Supporting information

The magnitude and progress of lean body mass, fat-free mass and skeletal muscle mass loss following bariatric surgery: a systematic review and meta-analysis.

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Supplemental Table 1. Extensive search strategy for all key words adapted for each database.

Key word	Pubmed	EMBASE	Web of science
Bariatric surgery	"Bariatric Surgery"[Mesh:NoExp] OR "Gastroplasty"[Mesh] OR "Jejunoileal Bypass"[Mesh] OR "Gastric Bypass"[Mesh] OR "Anastomosis, Roux-en-Y"[Mesh] OR "Biliopancreatic Diversion"[Mesh] OR bariatric surg*[tiab] OR weight loss surger*[tiab] OR metabolic surger*[tiab] OR gastric bypass[tiab] OR RYGB[tiab] OR Sleeve gastrectom*[tiab] OR Sleeved gastrectom*[tiab] OR Gastric sleev*[tiab] OR gastric band*[tiab] OR Gastroileal Bypass[tiab] OR Gastrojejunostom*[tiab] OR Gastroplast*[tiab] OR Jejunoileal Bypass[tiab] OR Jejuno-ileal Bypass[tiab] OR Intestinal Bypass[tiab] OR bariatric oper*[tiab] OR bariatric procedure*[tiab] OR obesity surg*[tiab] OR stomach bypass[tiab] OR jejunoileac bypass[tiab] OR ileojejunal bypass[tiab] OR Intestine bypass[tiab] OR Ileum bypass[tiab] OR Ileal bypass[tiab] OR Biliopancreatic[tiab] OR Bilio pancreatic[tiab] OR Duodenal switch[tiab] OR biliointestinal anastomosis[tiab] OR intestinal anastomosis[tiab] OR intestine anastomosis[tiab] OR roux-en-Y[tiab] OR roux Y[tiab]	exp bariatric surgery/ OR exp gastric bypass surgery/ OR Gastroplasty/ OR exp intestine bypass/ OR exp intestine anastomosis/ OR (bariatric surg* OR bariatric oper* OR bariatric procedure* OR obesity surg* OR weight loss surger* OR metabolic surger* OR gastric bypass OR stomach bypass OR RYGB OR Sleeve gastrectom* OR Sleeved gastrectom* OR Gastric sleev* OR gastric band* OR Gastroileal Bypass OR Gastrojejunostom* OR Gastroplast* OR Jejunoileal Bypass OR Jejuno-ileal Bypass OR jejunoileac bypass OR ileojejunal bypass OR Intestinal Bypass OR Intestine bypass OR Ileum bypass OR Ileal bypass OR Biliopancreatic OR Bilio pancreatic OR Duodenal switch OR biliointestinal anastomosis OR intestinal anastomosis OR intestine anastomosis OR roux-en-Y OR roux Y).ti,ab,kw.	"bariatric surg*" OR "bariatric oper*" OR "bariatric procedure*" OR "obesity surg*" OR "weight loss surger*" OR "metabolic surger*" OR "gastric bypass" OR "stomach bypass" OR RYGB OR "Sleeve gastrectom*" OR "Sleeved gastrectom*" OR "Gastric sleev*" OR "gastric band*" OR "Gastroileal Bypass" OR Gastrojejunostom* OR Gastroplast* OR "Jejunoileal Bypass" OR "Jejuno-ileal Bypass" OR "jejunoileac bypass" OR "ileojejunal bypass" OR "Intestinal Bypass" OR "Intestine bypass" OR "Ileum bypass" OR "Ileal bypass" OR Biliopancreatic OR "Bilio pancreatic" OR "Duodenal switch" OR "biliointestinal anastomosis" OR "intestinal anastomosis" OR "intestine anastomosis" OR "roux-en-Y" OR "roux Y"

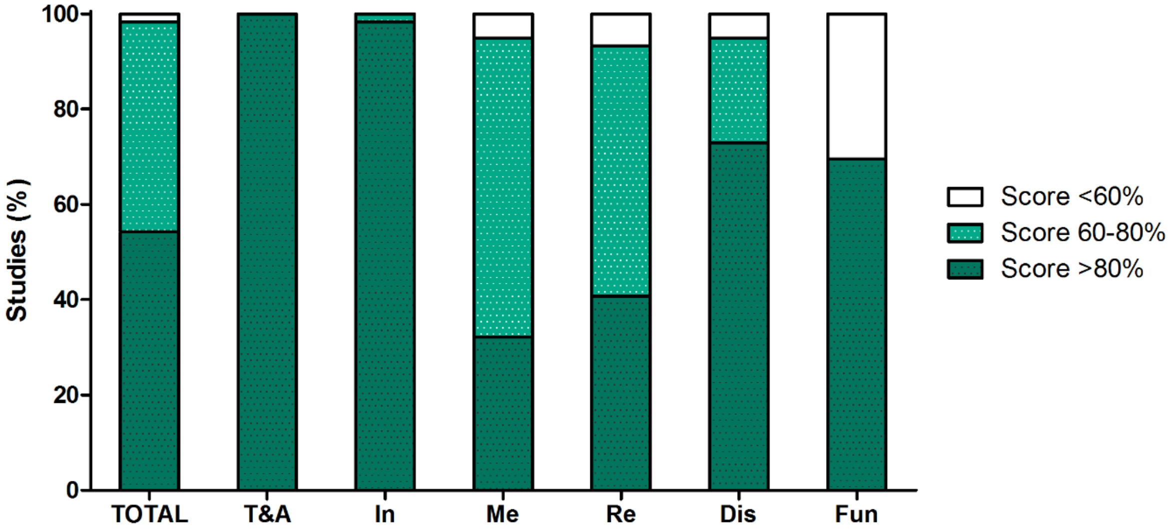
DXA	"Absorptiometry, Photon"[Mesh] OR DEXA[tiab] OR DXA[tiab] OR dual energ*[tiab] OR Dual-Photon Absorptiometr*[tiab] OR X-Ray Absorptiometr*[tiab] OR XRay Absorptiometr*[tiab]	dual energy X ray absorptiometry/ OR dual energy computed tomography/ OR (DEXA OR DXA OR dual energ* OR Dual-Photon Absorptiometr* OR X-Ray Absorptiometr* OR XRay Absorptiometr*).ti,ab,kw.	DEXA OR DXA OR "dual energ*" OR "Dual-Photon Absorptiometr*" OR "X-Ray Absorptiometr*" OR "XRay Absorptiometr*"
CT / MRI	"Tomography, X-Ray Computed"[Mesh] OR CT[tiab] OR CAT[tiab] OR Computed tomography[tiab] OR Computer assisted tomography[tiab] OR Computed X Ray Tomography[tiab] OR Computerized Tomography[tiab] OR X-Ray Computerized Axial Tomography[tiab] OR XRay Computerized Axial Tomography[tiab] OR Computerized X ray tomography[tiab] OR Computerised X ray tomography[tiab] OR Computerized Xray tomography[tiab] OR Computerised Xray tomography[tiab] OR Computerised Tomography[tiab] OR X-Ray Computerised Axial Tomography[tiab] OR XRay Computerised Axial Tomography[tiab] OR "magnetic resonance imaging"[MeSH Terms] OR magnetic resonance imaging[tiab] OR mri[tiab] OR MR Tomography[tiab]	exp computer assisted tomography/ OR (CT OR CAT OR Computed tomograph* OR Computer assisted tomography OR Computed X Ray Tomograph* OR Computeri#ed Tomograph* OR X-Ray Computeri#ed Axial Tomograph* OR Computeri#ed X ray tomography OR Computeri#ed Xray tomography OR XRay Computeri#ed Axial Tomography).ti,ab,kw. OR exp nuclear magnetic resonance imaging/ OR (magnetic resonance imaging OR mri OR MR Tomography OR mr imaging OR magnetic resonance tomography).ti,ab,kw. OR X ray absorptiometry/ OR single energy X ray absorptiometry/ OR (X ray absorptiometry OR Xray absorptiometry).ti,ab,kw.	CT OR CAT OR "Computed tomograph*" OR "Computer assisted tomography" OR "Computed X Ray Tomograph*" OR "Computeri?ed Tomograph*" OR "X-Ray Computeri?ed Axial Tomograph*" OR "XRay Computeri?ed Axial Tomograph*" OR "Computeri?ed X ray tomography" OR "Computeri?ed Xray tomography" OR "magnetic resonance imaging" OR mri OR "MR Tomography" OR "mr imaging" OR "magnetic resonance tomography" OR "X ray absorptiometry" OR "Xray absorptiometry"

