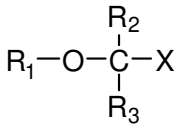
CLAIMS

1. A lipid compound of formula (I):



(I),

wherein R_1 is a C_{10}-C_{22} alkenyl group having 3-6 double bonds or a C_{16}-C_{22} alkynyl group having 1-6 triple bonds;

R_2 and R_3 are the same or different and are chosen from a hydrogen atom, an alkyl group, a halogen atom, an alkoxy group, an acyloxy group, an acyl group, an alkenyl group, an alkynyl group, an aryl group, an alkylthio group, an alkylsulfinyl group, an alkylsulfonyl group, an amino group, and an alkylamino group, with the proviso that R_2 and R_3 are not both a hydrogen atom; or

R_2 and R_3 together form a cycloalkyl group; and

X is a carboxylic acid or a derivative thereof,

or a pharmaceutically acceptable salt, solvate, or a solvate of such salt.

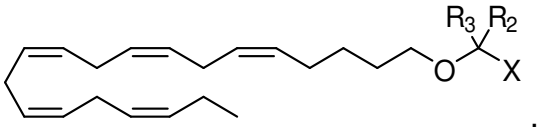
2. A lipid compound according to claim 1, wherein R_1 is a C_{10}-C_{22}-alkenyl group having 3-6 double bonds.

3. A lipid compound according to claim 1, wherein the double bonds are methylene interrupted double bonds in the *Z* configuration.

4. A lipid compound according to claim 1, wherein R_1 is a C_{14}-C_{22} alkenyl group having at least one double bond having *Z* configuration, and having the first double bond at the third carbon-carbon bond from the omega (ω) end of the carbon chain.

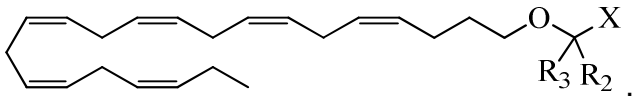
5. A lipid compound according to claim 1, wherein R_1 is chosen from a C_{18}, C_{20}, or C_{22} alkenyl group having 3, 4, 5, or 6 double bonds.

6. A lipid compound according to claim 1, of formula:



.

7. A lipid compound according to claim 1, of formula:

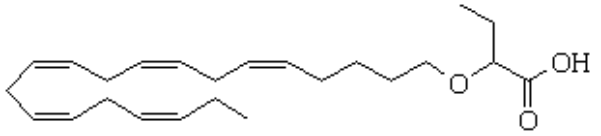


.

8. A lipid compound according to claim 1, wherein R_2 is hydrogen, R_3 is an alkyl group, and X is a carboxylic acid.

9. A lipid compound according to claim 8, wherein the alkyl group is an ethyl group.

10. A lipid compound according to claim 1, of formula:



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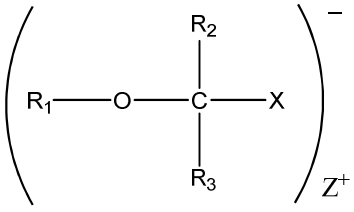
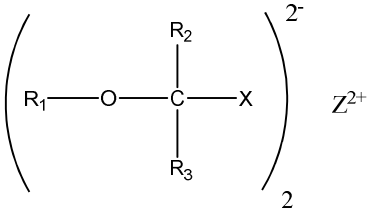
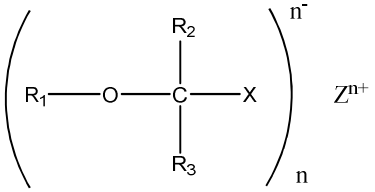
11. A lipid compound according to claim 1, wherein the salt of the compound of formula (I) is chosen from



