Supplementary data

In our study, the comprehensive search strategy is detailed in Table S1. Regarding the quality assessment of the articles, Figure S1 presents the risk of bias evaluation for each included study.

For the assessment of nutrient supplements (NS) on physical performance, the effects of NS treatment were evaluated using various tests. These included the 6-minute walk test (6-MWT), physical activity level (PAL), incremental shuttle walk test (ISWT), endurance shuttle walk test (ESWT), short physical performance battery (SPPB), five-repetition sit-to-stand test (STS5), and cycle endurance time (CET), as illustrated in Figure S2.

In the conducted subgroup analyses, stratification by intervention periods, as displayed in Figures S3 to S9, revealed that NS with a longer intervention duration (≥ 12 weeks) resulted in more significant improvements in both body weight (P=0.04; Figure S3) and quadriceps muscle strength (P=0.01; Figure S8) compared to NS with shorter intervention periods (< 12 weeks). Interestingly, the impact of NS on sarcopenia did not show significant changes irrespective of the combination with pulmonary rehabilitation, as illustrated in Figures S10 to S16. In contrast, the 6-minute walk test (6-MWT) demonstrated potential benefits when not combined with pulmonary rehabilitation, though this finding was not statistically significant (P=0.18; Figure S16). Furthermore, subgroup analyses comparing different types of NS did not reveal any significant differences, as shown in Figures S17 to S21.

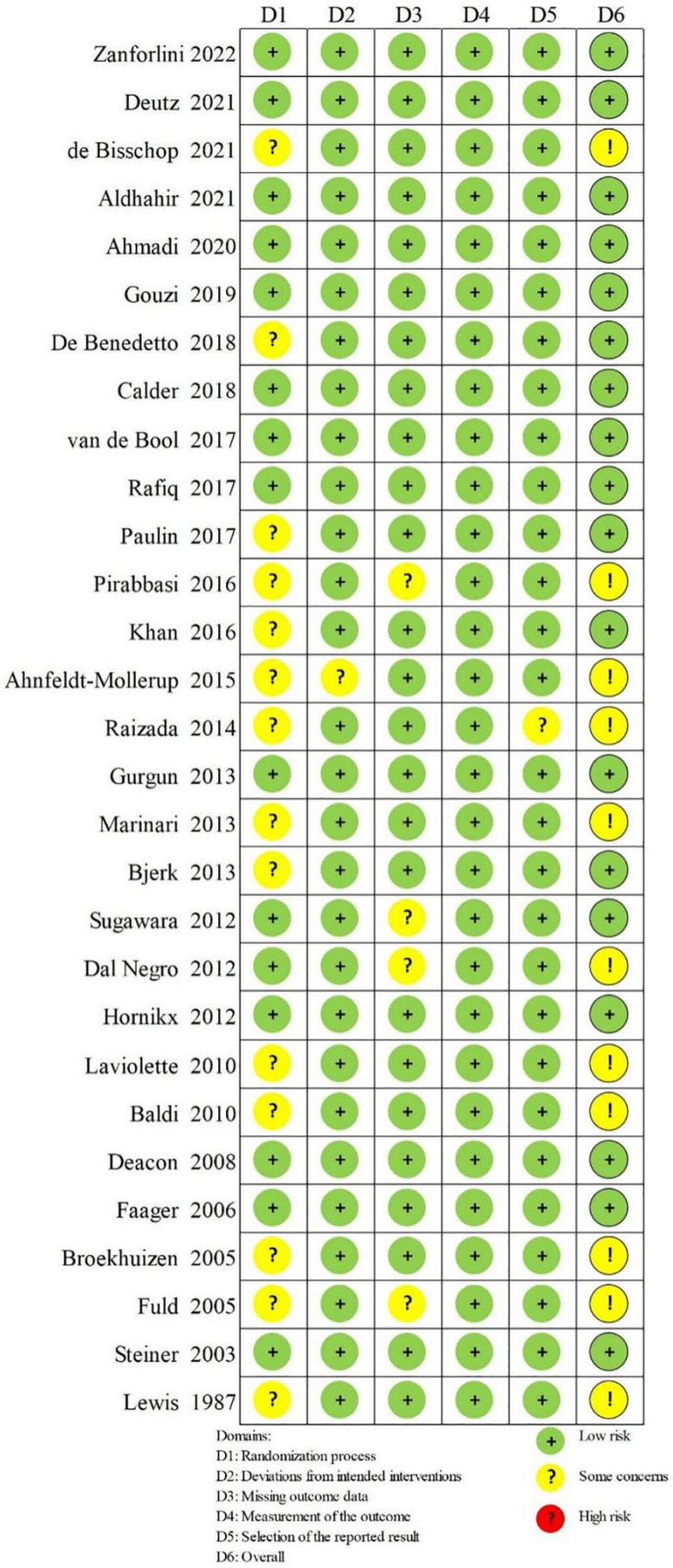

Figure S1. Risk of bias graph. Assessment of the risk-of-bias for each study is based on the Cochrane risk-of-bias 2 tools.