	OR mr imaging[tiab] OR magnetic resonance tomography[tiab]		
FFM / LBM / SMM	"muscle, skeletal"[Mesh:NoExp] OR "body composition"[MeSH Terms] OR FFM[tiab] OR fat-free mass[tiab] OR Lean tissue[tiab] OR Lean body mass[tiab] OR Lean mass[tiab] OR muscle mass[tiab] OR muscle tissue[tiab] OR skeletal muscle*[tiab] OR body composition[tiab] OR muscle thickness[tiab] OR muscle volume[tiab] OR lean body weight[tiab] OR lean weight[tiab]	skeletal muscle/ OR fat free mass/ OR muscle mass/ OR muscle thickness/ OR body composition/ OR body fat/ OR body fat distribution/ OR lean body weight/ OR (FFM OR fat-free mass OR Lean tissue OR Lean body mass OR Lean mass OR muscle mass OR muscle tissue OR muscle thickness OR muscle volume OR skeletal muscle* OR body composition OR lean body weight OR lean weight).ti,ab,kw.	FFM OR "fat-free mass" OR "Lean tissue" OR "Lean body mass" OR "Lean mass" OR "muscle mass" OR "muscle tissue" OR "muscle thickness" OR "muscle volume" OR "skeletal muscle*" OR "body composition" OR "lean body weight" OR "lean weight"
Search strategy = Bariatric surgery AND (DXA OR (CT / MRI AND FFM / LBM / SMM)) Pubmed (n=267); EMBASE (n=444); Web of Science (n=280)			

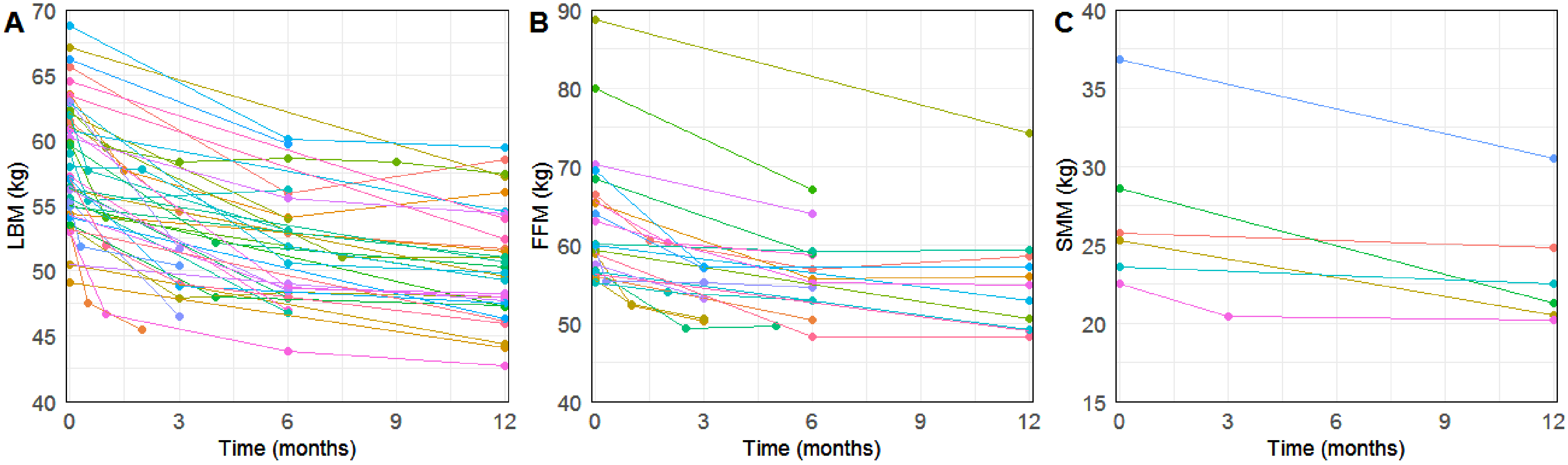
Supplemental Table 2. STROBE total and subscale scores per individual study (n=59).

