THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Barley grain comprising a reduced level or activity of SSIIa protein and a starch content of at least 41% (w/w).

2. The barley grain of claim 1, comprising a starch content of at least 43% (w/w), at least 45% (w/w), at least 47% (w/w), at least 50% (w/w), or comprising a starch content of 41-65% (w/w).

3. The grain of claim 1 or 2, comprising an amylose content of at least 50% as a proportion of the total starch in the grain.

4. The grain of claim 3, comprising an amylose content of at least 60% as a proportion of the total starch in the grain.

5. The grain of any one of claims 1 to 4, comprising a β-glucan content of 5-9% (w/w), or greater than 9% (w/w).

6. The grain of any one of claims 1 to 5, comprising a fructan content of 3-11% (w/w), or 4-11% (w/w).

7. The grain of claim 6, wherein the fructan comprises a degree of polymerization from about 3 to about 12.

8. The grain of any one of claims 1 to 7 comprising a mutation in an endogenous gene encoding a polypeptide with SSIIa activity wherein the mutation reduces the expression of the gene encoding SSIIa in a barley plant or leads to the expression of SSIIa with reduced level or activity.

9. The grain of claim 8 which is homozygous for the *sex6*-292 allele.

10. The grain of any one of claims 1 to 7 wherein the level of SSIIa is reduced by an exogenous nucleic acid molecule which down-regulates the expression of a gene encoding SSIIa in a barley plant.

11. The grain of claim 10 wherein the exogenous nucleic acid molecule comprises a gene-silencing chimeric gene, an antisense, ribozyme, co-suppression, dsRNA molecule, hairpin RNA molecule or microRNA that down-regulates endogenous *SSIIa* expression.

12. The grain of any one of claims 1 to 11, wherein the grain further comprises a genetic variation which reduces the activity of an *amo1* gene.

13. The grain of claim 12 wherein the genetic variation comprises a mutation in an *amo1* gene.

14. The grain according to any one of claims 1 to 13, which is homozygous for the *amo1*-AC38 allele.

15. The grain of any one of claims 1 to 14 which is wholegrain or cracked, ground, polished, milled, kibbled, rolled or pearled grain.

16. A barley plant capable of producing the grain according to any one of claims 1 to 15.

17. Barley wholemeal or flour produced from the grain according to any one of claims 1 to 15.

18. A method of producing a food or beverage product, wherein the method comprises:

(i) obtaining or producing barley grain according to any one of claims 1 to 15; and

(ii) processing the grain to produce the product.

19. The method of claim 18 wherein the product is selected from the group consisting of wholemeal, flour, starch, bran, β-glucan, fructan, a non-starch polysaccharide, and cracked, ground, polished, milled, kibbled, rolled or pearled grain.

20. The method of claim 18 or 19 wherein the processed barley grain is mixed with one or more other ingredients to make the food or beverage product.

21. The method according to any one of claims 18 to 20 further comprising:

(iii) assessing the level or type of starch, starch content, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharides, dietary fibre, resistant starch in the barley grain or the product therefrom.

22. The method of any one of claims 18 to 21 wherein the food or beverage product is a grain, flour, breakfast cereal, biscuit, muffin, muesli bar, noodle, a sweetening agent, a low calorie additive, a bulking agent, a dietary fibre, a texturizing agent, a preservative, a probiotic agent or the like or any combination of these.

23. A method of producing a barley plant capable of producing grain which has a reduced level or activity of SSIIa protein and a starch content of at least 41%, wherein the method comprises: (i) introducing into said plant an agent which down-regulates the level or activity of endogenous starch synthase IIa (SSIIa) in the plant relative to a control plant, or a mutation in an endogenous gene encoding SSIIa in the plant, and (ii) selecting the barley plant which produces said grain and a genetic variation which reduces the activity of an *amo1* gene.

24. The method of claim 23 comprising introducing into the plant a genetic variation which reduces the activity of an *amo1* gene.