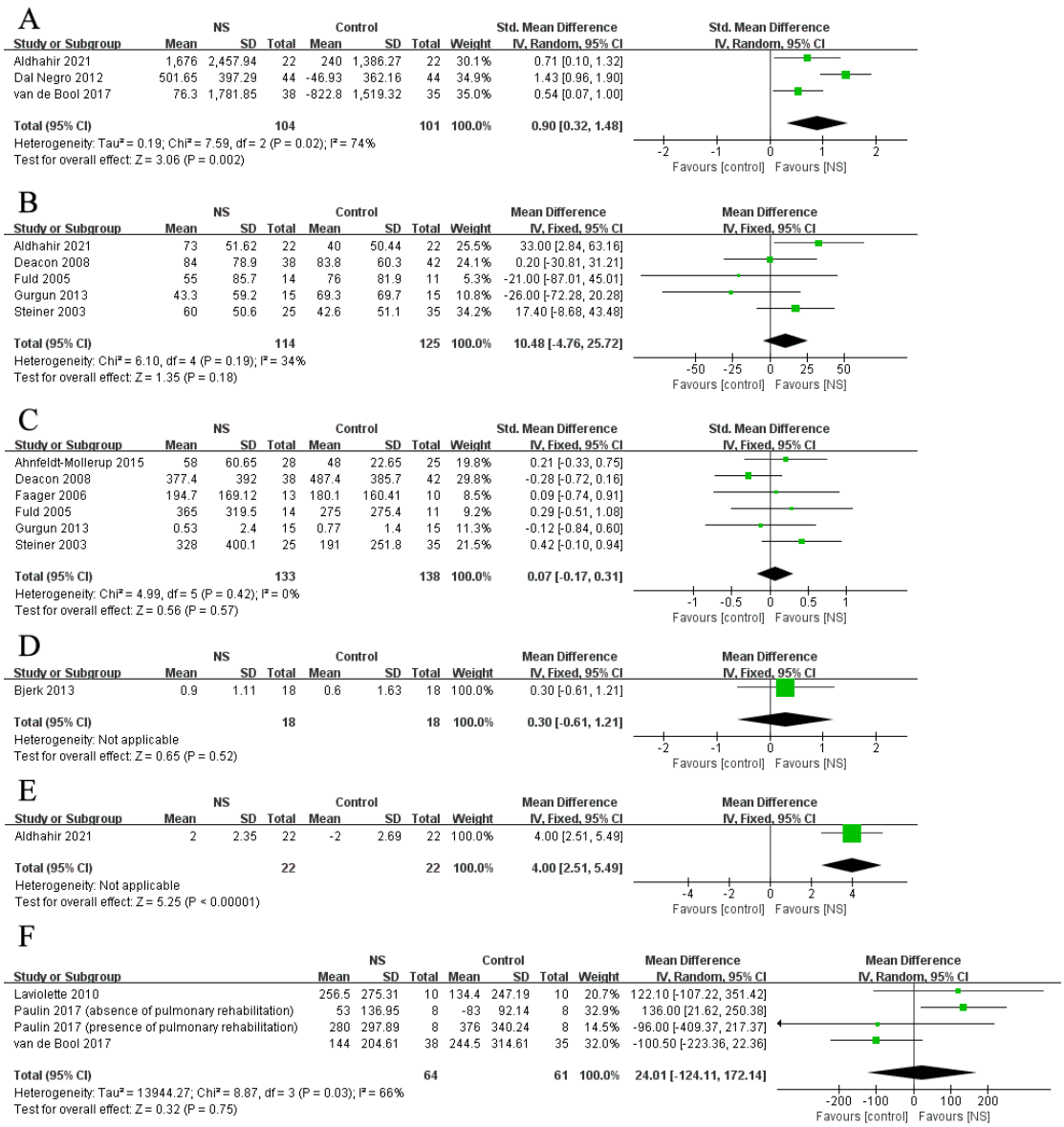

Figure S2. Forest plot of meta-analysis results from the effect of nutrient supplements on changes in physical activity level (A), incremental shuttle walk test (B), endurance shuttle walk test (C), short physical performance battery (D), five-repetition sit-to-stand test (E), cycle endurance time (F) in people with chronic obstructive pulmonary disease.