Study	Total score	Title & Abstract	Intro	Methods	Results	Discussion	Funding
Arhire (2018)	18.5 (61.7)	2 (100)	2 (100)	7 (58.3)	5.5 (61.1)	1 (25)	1 (100)
Bazzocchi (2015)	23.8 (79.3)	2 (100)	2 (100)	9.5 (79.2)	7.5 (83.3)	2.8 (70)	0 (0)
Beckman (2017)	21.8 (72.7)	2 (100)	2 (100)	8.3 (69.2)	5 (55.6)	3.5 (87.5)	1 (100)
Bellicha (2019)	26.1 (87)	2 (100)	2 (100)	9.8 (81.7)	7.5 (83.3)	3.8 (95)	1 (100)
Blom-Høgestøl (2020)	25 (80.6)	2 (100)	2 (100)	10.5 (80.8)	6.5 (72.2)	4 (100)	0 (0)
Bojsen-Møller (2015)	24.6 (82)	2 (100)	2 (100)	9.3 (77.5)	6.5 (72.2)	3.8 (95)	1 (100)
Brzozowska (2020)	27.2 (90.7)	2 (100)	2 (100)	10.1 (84.2)	7.5 (83.3)	3.8 (95)	1 (100)
Busetto (2000)	24.4 (81.3)	2 (100)	2 (100)	9.3 (77.5)	7.5 (83.3)	3.6 (90)	0 (0)
Calleja-Fernández (2015)	27.3 (88.1)	2 (100)	2 (100)	11.5 (88.5)	7 (77.8)	3.8 (95)	1 (100)
Carrasco (2009)	25.3 (84.3)	2 (100)	2 (100)	9.3 (77.5)	7.5 (83.3)	3.5 (87.5)	1 (100)
Chen (2021)	22.2 (74)	2 (100)	2 (100)	7.9 (65.8)	5.5 (61.1)	3.8 (95)	1 (100)
Ciangura (2010)	23.4 (75.5)	2 (100)	2 (100)	9.1 (70)	6.5 (72.2)	3.8 (95)	0 (0)
Clements (2011)	24.8 (82.7)	2 (100)	2 (100)	8.3 (69.2)	7.5 (83.3)	4 (100)	1 (100)
Cole (2017)	25.5 (85)	2 (100)	2 (100)	10 (83.3)	7 (77.8)	3.5 (87.5)	1 (100)
Coupaye (2005)	21.3 (68.7)	2 (100)	2 (100)	8.8 (67.7)	6 (66.7)	2.5 (62.5)	0 (0)
Coupaye (2007)	21.1 (68.1)	2 (100)	2 (100)	7.6 (58.5)	6 (66.7)	3.5 (87.5)	0 (0)
Davidson (2018)	25.1 (81)	2 (100)	2 (100)	9.5 (73.1)	6.8 (75.6)	3.8 (95)	1 (100)
Diniz-Sousa (2020)	30.6 (95.6)	2 (100)	2 (100)	12.8 (91.4)	9 (100)	3.8 (95)	1 (100)
Faucher (2019)	24.5 (79)	2 (100)	2 (100)	11 (84.6)	6 (66.7)	3.5 (87.5)	0 (0)
Favre (2018)	25.8 (83.2)	2 (100)	2 (100)	10 (76.9)	7 (77.8)	3.8 (95)	1 (100)
Fjeldborg (2015)	26.8 (86.5)	2 (100)	2 (100)	10.8 (83.1)	7 (77.8)	4 (100)	1 (100)
Garrapa (2005)	23.5 (75.8)	2 (100)	2 (100)	9 (69.2)	7.5 (83.3)	3 (75)	0 (0)
Hayashi (2017)	23.3 (77.7)	2 (100)	2 (100)	7.8 (65)	8 (88.9)	3.5 (87.5)	0 (0)
Hirsch (2020)	24.9 (83)	2 (100)	2 (100)	8.1 (67.5)	8.3 (92.2)	3.5 (87.5)	1 (100)
Jacobsen (2013)	21.1 (70.3)	2 (100)	1.5 (75)	8.1 (67.5)	6 (66.7)	2.5 (62.5)	1 (100)
Johnson (2017)	21.3 (71)	2 (100)	2 (100)	7.8 (65)	5.5 (61.1)	3 (75)	1 (100)
Jorsal (2020)	25.2 (84)	2 (100)	2 (100)	9.3 (77.5)	7.8 (86.7)	3.1 (77.5)	1 (100)
Kayser (2017)	25.8 (86)	2 (100)	2 (100)	9.5 (79.2)	7.5 (83.3)	3.8 (95)	1 (100)
Kenngott (2019)	25.3 (81.6)	2 (100)	2 (100)	11 (84.6)	6.5 (72.2)	3.8 (95)	0 (0)
Khoo (2014)	27.2 (87.7)	2 (100)	2 (100)	10.6 (81.5)	8 (88.9)	3.6 (90)	1 (100)
Kim (2020)	26.4 (88)	2 (100)	2 (100)	9.6 (80)	7.8 (86.7)	4 (100)	1 (100)
Legro (2012)	26.8 (89.3)	2 (100)	2 (100)	9.5 (79.2)	8.5 (94.4)	3.8 (95)	1 (100)
Lubrano (2004)	18.3 (61)	2 (100)	2 (100)	6.8 (56.7)	5 (55.6)	2.5 (62.5)	0 (0)
Maïmoun (2019)	25.5 (85)	2 (100)	2 (100)	10 (83.3)	7.5 (83.3)	4 (100)	0 (0)
Marengo (2017)	26.3 (87.7)	2 (100)	2 (100)	10.3 (85.8)	7 (77.8)	4 (100)	1 (100)
Matos (2020)	21.6 (72)	2 (100)	2 (100)	7.8 (65)	7 (77.8)	2.8 (70)	0 (0)
Mingrone (2002)	23.6 (78.7)	2 (100)	2 (100)	9.5 (79.2)	7.5 (83.3)	2.6 (65)	0 (0)
Moehlecke (2017)	27.6 (89)	2 (100)	2 (100)	11.8 (90.8)	7 (77.8)	3.8 (95)	1 (100)
Moizé (2013)	25.8 (86)	2 (100)	2 (100)	9.5 (79.2)	7.5 (83.3)	3.8 (95)	1 (100)
Nielsen (2021)	25.4 (84.7)	2 (100)	2 (100)	9.6 (80)	7 (77.8)	3.8 (95)	1 (100)
Olbers (2006)	22.9 (73.9)	2 (100)	1.8 (90)	8.8 (67.7)	8 (88.9)	2.3 (57.5)	0 (0)