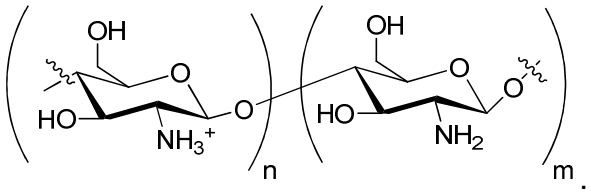
wherein X is COO^-, and Z^+ is chosen from Li^+, Na^+, K^+, NH_4^+, a protonated primary amine, a protonated aminopyridine, a protonated secondary amine, a protonated tertiary amine, a protonated guanidine, or a protonated heterocycle;



wherein X is COO^-, and Z^{2+} is chosen from Mg^{2+}, Ca^{2+}, or a diprotonated diamine; or



wherein X is COO^- and Z^{n+} is protonated Chitosan:



12. A lipid compound according to claim 1, wherein R_2 and R_3 are independently chosen from a hydrogen atom, an alkyl group, or an alkoxy group.

13. A lipid compound according to claim 12, wherein the alkyl group is methyl, ethyl, or propyl.

14. A lipid compound according to claim 1, wherein one of R_2 and R_3 is a hydrogen atom, and the other one of R_2 and R_3 is chosen from an alkyl group, a

halogen atom, an alkoxy group, an acyloxy group, an acyl group, an alkenyl group, an alkynyl group, an aryl group, an alkylthio group, an alkylsulfinyl group, an alkylsulfonyl group, an amino group, and an alkylamino group.

15. A lipid compound according to claim 1, wherein X is a carboxylic acid or a derivative thereof in the form of an ester, a mono-glyceride, a 2-mono-glyceride, a diglyceride, a triglyceride, or a phospholipid.

16. A lipid compound according to claim 15, wherein X is a carboxylic acid.

17. A lipid compound according to claim 1, in a mixture of diastereomers, enantiomers, or in racemic form.

18. A lipid compound according to claim 1, wherein the compound is chosen from:

(A) a lipid compound derived from polyunsaturated fatty acids, wherein R_1 is a C_{20} alkenyl having 5 double bonds;

(B) a lipid compound derived from polyunsaturated fatty acids, wherein R_1 is a C_{22} alkenyl having 6 double bonds;

(C) a lipid compound derived from polyunsaturated fatty acids, wherein R_1 is a C_{18} alkyenyl having 3 double bonds;

(D) a lipid compound derived from polyunsaturated fatty acids, wherein R_1 is a C_{15} alkenyl having 4 double bonds;

(E) a lipid compound derived from polyunsaturated fatty acids, wherein R_1 is a C_{18} alkenyl having 5 double bonds;

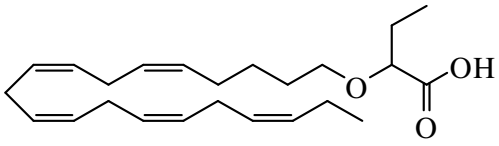
(F) a lipid compound wherein X is a carboxylic acid in the form of a triglyceride; or

(G) a lipid compound wherein X is a carboxylate salt.

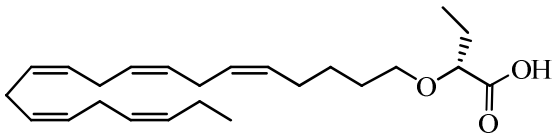
19. A lipid compound according to claim 15, wherein the compound is present in the form of its R enantiomer at the carbon attached to -OR_1, R_2, R_3, and X.

20. A lipid compound according to claim 15, wherein the compound is present in the form of its S enantiomer at the carbon attached to -OR_1, R_2, R_3, and X.