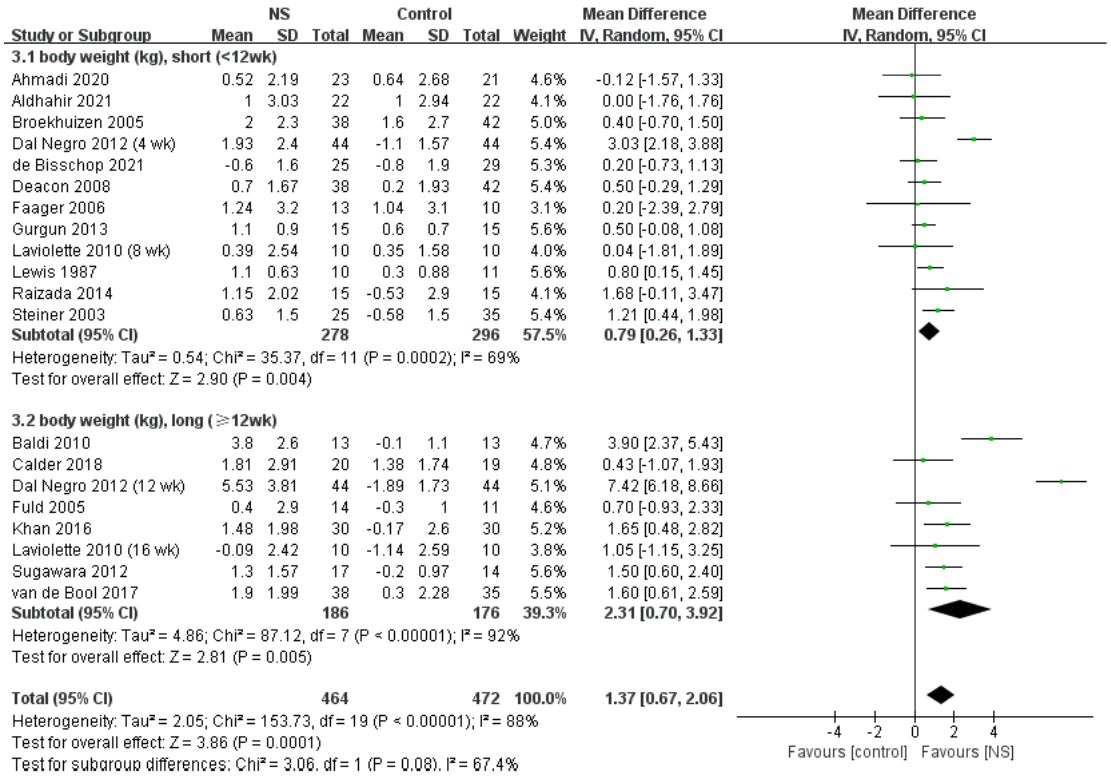

Figure S3. Forest plot of subgroup analysis results from body weight changes in response to nutrient supplements based on different intervention periods in people with chronic obstructive pulmonary disease.

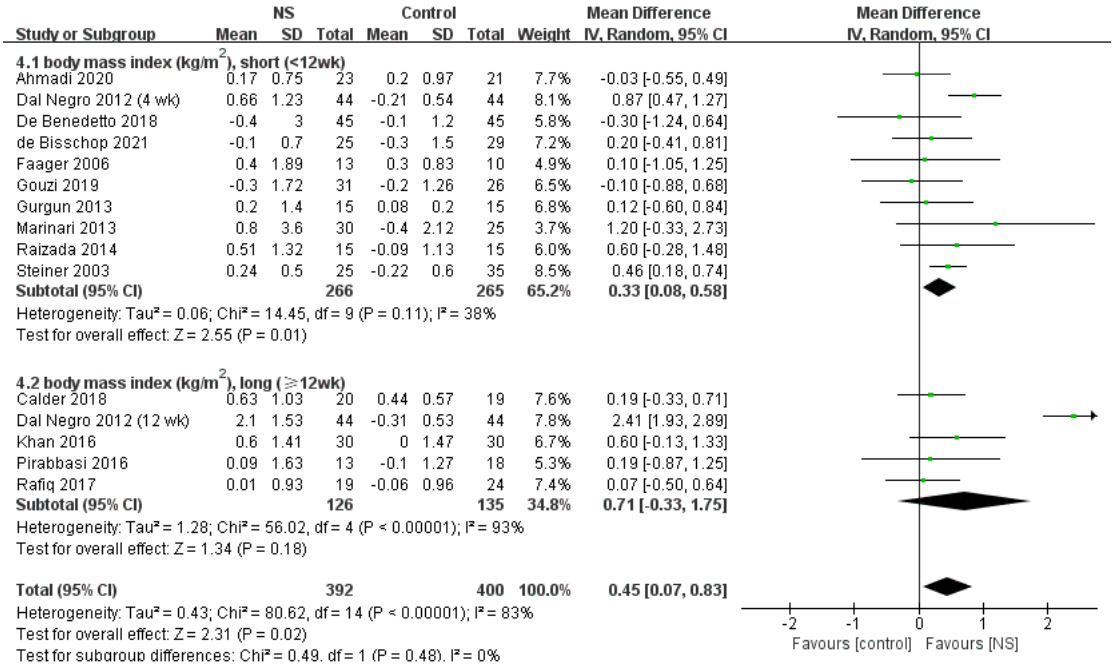

Figure S4. Forest plot of subgroup analysis results from body mass index changes in response to nutrient supplements based on different intervention periods in people with chronic obstructive pulmonary disease.