Oppert (2018)	27.5 (91.7)	2 (100)	2 (100)	10.5 (87.5)	8 (88.9)	4 (100)	1 (100)
Rabl (2014)	23.9 (79.7)	2 (100)	2 (100)	9.1 (75.8)	6.5 (72.2)	3.3 (82.5)	1 (100)
Raffaelli (2015)	23.3 (77.7)	2 (100)	2 (100)	8 (66.7)	7 (77.8)	3.3 (82.5)	1 (100)
Sajoux (2019)	20.1 (67)	2 (100)	2 (100)	7.6 (63.3)	4.5 (50)	3 (75)	1 (100)
Savastano (2010)	25.1 (83.7)	2 (100)	2 (100)	10 (83.3)	7.3 (81.1)	2.8 (70)	1 (100)
Sergi (2003)	23.3 (77.7)	2 (100)	2 (100)	8.5 (70.8)	7.5 (83.3)	3.3 (82.5)	0 (0)
Tacchino (2003)	18.4 (59.4)	2 (100)	2 (100)	7.9 (60.8)	5 (55.6)	1.5 (37.5)	0 (0)
Talalaj (2020)	21.4 (71.3)	2 (100)	2 (100)	7.3 (60.8)	6.5 (72.2)	2.6 (65)	1 (100)
Tamboli (2010)	26.6 (85.8)	2 (100)	2 (100)	11.8 (90.8)	7 (77.8)	2.8 (70)	1 (100)
Tan (2016)	25.2 (84)	2 (100)	2 (100)	9.4 (78.3)	7 (77.8)	3.8 (95)	1 (100)
Turcotte (2019)	26.3 (87.7)	2 (100)	2 (100)	9.5 (79.2)	7.8 (86.7)	4 (100)	1 (100)
Vatier (2012)	22.9 (76.3)	2 (100)	2 (100)	9.1 (75.8)	6.5 (72.2)	3.3 (82.5)	0 (0)
Vaurs (2015)	24.5 (79)	2 (100)	2 (100)	10 (76.9)	5.5 (61.1)	4 (100)	1 (100)
Vilarrasa (2011)	24.6 (79.4)	2 (100)	2 (100)	10.1 (77.7)	5.5 (61.1)	4 (100)	1 (100)
von Scholten (2017)	22.7 (75.7)	2 (100)	1.8 (90)	7.8 (65)	6.5 (72.2)	3.6 (90)	1 (100)
Werling (2015)	24.7 (82.3)	2 (100)	2 (100)	9.1 (75.8)	7.3 (81.1)	3.3 (82.5)	1 (100)
Zhang X (2018)	24.9 (83)	2 (100)	2 (100)	9.8 (81.7)	6.5 (72.2)	3.6 (90)	1 (100)
Zhang Y (2017)	23.3 (77.7)	2 (100)	2 (100)	7.8 (65)	6.5 (72.2)	4 (100)	1 (100)
Points (mean ± SD)	24.3 ± 2.4	2 ± 0	2.0 ± 0.1	9.3 ± 1.3	6.9 ± 0.9	3.4 ± 0.6	0.7 ± 0.5
%valid (mean ± SD)	80.0 ± 7.7	100 ± 0	99.2 ± 3.7	75.2 ± 8.9	76.4 ± 10.5	85.2 ± 15.8	69.5 ± 46.4

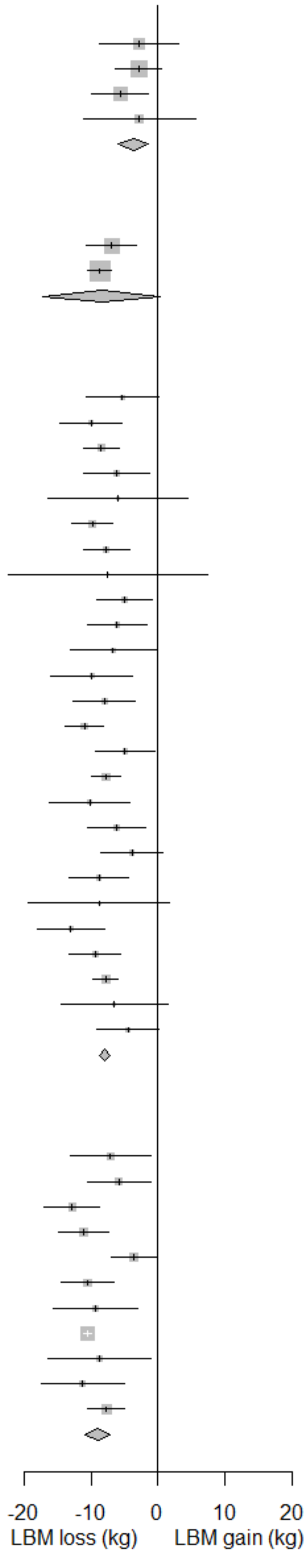


Supplemental Figure 1. STROBE reporting quality per subitem and total score. Bars reflect the number of studies that score within each category (<60%, 60-80% ≥80%). Percentages are based on the points divided by the amount of applicable items within each subitem. T&A= title and abstract, In=Introduction, Me=methods, Re=results, Dis=discussion, Fun=funding.