25. The method of claim 23 wherein the agent comprises a nucleic acid molecule which down-regulates endogenous *SSIIa* gene expression.

26. The method of claim 25 wherein the nucleic acid molecule comprises a gene-silencing chimeric gene, an antisense, ribozyme, co-suppression, dsRNA molecule, hairpin RNA or other exogenous nucleic acid molecule that down-regulates endogenous *SSII* expression.

27. The method according to any one of claims 23 to 26 wherein the method further comprises assessing the level, activity and/or type of starch, starch content, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharide, dietary fibre or resistant starch in the barley grain or a product therefrom, or analysing the plant with one or more genetic markers.

28. The method of any one of claims 23 to 27 wherein the reduced level or activity of SSIIa protein is less than 25%, less than 10%, less than 5%, or essentially lacking relative to that of a control plant or the plant prior to the introduction of the agent or mutation.

29. A method of producing the barley grain of claims 1 to 15, comprising the steps of growing a barley plant and harvesting the grain.

30. The plant or grain or wholemeal or flour of any one of claims 1 to 17 when used or for use in the production of a product to increase the level of resistant starch, dietary fibre, water soluble carbohydrate, β-glucan, fructan or non-starch carbohydrate in said product or to decrease the glycemic index (GI) of said product.

31. Use of starch, β-glucan or fructan isolated from a plant, grain, wholemeal or flour of any one of claims 1 to 17 in a food as a sweetening agent, a low calorie additive, a bulking agent, a dietary fibre, a texturizing agent, a preservative, a probiotic agent or the like or any combination of these.

32. Use of a grain, flour, wholemeal, starch, β-glucan or fructan isolated from a plant, grain, wholemeal or flour of any one of claims 1 to 17 in the production of a food product to increase the level of resistant starch, dietary fibre, water soluble carbohydrate, β-glucan or fructan in said food product or to decrease the glycemic index (GI) of said food product.

33. Use of claim 32 wherein the level of amylose, β-glucan and fructan are increased.

34. A food product comprising a food ingredient at a level of at least 10% on a dry weight basis, wherein the food ingredient is a barley grain of any one of claims 1 to 15 or wholemeal or flour obtained therefrom wherein the wholemeal or flour comprises a reduced level or activity of SSIIa protein and a starch content of at least 41% (w/w).

35. The food product of claim 34 wherein the wholemeal or flour comprises 3-11% fructan (w/w) or 4-11% (w/w) fructan on a weight basis.

36. The food product of claim 34 or 35 wherein the wholemeal or flour comprises a β-glucan content of 5-9% (w/w), or greater than 9% (w/w).

37. The food product of any one of claims 34 to 36 where the wholemeal or flour comprises 50% or 60% amylose as a proportion of total starch in the wholemeal or flour.

38. The food product of any one of claims 34 to 37 wherein the product is selected from the group consisting of bread, buns, breakfast cereal, cake, biscuit, pastry, crackers, muffins, pizza, croissants, bagels, pretzels, pasta, noodles, baking ingredients, baking mixes, soup, sauce, thickening agent, confectionary, and other farinaceous goods.

39. The product of any one of claims 34 to 38 wherein the barley comprises the *sex6-292* allele.

40. Use of a grain or flour isolated from a plant or grain of any one of claims 1 to 17 in the product of a food product to increase the level of starch, starch content, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharide, dietary fibre or resistant starch in the food product.

41. A method of identifying a variety of barley grain which has increased levels of amylose, and one or more of starch, starch content, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharide, dietary fibre or resistant starch:

(i) obtaining barley grain which is altered in starch *via* synthesis or catabolism,

(ii) determining the amount of starch, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharide, dietary fibre or resistant starch in the grain,

(iii) comparing the level in (ii) to that in a control grain or parental grain; and

(iv) if the level of one or more of starch, starch content, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharide, dietary fibre or resistant starch are increased in the altered grain, selecting the grain.