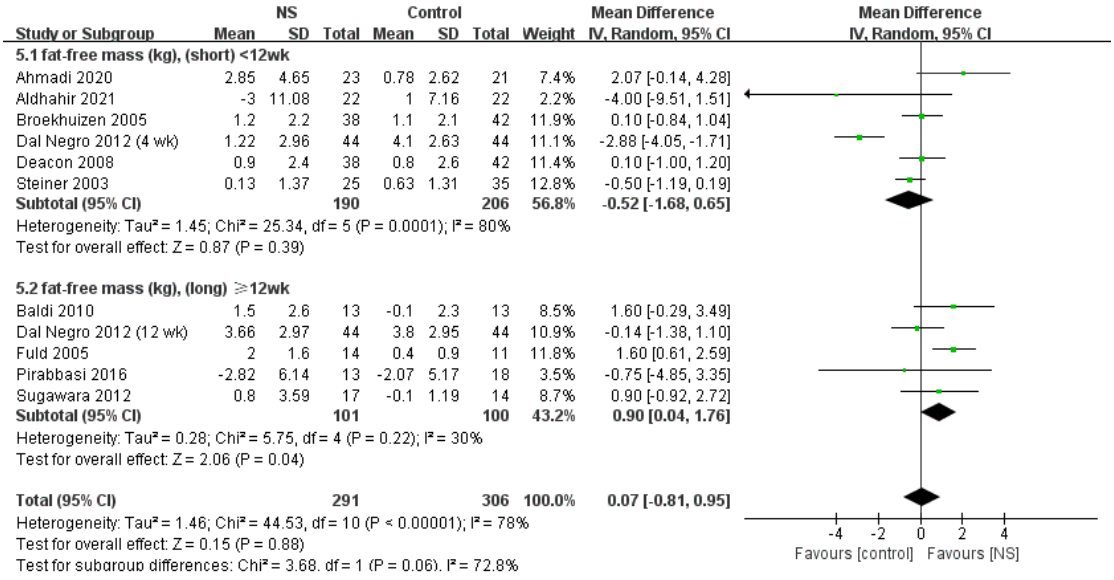

Figure S5. Forest plot of subgroup analysis results from fat-free mass changes in response to nutrient supplements based on different intervention periods in people with chronic obstructive pulmonary disease.

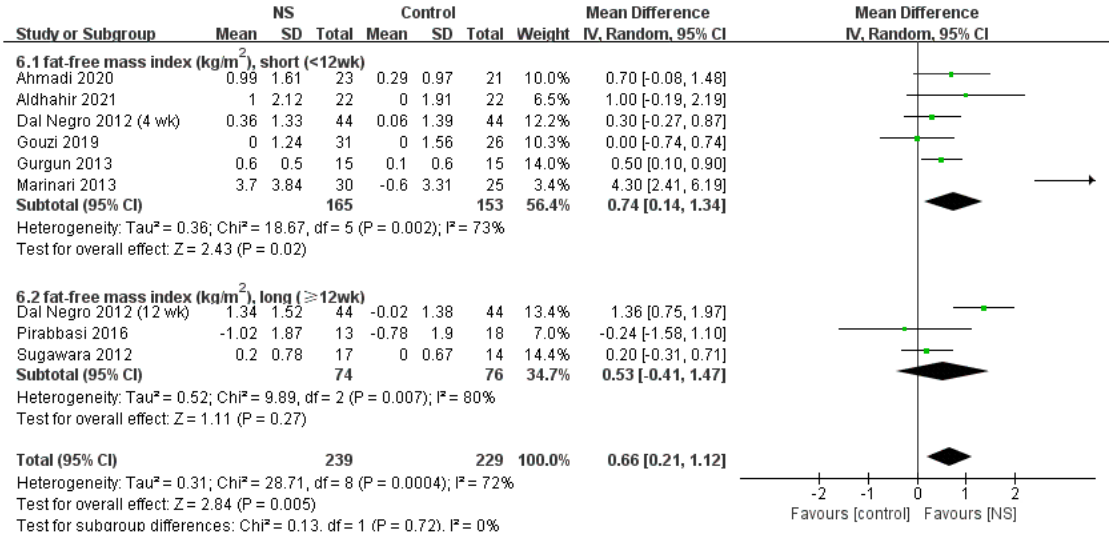

Figure S6. Forest plot of subgroup analysis results from fat-free mass index changes in response to nutrient supplements based on different intervention periods in people with chronic obstructive pulmonary disease.

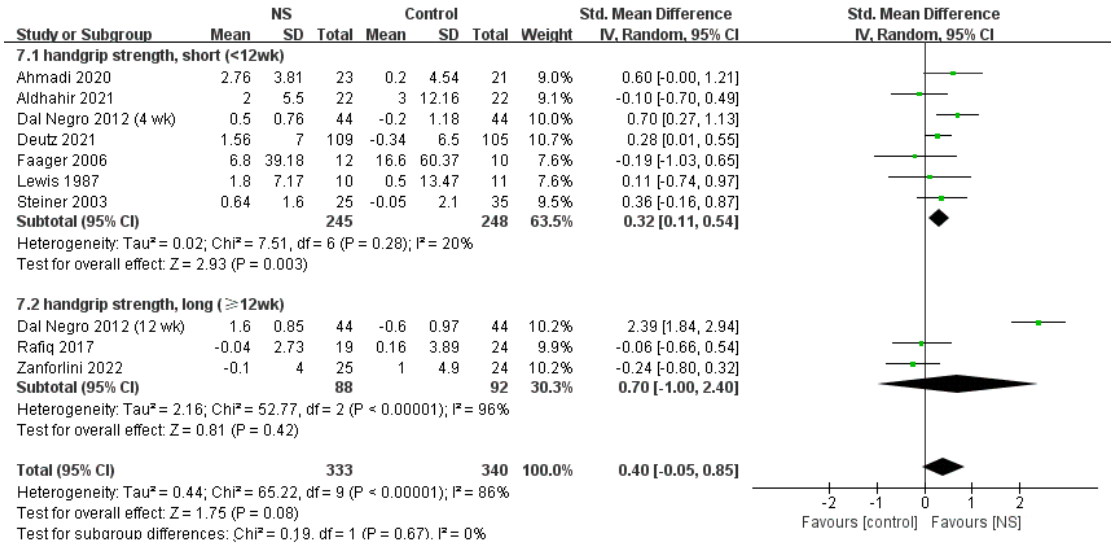

Figure S7. Forest plot of subgroup analysis results from handgrip strength changes in response to nutrient supplements based on different intervention periods in people with chronic obstructive pulmonary disease.