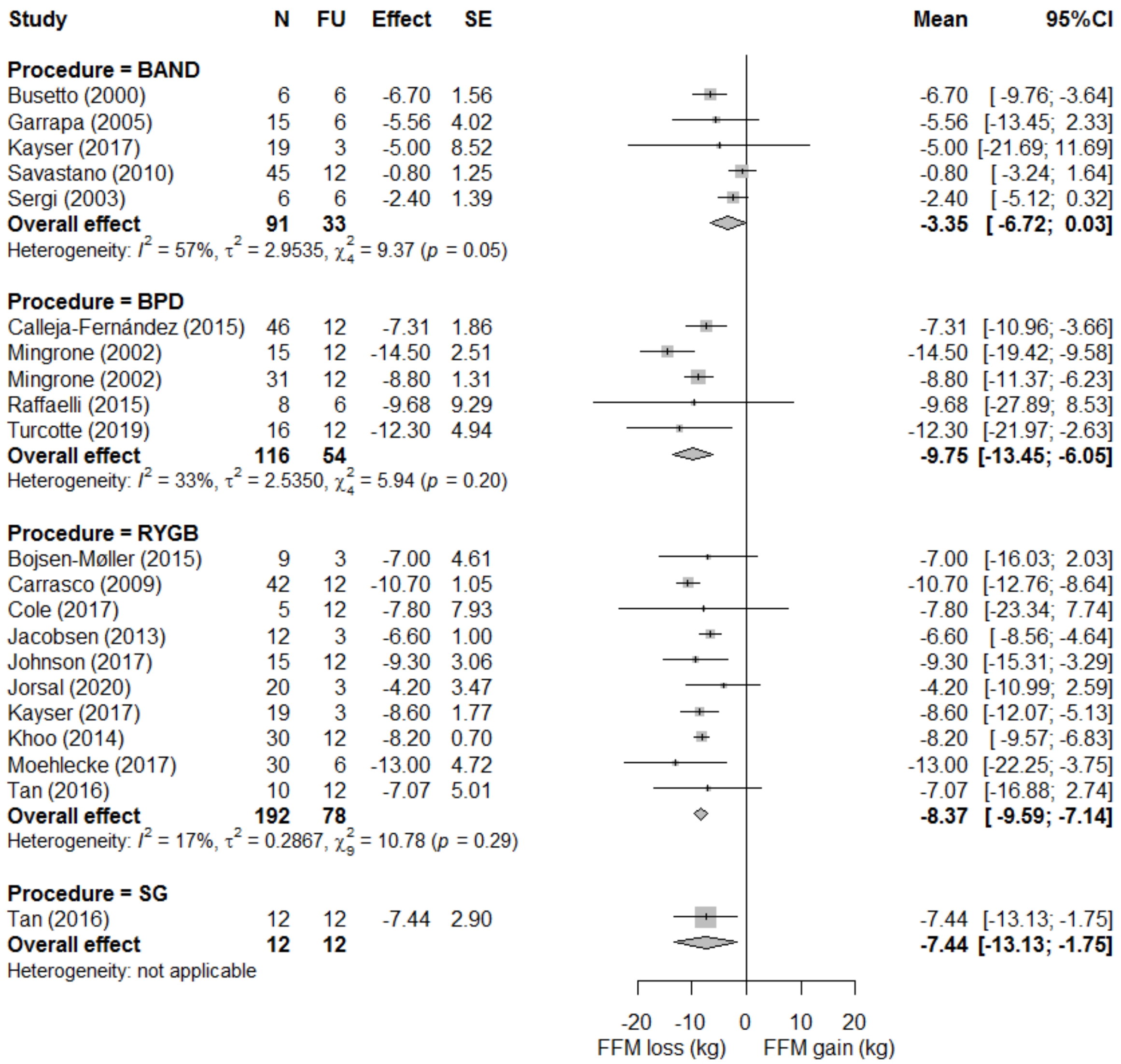


Supplemental Figure 2. Time-dependent changes in lean body mass (2A), fat-free mass (2B) and skeletal muscle mass (2C) up to 12-months post-surgery for each individual study arm.

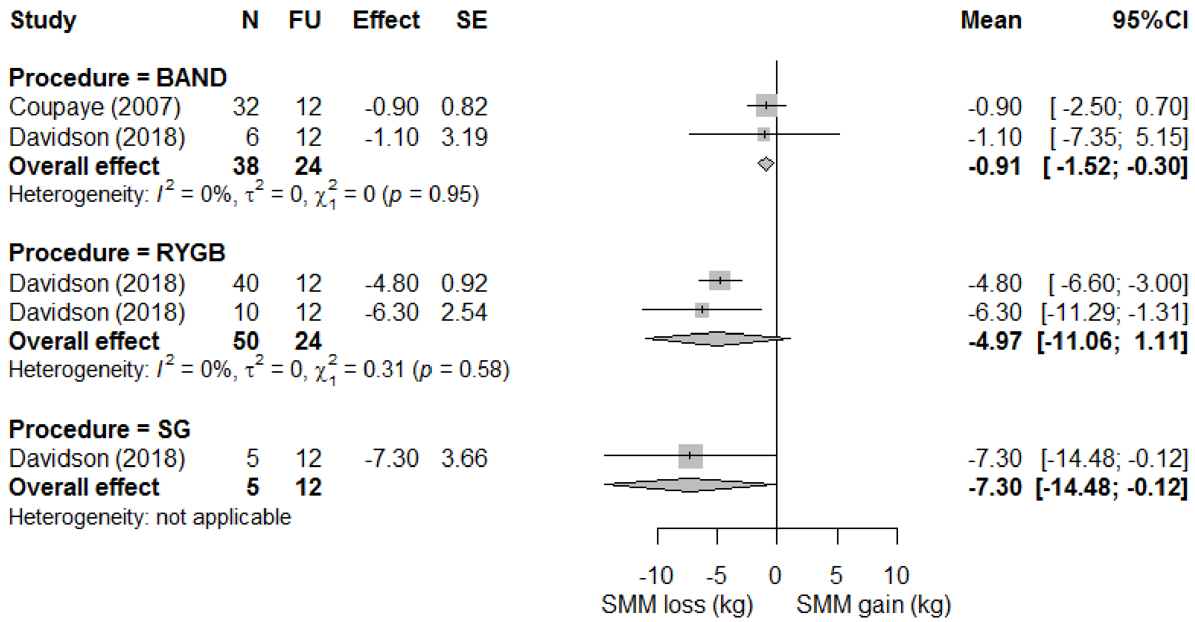
Study	N	FU	Effect	SE	Mean	95%CI
Procedure = BAND						
Brzozowska (2020)	10	12	-2.80	3.03	-2.80	[-8.75; 3.15]
Coupaye (2005)	36	12	-2.90	1.76	-2.90	[-6.34; 0.54]
Olbers (2006)	31	12	-5.60	2.17	-5.60	[-9.85; -1.35]
Rabl (2014)	7	6	-2.80	4.28	-2.80	[-11.19; 5.59]
Overall effect	**84**	**42**			**-3.70**	**[-6.01; -1.39]**
Heterogeneity: $I^2 = 0\%$, $\tau^2 = 0$, $\chi^2_3 = 1.11$ ($p = 0.77$)						
Procedure = BPD						
Calleja-Fernández (2015)	46	12	-6.95	1.91	-6.95	[-10.69; -3.21]
Tacchino (2003)	101	12	-8.70	0.93	-8.70	[-10.53; -6.87]
Overall effect	**147**	**24**			**-8.36**	**[-17.14; 0.41]**
Heterogeneity: $I^2 = 0\%$, $\tau^2 = 0$, $\chi^2_1 = 0.68$ ($p = 0.41$)						
Procedure = RYGB						
Bazzocchi (2015)	29	12	-5.35	2.75	-5.35	[-10.74; 0.04]
Beckman (2017)	20	12	-10.00	2.37	-10.00	[-14.64; -5.36]
Bellicha (2019)	45	6	-8.50	1.36	-8.50	[-11.16; -5.84]
Blom-Høgestøl (2020)	34	12	-6.20	2.55	-6.20	[-11.19; -1.21]
Brzozowska (2020)	7	12	-6.00	5.32	-6.00	[-16.43; 4.43]
Ciangura (2010)	42	12	-9.80	1.58	-9.80	[-12.90; -6.70]
Clements (2011)	30	2	-7.70	1.74	-7.70	[-11.12; -4.28]
Cole (2017)	5	12	-7.50	7.57	-7.50	[-22.33; 7.33]
Favre (2018)	21	12	-4.97	2.12	-4.97	[-9.13; -0.81]
Favre (2018)	18	12	-6.10	2.23	-6.10	[-10.47; -1.73]
Favre (2018)	5	12	-6.67	3.23	-6.67	[-12.99; -0.35]
Fjeldborg (2015)	31	12	-9.90	3.10	-9.90	[-15.98; -3.82]
Kim (2020)	44	6	-8.00	2.36	-8.00	[-12.62; -3.38]
Legro (2012)	17	12	-11.00	1.50	-11.00	[-13.94; -8.06]
Lubrano (2004)	45	12	-4.90	2.31	-4.90	[-9.42; -0.38]
Marengo (2017)	38	12	-7.75	1.07	-7.75	[-9.84; -5.66]
Matos (2020)	17	6	-10.20	3.08	-10.20	[-16.24; -4.16]
Moizé (2013)	25	12	-6.20	2.19	-6.20	[-10.50; -1.90]
Olbers (2006)	29	12	-3.90	2.35	-3.90	[-8.50; 0.70]
Oppert (2018)	22	6	-8.80	2.28	-8.80	[-13.27; -4.33]
Rabl (2014)	14	6	-8.80	5.39	-8.80	[-19.37; 1.77]
Tamboli (2010)	29	12	-13.02	2.54	-13.02	[-18.00; -8.04]
Vatier (2012)	86	12	-9.40	1.94	-9.40	[-13.21; -5.59]
Vilarrasa (2011)	59	12	-7.80	0.94	-7.80	[-9.64; -5.96]
von Scholten (2017)	19	6	-6.50	4.09	-6.50	[-14.51; 1.51]
Werling (2015)	6	3	-4.50	2.39	-4.50	[-9.18; 0.18]
Overall effect	**737**	**257**			**-7.94**	**[-8.72; -7.15]**
Heterogeneity: $I^2 = 0\%$, $\tau^2 = 0$, $\chi^2_{25} = 24.03$ ($p = 0.52$)						
Procedure = SG						
Arhire (2018)	26	12	-7.07	3.02	-7.07	[-12.99; -1.15]
Brzozowska (2020)	21	12	-5.80	2.44	-5.80	[-10.58; -1.02]
Chen (2021)	49	12	-12.80	2.12	-12.80	[-16.96; -8.64]
Hayashi (2017)	11	12	-11.02	1.90	-11.02	[-14.75; -7.30]
Hayashi (2017)	3	12	-3.54	1.77	-3.54	[-7.01; -0.07]
Maïmoun (2019)	30	12	-10.50	2.05	-10.50	[-14.52; -6.48]
Moizé (2013)	25	12	-9.30	3.18	-9.30	[-15.54; -3.06]
Talalaj (2020)	155	12	-10.50	0.31	-10.50	[-11.10; -9.90]
Zhang (2017)	14	3	-8.75	3.92	-8.75	[-16.43; -1.07]
Zhang (2017)	23	3	-11.23	3.18	-11.23	[-17.45; -5.01]
Zhang (2018)	128	6	-7.74	1.42	-7.74	[-10.53; -4.95]
Overall effect	**485**	**108**			**-9.00**	**[-10.88; -7.13]**
Heterogeneity: $I^2 = 59\%$, $\tau^2 = 3.3874$, $\chi^2_{10} = 24.48$ ($p < 0.01$)						