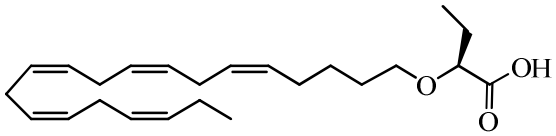
21. A lipid compound according to claim 1, wherein the compound is:



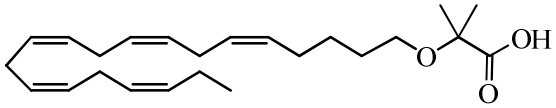
2-((5Z,8Z,11Z,14Z,17Z)-Icosa-5,8,11,14,17-pentaenyloxy)butanoic acid;



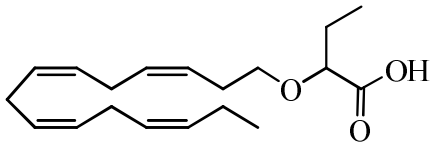
(R)-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenyloxy)butanoic acid;



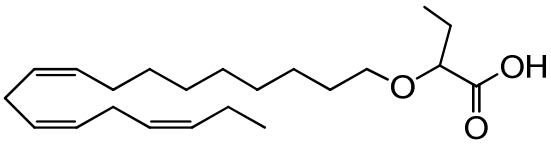
(S)-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenyloxy)butanoic acid;



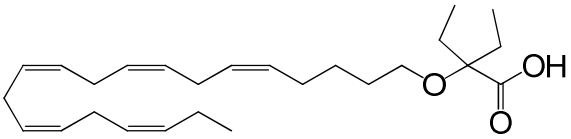
2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenyloxy)-2-methylpropanoic acid;



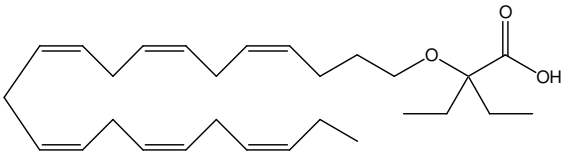
2-((3Z,6Z,9Z,12Z)-pentadeca-3,6,9,12-tetraenyloxy)butanoic acid;



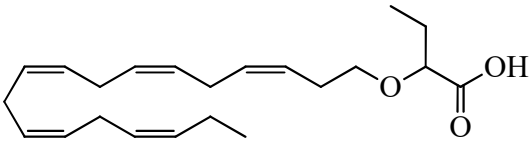
2-((9Z,12Z,15Z)-octadeca-9,12,15-trienyloxy)butanoic acid;



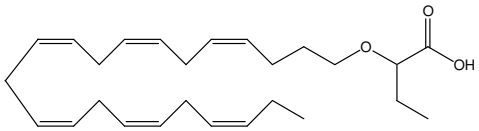
2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenyloxy)butanoic acid,



2-ethyl-2-((4Z,7Z,10Z,13Z,16Z,19Z)-docosa-4,7,10,13,16,19-hexaenyloxy)butanoic acid,



2-((3Z,6Z,9Z,12Z,15Z)-octadeca-3,6,9,12,15-pentaenyloxy)butanoic acid, or



2-((4Z,7Z,10Z,13Z,16Z,19Z)-docosa-4,7,10,13,16,19-hexaenyloxy)butanoic acid.

22. A pharmaceutical composition comprising a lipid compound according to any one of claims 1 to 21.

23. A pharmaceutical composition according to claim 22, further comprising a pharmaceutically acceptable carrier, excipient or diluent, or any combination thereof.

24. A pharmaceutical composition according to claim 22, further comprising a pharmaceutically acceptable antioxidant.

25. A pharmaceutical composition according to claim 22, formulated for oral administration.

26. A pharmaceutical composition according to claim 22, wherein the at least one lipid compound is administered in a daily dose ranging from 1 mg to 3 g.

27. A pharmaceutical composition according to claim 22, in the form of a gelatin capsule, a tablet, or a sachet.

28. A lipid composition comprising at least one lipid compound according to any one of claims 1 to 21.

29. A lipid compound according to any one of claims 1 to 21, for use as a medicament.

30. A compound according to any one of claims 1 to 21 for use in preventing or treating a disease or condition chosen from: inflammation; rheumatoid arthritis; inflammatory bowel disease (IBD); atherosclerosis; peripheral insulin resistance; diabetes; dyslipidemia or mixed dyslipidemia; metabolic syndrome; obesity or an overweight condition; or fatty liver disease.