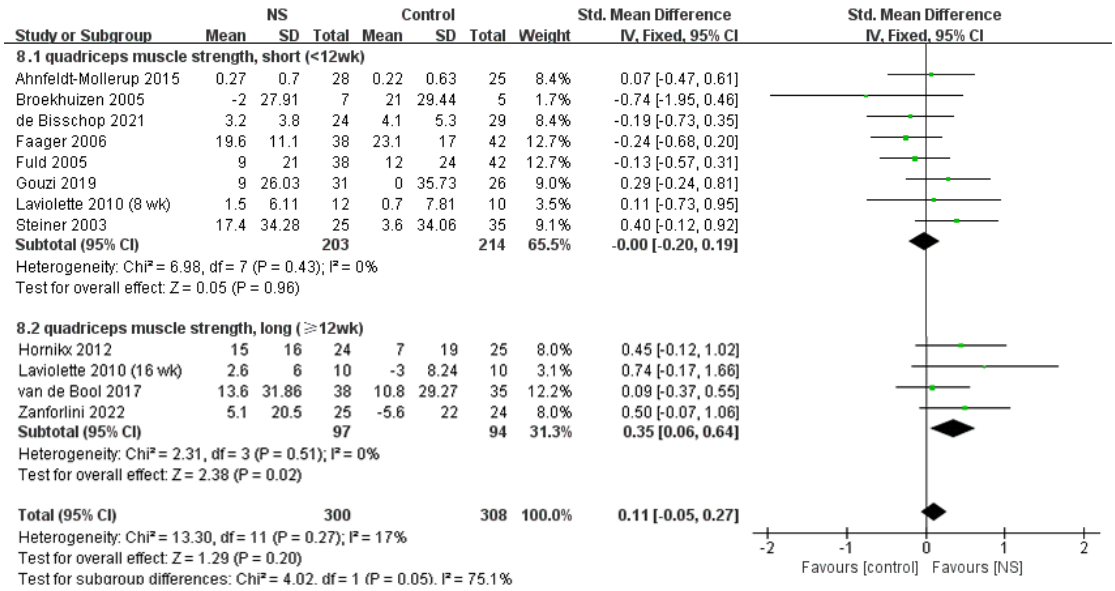

Figure S8. Forest plot of subgroup analysis results from quadriceps muscle strength changes in response to nutrient supplements based on different intervention periods in people with chronic obstructive pulmonary disease.

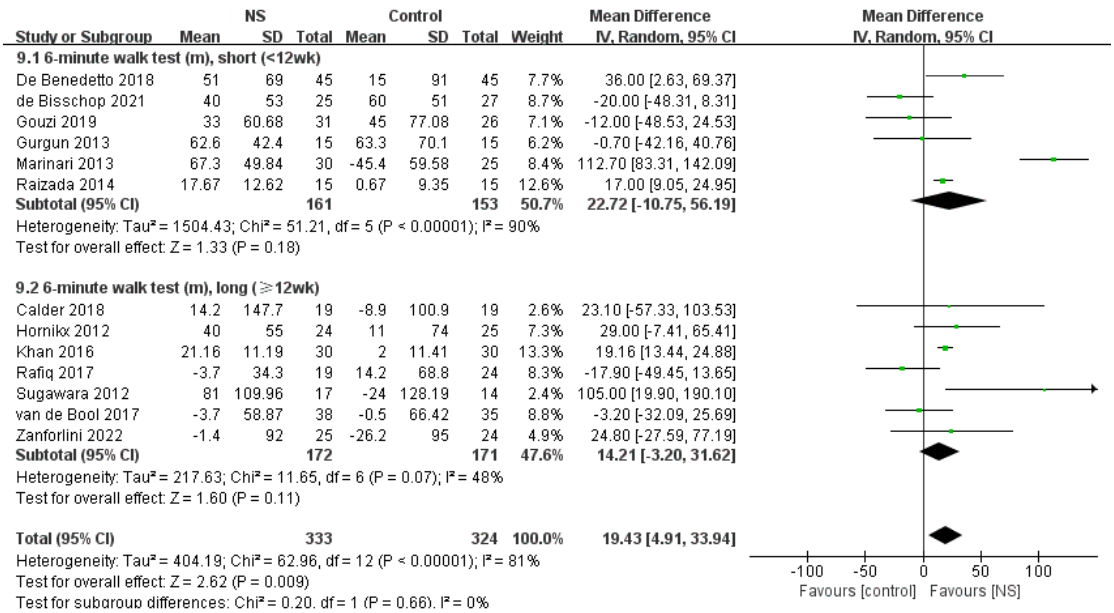

Figure S9. Forest plot of subgroup analysis results from 6-minute walk test changes in response to nutrient supplements based on different intervention periods in people with chronic obstructive pulmonary disease.