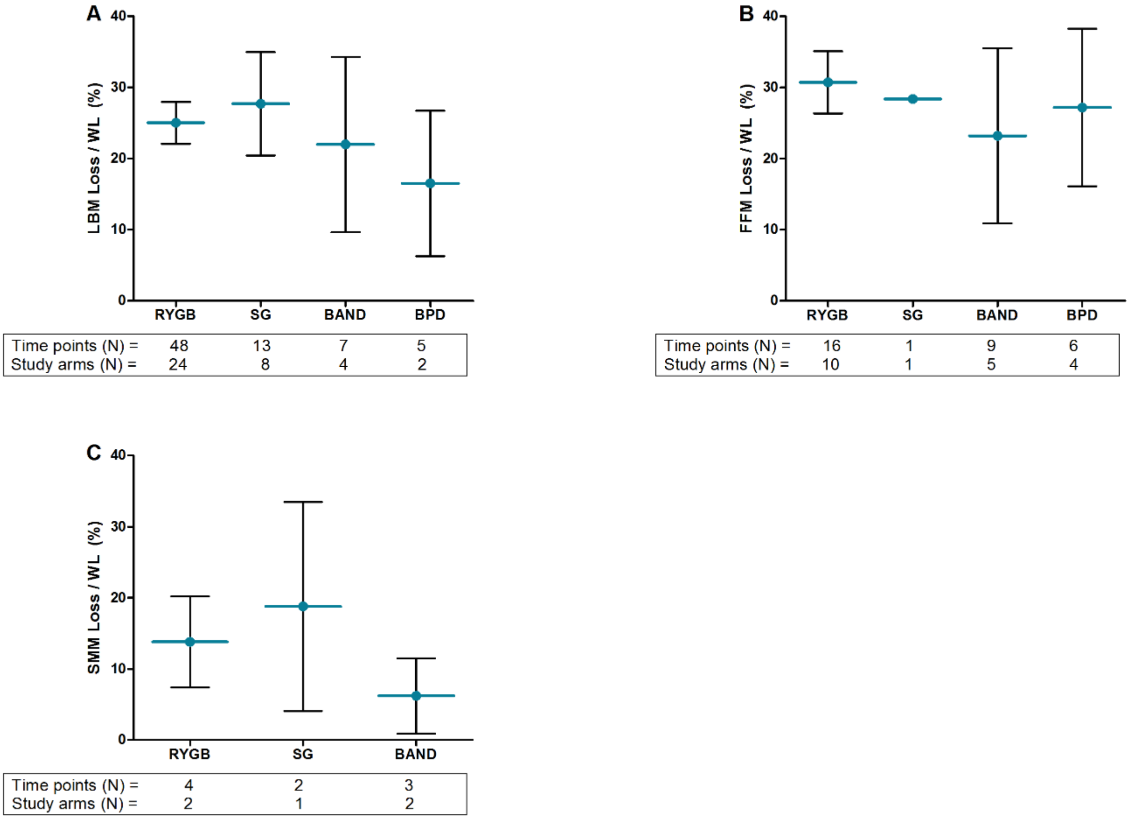
Supplemental figure 3. Forest plots of lean body mass loss with respect to preoperative measures for each bariatric procedure. The effects size (mean differences between preoperative and postoperative measure) and 95% CI for individual studies and the pooled estimate per bariatric procedure are depicted. For each study, either the 12-month follow-up timepoint or the latest available timepoint was included for analysis. BAND = adjustable gastric band operation, BPD = biliopancreatic diversion, RYGB = Roux-en-Y gastric bypass, SG = sleeve gastrectomy, N = number of subjects, FU = follow up timepoint in months.



