the standard medium has a reduced content of methionine of at most 5 µM for the differentiation of mesenchymal stem cells from umbilical cord of an agricultural animal. In another aspect, the present disclosure provides a method for producing a meat-like composition, comprising I) myogenic differentiation of mesenchymal stem cells according to the method of the invention for the myogenic differentiation of mesenchymal stem cells according to the invention; II) three-dimensional structuring of the differentiated mesenchymal stem cells obtained in step I), and III) growth of the cells in the three-dimensional structure obtained in step II).

In the context of the present specification, the terms “contain”, “comprise” or “include” and any grammatical variations thereof are used in non-exclusive meaning. These terms can thus, on the one hand relate to a situation in which, in addition to the features which are introduced by the terms, no further features are present in the subject matter described, but also to a situation in which one or several further features are present. Thus, for example the expressions “A comprises B”, “A contains B” and “A includes B” can both refer to a

Claims

1. A method for producing a composition which contains animal protein, comprising

(a) isolating mesenchymal stem cells from an umbilical cord of an agricultural animal, preferably from the family Suidae, more preferably from the genus Sus, most preferably from the species Sus scrofa;

(b) incubating the mesenchymal stem cells under conditions which lead to a myogenic differentiation of the mesenchymal stem cells, wherein the conditions which lead to a myogenic differentiation comprise incubation in a nutrient medium, which in comparison to the standard medium has a reduced content of methionine of at most 5 µM; and

(c) harvesting the myogenically differentiated cells.

2. The method according to claim 1, wherein the mesenchymal stem cells are perinatal mesenchymal stem cells.

3. The method according to claim 1 or 2, wherein the growth of the mesenchymal stem cells comprises introduction of the mesenchymal stem cells into a serum-free nutrient medium, which preferably contains a proportion of conditioned serum-free medium.

4. The method according to any one of claims 1 to 3, wherein the conditions which lead to a myogenic differentiation comprise incubation in a nutrient medium with a concentration of methionine of at most 4 µM, preferably at most 3 µM, still more preferably at most 2.5 µM, and most preferably incubation in a nutrient medium without added methionine (0 µM methionine).

5. The method according to any one of claims 1 to 4, wherein during the myogenic differentiation contact of the mesenchymal stem cells with a solid surface is

avoided, whereby microtissues of myogenically differentiated mesenchymal stem cells are preferentially produced.

6. The method according to claim 1, wherein step (a) comprises the following steps:

(A) providing at least one perinatal tissue of an umbilical cord of an agricultural animal;

(B) chopping the perinatal tissue, so that pieces thereof are obtained,

(C) incubating the pieces of the perinatal tissue in a nutrient medium;

(D) whereby mesenchymal stem cells are obtained.

7. The method according to claim 6, wherein the nutrient medium in step (C) is a nutrient medium which is free from serum of an agricultural animal, and is preferably a serum-free medium.

8. Use of a nutrient medium which in comparison to the standard medium has a reduced content of methionine of at most 5 µM for the differentiation of mesenchymal stem cells from umbilical cord of an agricultural animal.

9. A method for producing a meat-like composition, comprising

I) myogenic differentiation of mesenchymal stem cells according to the method of the invention for the myogenic differentiation of mesenchymal stem cells according to one of Claims 1 to 7;

II) three-dimensional structuring of the differentiated mesenchymal stem cells obtained in step I), and

III) growth of the cells in the three-dimensional structure obtained in step II).

10. The method according to claim 9, wherein the three-dimensional structure in step II) is obtained by

bioprinting of differentiated mesenchymal stem cells, preferably by bioprinting of microtissues containing differentiated mesenchymal stem cells.