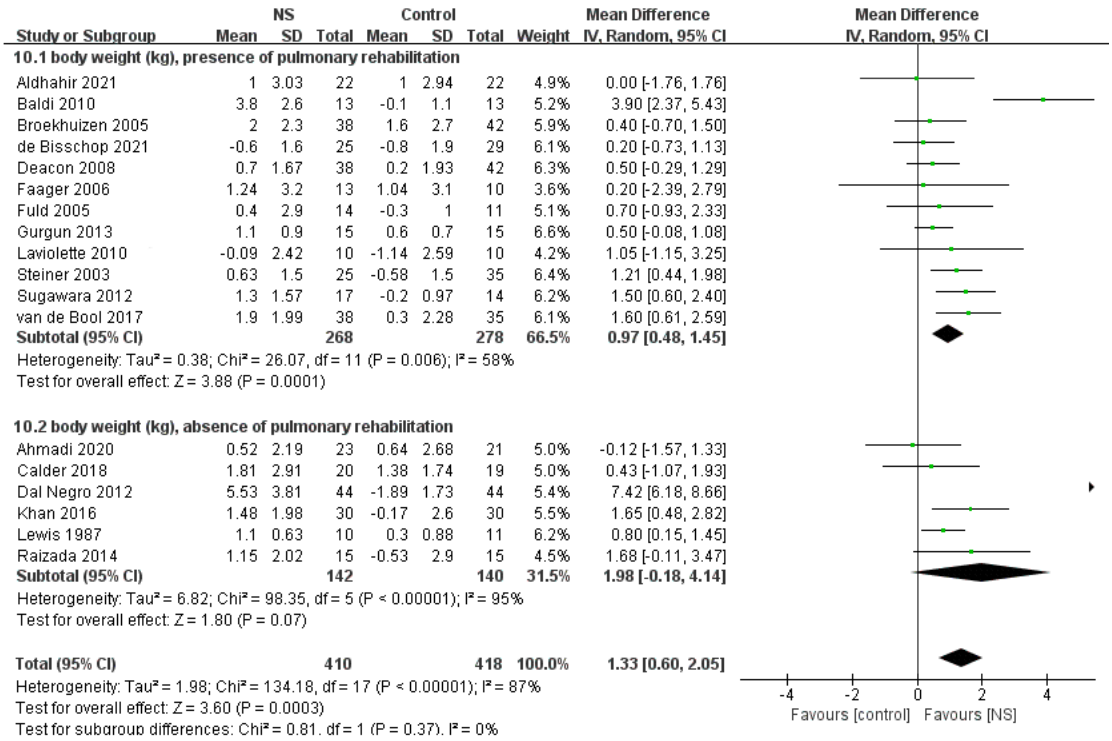

Figure S10. Forest plot of subgroup analysis results from body weight changes in response to nutrient supplements based on the presence or absence of pulmonary rehabilitation in people with chronic obstructive pulmonary disease.

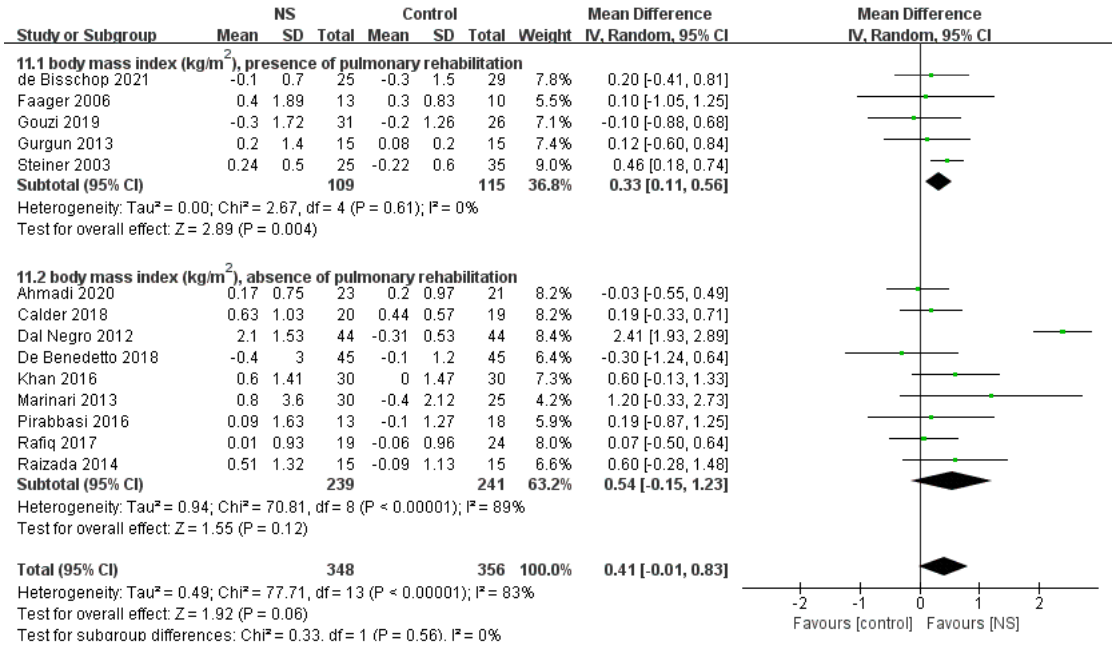

Figure S11. Forest plot of subgroup analysis results from body mass index changes in response to nutrient supplements based on the presence or absence of pulmonary rehabilitation in people with chronic obstructive pulmonary disease.