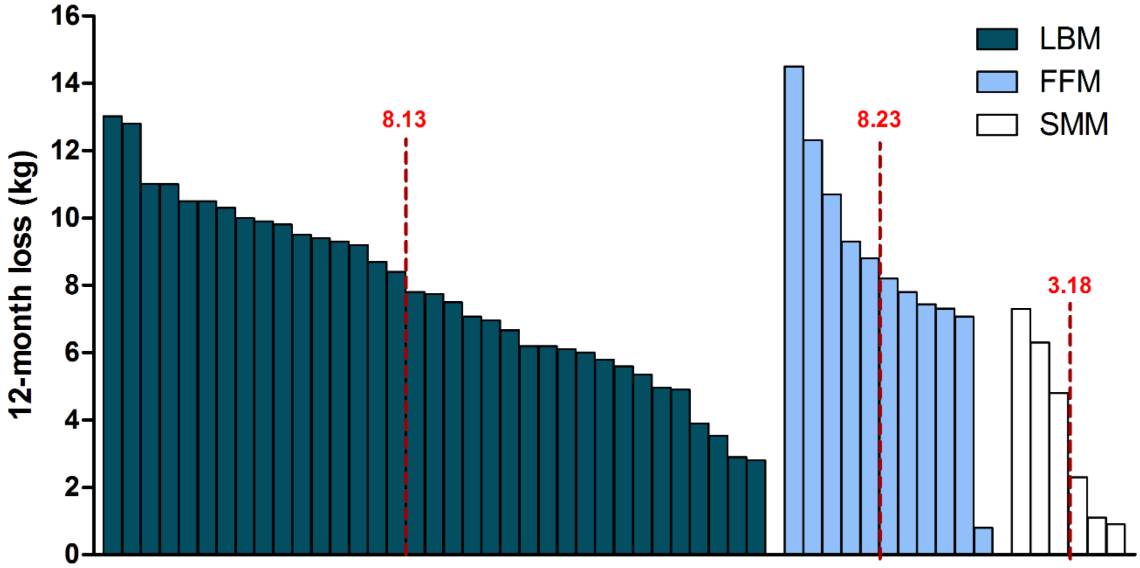
Supplemental figure 4. Forest plots of fat-free mass loss with respect to preoperative measures for each bariatric procedure. The effects size (mean differences between preoperative and postoperative measure) and 95% CI for individual studies and the pooled estimate per bariatric procedure are depicted. For each study, either the 12-month follow-up timepoint or the latest available timepoint was included for analysis. BAND = adjustable gastric band operation, BPD = biliopancreatic diversion, RYGB = Roux-en-Y gastric bypass, SG = sleeve gastrectomy, N = number of subjects, FU = follow up timepoint in months.



Supplemental figure 5. Forest plots of skeletal muscle mass loss with respect to preoperative measures for each bariatric procedure. The effects size (mean differences between preoperative and postoperative measure) and 95% CI for individual studies and the pooled estimate per bariatric procedure are depicted. For each study, either the 12-month follow-up timepoint or the latest available timepoint was included for analysis. BAND = adjustable gastric band operation, BPD = biliopancreatic diversion, RYGB = Roux-en-Y gastric bypass, SG = sleeve gastrectomy, N = number of subjects, FU = follow up timepoint in months.



Supplemental Figure 6. Proportional loss with respect to weight loss for lean body mass (LBM, panel A), fat-free mass (FFM, panel B) and skeletal muscle mass (SMM, panel C). Blue lines reflect the pooled effect and the error bars reflect the corresponding lower and upper limit of the 95%CI. RYGB = Roux-en-Y Gastric bypass, SG = sleeve gastrectomy, BAND = adjustable gastric band operation, BPD = biliopancreatic diversion. No significant differences in proportional muscle loss between the different bariatric procedures were found for any of the outcome measures.



Supplemental Figure 7. Waterfall plot for the 12-month loss of LBM (dark blue), FFM (light blue) and SMM (white). Bars reflect individual study arms and are ranked from the largest effect to the smallest effect. The red dotted line reflects the pooled loss, as calculated by the meta-analysis.

Supplemental document: R script

################################ start program ################################

load packages for meta-analysis

```
library (metafor)
library (meta)
library(rms)
library(readxl)
library(ggplot2)
library(ggpubr)
```

1. do meta-analysis per grouped timepoints (visit) and make forest plot

read data with visits; make subsets for LBM, FFM and SMM; sort on visit.

```
dat_dif <- read_excel(".../Difference_data def_z dubbele.xlsx")

datdif_FFM <- dat_dif[which(dat_dif$uitkomstmaat=="FFM"),]
datdif_LBM <- dat_dif[which(dat_dif$uitkomstmaat=="LBM"),]
datdif_SMM <- dat_dif[which(dat_dif$uitkomstmaat=="SMM"),]

datdif_FFM <- datdif_FFM[order(datdif_FFM$visit_n, datdif_FFM$Studie),]
datdif_LBM <- datdif_LBM[order(datdif_LBM$visit_n, datdif_LBM$Studie),]
datdif_SMM <- datdif_SMM[order(datdif_SMM$visit_n, datdif_SMM$Studie),]
```

##Meta-analysis and forest plot LBM

```
resbyvisit1 <- metagen(TE=datdif_LBM$mean, seTE=datdif_LBM$SE, studlab=datdif_LBM$Studie,
byvar=datdif_LBM$Visit, method.tau="EB", hakn=T, comb.fixed = F, comb.random = T)

resbyvisit1

forest(resbyvisit1, test.overall.random = FALSE, print.Q = T, colgap.forest.left = "5cm", col.by =
"black", test.subgroup.random =  F, text.random = "Overall effect", overall.hetstat = FALSE, overall =
FALSE, leftlabs= c("Study", "Effect", "SE"),rightlabs =  c("Mean", "95%CI"),xlab="LBM loss (kg)      LBM
gain (kg)", digits.se = 2)
print
```

##Meta-analysis and forest plot FFM

```
resbyvisit2 <- metagen(TE=datdif_FFM$mean, seTE=datdif_FFM$SE, studlab=datdif_FFM$Studie,
byvar=datdif_FFM$Visit, method.tau="EB", hakn=T, comb.fixed = F, comb.random = T)

resbyvisit2

forest(resbyvisit2, test.overall.random = FALSE, print.Q = T, colgap.forest.left = "5cm", col.by =
"black", test.subgroup.random =  F, text.random = "Overall effect", overall.hetstat = FALSE, overall =
FALSE, leftlabs= c("Study", "Effect", "SE"),rightlabs =  c("Mean", "95%CI"),xlab="FFM loss (kg)      FFM
```

gain (kg)", digits.se = 2)
print

Meta-analysis and forest plot SMM

resbyvisit3 <- metagen(TE=datdif_SMM$mean, seTE=datdif_SMM$SE, studlab=datdif_SMM$Studie, byvar=datdif_SMM$Visit, method.tau="EB", hakn=T, comb.fixed = F, comb.random = T)

resbyvisit3

forest(resbyvisit3, test.overall.random = FALSE, print.Q = T, colgap.forest.left = "5cm", col.by = "black", test.subgroup.random = F, text.random = "Overall effect", overall.hetstat = FALSE, overall = FALSE, leftlabs= c("Study", "Effect", "SE"),rightlabs = c("Mean", "95%CI"),xlab="SMM loss (kg)
SMM gain (kg)", digits.se = 2)
print