31. The compound according to claim 30, wherein the dyslipidemia is hypertriglyceridemia.

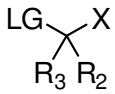
32. A compound according to any one of claims 1 to 21 for use in lowering cholesterol.

33. The compound according to claim 32, wherein the cholesterol is non-HDL cholesterol.

34. The compound according to claim 32, wherein the cholesterol is LDL and/or VLDL cholesterol.

35. A compound according to any one of claims 1 to 21 for use in raising HDL cholesterol.

36. A method for the production of a lipid compound according to claim 1 comprising

a) reacting R_1-OH with  , wherein LG is a leaving group; and

b) isolating the lipid compound.

37. A method according to claim 36, wherein the leaving group is chosen from a mesylate group, a toslyate group, a hydroxy group, or a halogen atom.

38. A method according to claim 36, further comprising protection and de-protection steps.

39. A method according to claim 36, wherein step a) is run under Mitsonubo conditions.

40. A method for the production of 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenyloxy)butanoic acid comprising

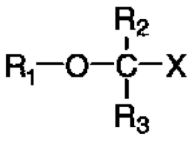
a) reacting (5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaen-1-ol with *t*-butyl 2-bromobutyrate;

b) converting the ester that results from step a) into a carboxylic acid; and

c) isolating said 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenyloxy)butanoic acid.

41. The pharmaceutical composition according to claim 24, wherein the antioxidant is tocopherol or 3-BHA.

42. A pharmaceutical formulation comprising a lipid compound of formula (I):



(I),

wherein R_1 is a C_{10}-C_{22} alkenyl group having 3-6 double bonds or a C_{16}-C_{22} alkynyl group having 1-6 triple bonds;

R_2 and R_3 are the same or different and are chosen from a hydrogen atom, an alkyl group, a halogen atom, an alkoxy group, an acyloxy group, an acyl group, an alkenyl group, an alkynyl group, an aryl group, an alkylthio group, an alkylsulfinyl group, an alkylsulfonyl group, an amino group, and an alkylamino group, with the proviso that R_2 and R_3 are not both a hydrogen atom; or

R_2 and R_3 together form a cycloalkyl group; and

X is a carboxylic acid or a derivative thereof,

or a pharmaceutically acceptable salt, solvate, or a solvate of such salt;

an emulsifier,

a viscosity modifier,

an antioxidant,

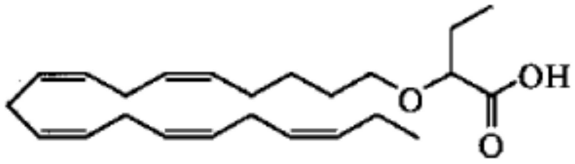
and a fatty substance.

43. The pharmaceutical formulation of claim 42, wherein the antioxidant is 3-BHA.

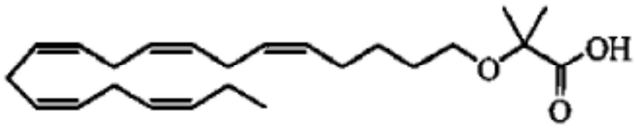
44. The pharmaceutical formulation of claim 42, wherein the formulation is in the form of an emulsion.

45. The pharmaceutical formulation of claim 42, further comprising gelatin.

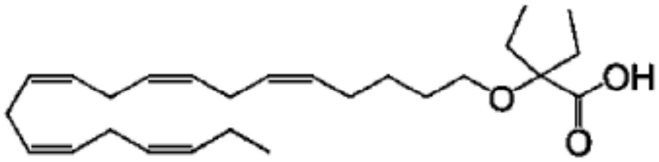
46. A pharmaceutical formulation comprising a lipid chosen from



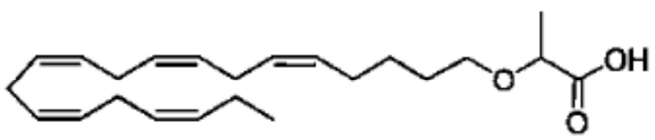
2-((5Z,8Z,11Z,14Z,17Z)-lcosa-5,8,11,14,17-pentaenyloxy)butanoic acid;