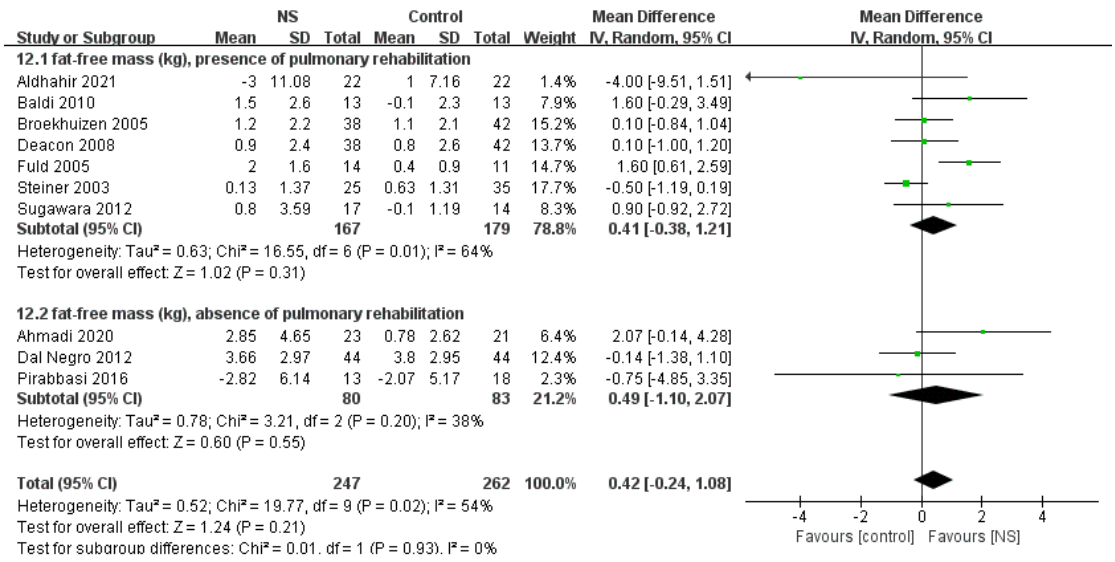

Figure S12. Forest plot of subgroup analysis results from fat-free mass changes in response to nutrient supplements based on the presence or absence of pulmonary rehabilitation in people with chronic obstructive pulmonary disease.

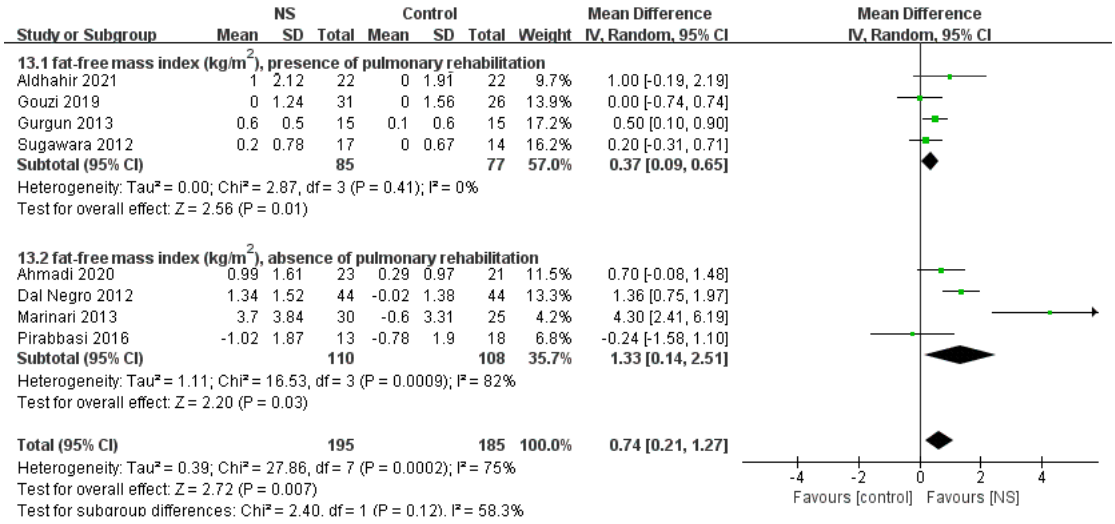

Figure S13. Forest plot of subgroup analysis results from fat-free mass index changes in response to nutrient supplements based on the presence or absence of pulmonary rehabilitation in people with chronic obstructive pulmonary disease.

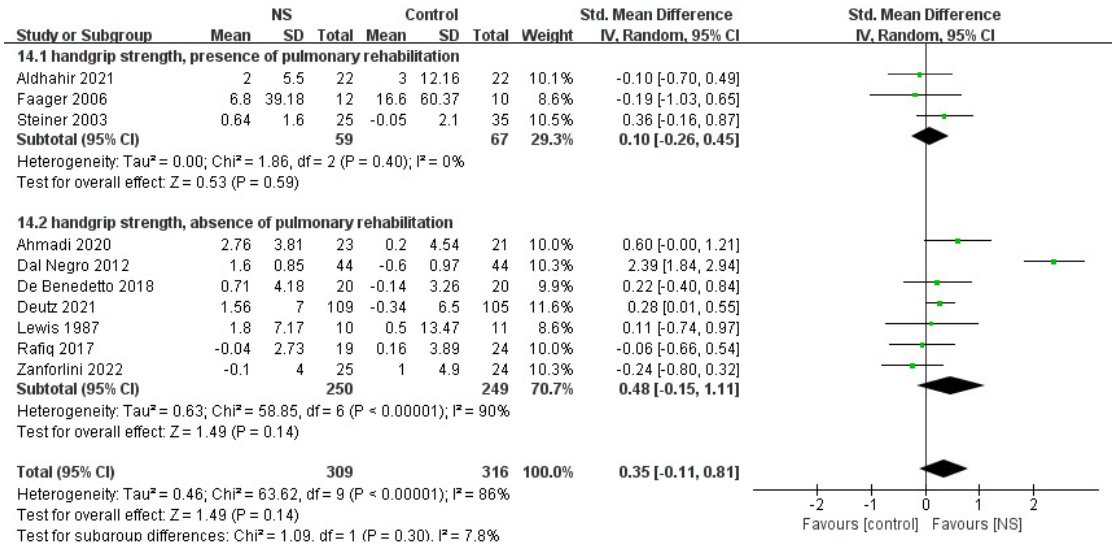

Figure S14. Forest plot of subgroup analysis results from handgrip strength changes in response to nutrient supplements based on the presence or absence of pulmonary rehabilitation in people with chronic obstructive pulmonary disease.