2. Plot line graphs muscle mass loss over time

read dataset with timepoints; make subsets for LBM, FFM and SMM.

dat_time <- read_excel(".../Timepoints_data def_met dubbele.xlsx")

dattime_FFM <- dat_time[which(dat_time$uitkomstmaat=="FFM"),]
dattime_LBM <- dat_time[which(dat_time$uitkomstmaat=="LBM"),]
dattime_SMM <- dat_time[which(dat_time$uitkomstmaat=="SMM"),]

##plot line graphs LBM/FFM/SMM loss over time for each study

#LBM

plot1=ggplot(data=dattime_LBM,aes(x=time.after.surg,y=mean,colour=as.factor(Study_nr)))+ geom_point()+ geom_line()+ theme_minimal()+ scale_y_continuous(expand=c(0,0),limits=c(40,70),breaks=seq(0,100,5))+ scale_x_continuous(expand=c(0,0),limits=c(-0.1,12.1),breaks=seq(0,12,3))+ theme(axis.text.y = element_text(size=11), axis.text.x = element_text(size=11), axis.title.y = element_text(size=11), axis.title.x = element_text(size=11), axis.line = element_line(colour = "black"), panel.border = element_rect(colour = "black", fill=NA))+ expand_limits(x = 0, y = 0)+ xlab("Time (months)")+ ylab("LBM (kg)")+ guides(colour=FALSE)

plot1

#FFM

plot2=ggplot(data=dattime_FFM,aes(x=time.after.surg,y=mean,colour=as.factor(Study_nr)))+ geom_point()+ geom_line()+ theme_minimal()+ scale_y_continuous(expand=c(0,0),limits=c(40,70),breaks=seq(0,100,5))+ scale_x_continuous(expand=c(0,0),limits=c(-0.1,12.1),breaks=seq(0,12,3))+ theme(axis.text.y = element_text(size=11), axis.text.x = element_text(size=11), axis.title.y = element_text(size=11), axis.title.x = element_text(size=11), axis.line = element_line(colour = "black"), panel.border =

```
element_rect(colour = "black", fill=NA))+ expand_limits(x = 0, y = 0)+ xlab("Time (months)")+
ylab("LBM (kg)")+ guides(colour=FALSE)

plot2

#SMM

plot3=ggplot(data=dattime_SMM,aes(x=time.after.surg,y=mean,colour=as.factor(Study_nr)))+
geom_point()+ geom_line()+ theme_minimal()+
scale_y_continuous(expand=c(0,0),limits=c(40,70),breaks=seq(0,100,5))+
scale_x_continuous(expand=c(0,0),limits=c(-0.1,12.1),breaks=seq(0,12,3))+ theme(axis.text.y  =
element_text(size=11), axis.text.x  = element_text(size=11), axis.title.y  = element_text(size=11),
axis.title.x  = element_text(size=11), axis.line = element_line(colour = "black"), panel.border =
element_rect(colour = "black", fill=NA))+ expand_limits(x = 0, y = 0)+ xlab("Time (months)")+
ylab("LBM (kg)")+ guides(colour=FALSE)

plot3

# combineren linegraphs into 1 layout

theme_set(theme_pubr())

figure_12m <- ggarrange(plot1, plot2, plot3, labels = c("A", "B", "C"), ncol = 3, nrow = 1)

figure_12m
```

2. Subanalyses per type of surgery

```
datsurg <- read_excel(".../Surgery_data def_z comb2.xlsx")

datsurgFFM <- datsurg[which(datsurg$uitkomstmaat=="FFM"),]
datsurgLBM <- datsurg[which(datsurg$uitkomstmaat=="LBM"),]
datsurgSMM <- datsurg[which(datsurg$uitkomstmaat=="SMM"),]

##LBM
## the marked field (type of surgery) was changed  to RYGB, BAND, SG or BPD in order to test for
different reference groups.

datsurgLBM$visit = as.factor(datsurgLBM$visit)
datsurgLBM$visitbin = as.factor(ifelse(datsurgLBM$visit=="0","Baseline","Post"))

datsurgLBM$operatie=relevel(as.factor(datsurgLBM$operatie),ref="RYGB")

resoverall <- metagen(TE=mean, seTE=SD/sqrt(Ntot), studlab=Studie, data=datsurgLBM,
method.tau="EB", hakn=T, comb.fixed = F, comb.random = T)
resoverall

res.MR= metareg(x=resoverall, formula=time.after.surg+operatie, hakn=T)
res.MR
```

```
res.MRvisit= metareg(x=resoverall, formula=visit+operatie, hakn=T)
res.MRvisit

#FFM
## the marked field (type of surgery) was changed  to RYGB, BAND, SG or BPD in order to test for different reference groups.

datsurgFFM$visit = as.factor(datsurgFFM$visit)
datsurgFFM$visitbin = as.factor(ifelse(datsurgFFM$visit=="0","Baseline","Post"))

datsurgFFM$operatie=relevel(as.factor(datsurgFFM$operatie),ref="RYGB")

resoverall <- metagen(TE=mean, seTE=SD/sqrt(Ntot), studlab=Studie, data=datsurgFFM, method.tau="EB", hakn=T, comb.fixed = F, comb.random = T)
resoverall

res.MR= metareg(x=resoverall, formula=time.after.surg+operatie, hakn=T)
res.MR

res.MRvisit= metareg(x=resoverall, formula=visit+operatie, hakn=T)
res.MRvisit

#SMM
## the marked field (type of surgery) was changed  to RYGB, BAND or SG in order to test for different reference groups.

datsurgSMM$visit = as.factor(datsurgSMM$visit)
datsurgSMM$visitbin = as.factor(ifelse(datsurgSMM$visit=="0","Baseline","Post"))

datsurgSMM$operatie=relevel(as.factor(datsurgSMM$operatie),ref="RYGB")

resoverall <- metagen(TE=mean, seTE=SD/sqrt(Ntot), studlab=Studie, data=datsurgSMM, method.tau="EB", hakn=T, comb.fixed = F, comb.random = T)
resoverall

res.MR= metareg(x=resoverall, formula=time.after.surg+operatie, hakn=T)
res.MR

res.MRvisit= metareg(x=resoverall, formula=visit+operatie, hakn=T)
res.MRvisit
```