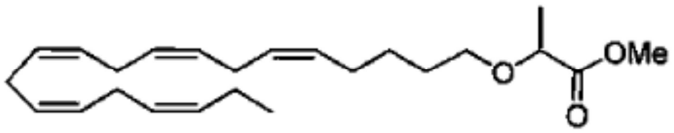
2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenyloxy)-2-methylpropanoic acid;



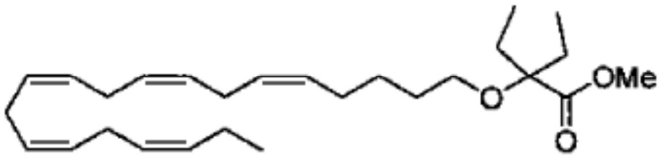
2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenyloxy)butanoic acid;



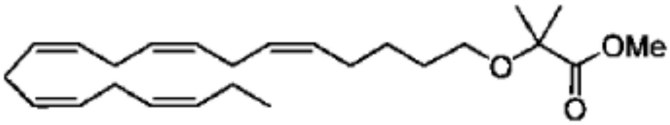
2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaenyloxy)propanoic acid;



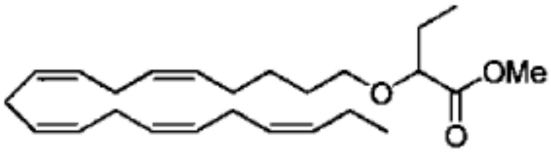
methyl 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaen-1-yloxy)propanoate;



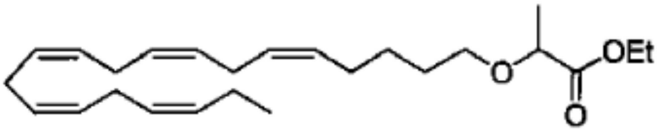
methyl 2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8, 11,14,17-pentaen-1-yloxy)butanoate;



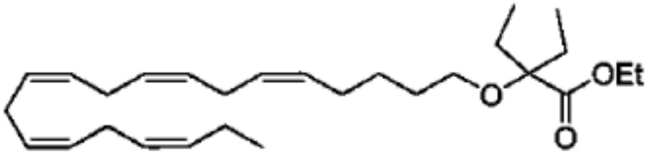
methyl 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaen-1-yloxy)-2-methylpropanoate;



methyl 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaen-1-yloxy)butanoate;

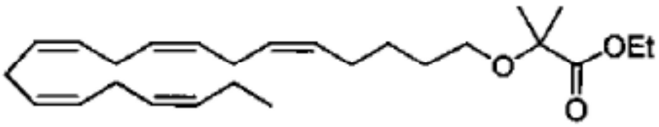


ethyl 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaen-1-yloxy)propanoate;

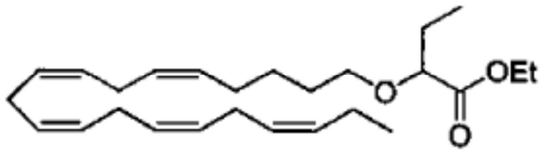


ethyl 2-ethyl-2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaen-1-

yloxy)butanoate;



ethyl 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaen-1-yloxy)-2-methylpropanoate; or



ethyl 2-((5Z,8Z,11Z,14Z,17Z)-icosa-5,8,11,14,17-pentaen-1-yloxy)butanoate;

an emulsifier,

a viscosity modifier,

an antioxidant,

and a fatty substance.

47. A lipid compound of claim 1, wherein the carboxylic acid derivative is a carboxamide.

48. A lipid compound according to claim 10, wherein the compound is present as a racemate.

49. A lipid compound according to any one of claims 1 to 21 for use in reducing body weight and/or preventing body weight gain.