42. The method of claim 41 which further comprises mutagenesis or plant cell transformation prior to step (i).

43. A method of determining the amount of fructan in barley grain, comprising the step of obtaining grain according to any one of claims 1 to 17, processing the grain so as to extract the fructan, and measuring the amount of extracted fructan so as to determine the amount of fructan in the grain.

44. A method for preparing a food or beverage, comprising mixing the barley grain of any one of claims 1 to 15 or the barley wholemeal or flour of claim 17 with another food or beverage ingredient.

45. A method for providing starch, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharide, dietary fibre or resistant starch to improve one or more indicators of health in a mammal, wherein the method comprises administering, to the mammal, a composition comprising barley grain, wholemeal or flour according to any one of claims 1 to 17 or the food product according to any one of claims 34 to 39.

46. The method of claim 45 wherein the grain, flour, starch, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharide, dietary fibre or resistant starch is in the form of a food product, a beverage or a pharmaceutical composition.

47. The method of claim 45 or 46, wherein the one or more indicators of health is an increased number of beneficial intestinal bacteria, reduced number of aberrant crypt foci, increased mineral absorption, reduced level of insulin, reduced glycaemic index, reduced glycaemic load, reduced blood glucose, reduced blood pressure, reduced body weight, reduced blood cholesterol level, increased HDL cholesterol level, increased bone density, increased calcium levels, more frequent bowel movement, or improved blood serum cardiovascular profile.

48. A method for ameliorating one or more symptoms of a condition associated with low levels of dietary starch, starch content, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharide, dietary fibre or resistant starch in a subject, said method comprising administering orally to the subject grain according to any one of claims 1 to 17 or a processed product comprising the starch, starch content, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharide, dietary fibre or resistant starch obtained therefrom for a time and under conditions sufficient to ameliorate one or more symptoms.

49. The method of claim 48 wherein the condition is selected from the group consisting of diabetes, obesity, heart disease, hypertension, constipation, osteoporesis and cancer.

50. The method of claim 48 wherein the subject is a human.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Barley grain comprising

(i) a mutation in an endogenous *SSIIa* gene or an exogenous nucleic acid molecule which down-regulates the expression of a *SSIIa* gene in a barley plant, wherein the mutation reduces expression of the *SSIIa* gene in a barley plant relative to a wild-type *SSIIa* gene and/or leads to the expression of a SSIIa polypeptide having reduced starch synthase activity relative to a wild-type SSIIa polypeptide,

(ii) a mutation in an *amo1* gene which reduces the activity of the *amo1* gene,

(iii) a reduced level or activity of the SSIIa polypeptide relative to wild-type barley grain, and

(iv) a starch content of at least 41% (w/w).

2. The grain of claim 1, comprising a starch content of at least 43% (w/w), at least 45% (w/w), at least 47% (w/w), at least 50% (w/w), or whose starch content is between 41% and 65% (w/w).

3. The grain of claim 1 or claim 2, comprising an amylose content of at least 50% or at least 60% as a proportion of the total starch in the grain.

4. The grain of any one of claims 1 to 3, comprising (i) a β-glucan content of 5-9% (w/w) or greater than 9% (w/w), (ii) a fructan content of 3-11% (w/w) or 4-11% (w/w), or (iii) a fructan content of 3-11% (w/w) or 4-11% (w/w), wherein the fructan comprises a degree of polymerization from about 3 to about 12.

5. The grain of any one of claims 1 to 4 which is homozygous for the *sex6*-292 allele.

6. The grain of any one of claims 1 to 5 wherein the level or activity of SSIIa is reduced by an exogenous nucleic acid molecule which down-regulates the expression of a *SSIIa* gene in a barley plant.

7. The grain of claim 6 wherein the exogenous nucleic acid molecule comprises a gene-silencing chimeric gene, an antisense, ribozyme, co-suppression or dsRNA molecule, a hairpin RNA molecule or a microRNA that down-regulates endogenous *SSIIa* expression.

8. The grain according to any one of claims 1 to 7, which is homozygous for the *amo1*-AC38 allele.

9. The grain of any one of claims 1 to 8 which is wholegrain or cracked, ground, polished, milled, kibbled, rolled or pearled grain.

10. A barley plant capable of producing the grain according to any one of claims 1 to 9.

11. Barley wholemeal or flour produced from the grain according to any one of claims 1 to 9.

12. A method of producing a food or beverage product, wherein the method comprises:
    (i) obtaining or producing barley grain according to any one of claims 1 to 9; and
    (ii) processing the grain to produce the product.

13. The method of claim 12 wherein the product is selected from the group consisting of wholemeal, flour, starch, bran, β-glucan, fructan, a non-starch polysaccharide, and cracked, ground, polished, milled, kibbled, rolled or pearled grain.

14. The method of claim 12 or claim 13 wherein the food or beverage product is a grain, flour, breakfast cereal, biscuit, muffin, muesli bar, noodle, a sweetening agent, a low calorie additive, a bulking agent, a dietary fibre, a texturizing agent, a preservative, a probiotic agent or the like or any combination of these.

15. A method of producing a barley plant capable of producing grain which comprises (i) a mutation in an *amo1* gene which reduces the activity of the *amo1* gene, (ii) a reduced level or activity of a SSIIa polypeptide relative to wild-type barley grain and (iii) a starch content of at least 41% (w/w), wherein the method comprises: (a) introducing into a barley plant an agent which down-regulates the level or activity of endogenous starch synthase IIa (SSIIa) in the plant relative to a control plant, or a mutation in an endogenous *SSIIa* gene in the plant, and (b) selecting the barley plant which produces said grain.

16. The method of claim 15 further comprising introducing into the plant the mutation which reduces the activity of the *amo1* gene.

17. A method of producing the barley grain of claims 1 to 9, comprising the steps of growing a barley plant and harvesting the grain.

18. The barley grain of any one of claims 1 to 9, the barley plant of claim 10 or the barley wholemeal or flour of claim 11 when used in the production of a product to increase the level of resistant starch, dietary fibre, water soluble carbohydrate, β-glucan, fructan or non-starch carbohydrate in said product or to decrease the glycemic index (GI) of said product.

19. Use of starch, β-glucan or fructan isolated from a grain of any one of claims 1 to 9, a plant of claim 10 or wholemeal or flour of claim 11 in a food as a sweetening agent, a low calorie additive, a bulking agent, a dietary fibre, a texturizing agent, a preservative, a probiotic agent or the like or any combination of these.

20. A food product comprising a food ingredient at a level of at least 10% on a dry weight basis, wherein the food ingredient is a barley grain of any one of claims 1 to 9 or wholemeal or flour obtained therefrom wherein the wholemeal or flour comprises (i) a reduced level or activity of SSIIa polypeptide relative to a wild-type barley wholemeal or flour and (ii) a starch content of at least 41% (w/w).

21. The food product of claim 20 wherein the product is selected from the group consisting of bread, buns, breakfast cereal, cake, biscuit, pastry, crackers, muffins, pizza, croissants, bagels, pretzels, pasta, noodles, baking ingredients, baking mixes, soup, sauce, thickening agent, confectionary, and other farinaceous goods.

22. Use of a grain of any one of claims 1 to 9 or the wholemeal or flour of claim 11 in the production of a food product to increase the level of starch, starch content, amylose, amylopectin, β-glucan, fructan, non-starch polysaccharide, dietary fibre or resistant starch in the food product.

23. A method for preparing a food or beverage, comprising mixing the barley grain of any one of claims 1 to 9 or the barley wholemeal or flour of claim 11 with another food or beverage ingredient.