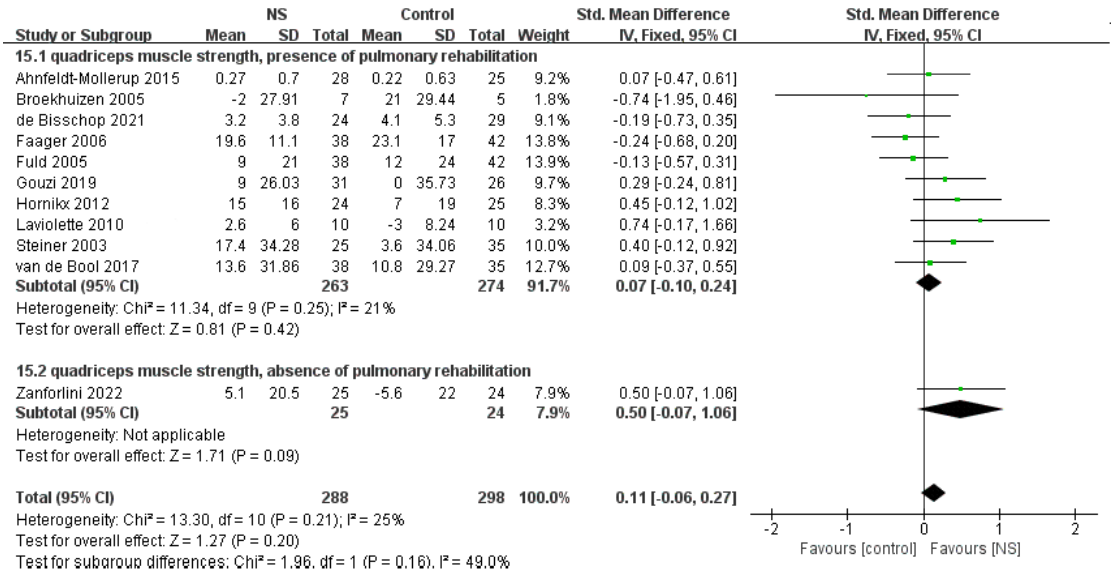

Figure S15. Forest plot of subgroup analysis results from quadriceps muscle strength changes in response to nutrient supplements based on the presence or absence of pulmonary rehabilitation in people with chronic obstructive pulmonary disease.

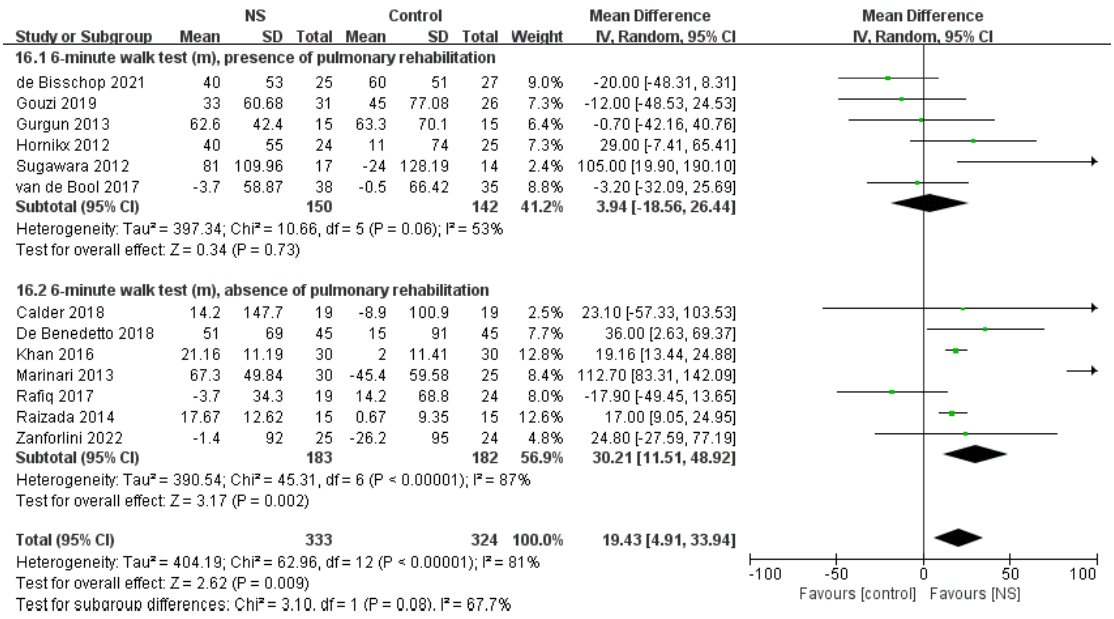

Figure S16. Forest plot of subgroup analysis results from 6-minute walk test changes in response to nutrient supplements based on the presence or absence of pulmonary rehabilitation in people with chronic obstructive pulmonary disease.

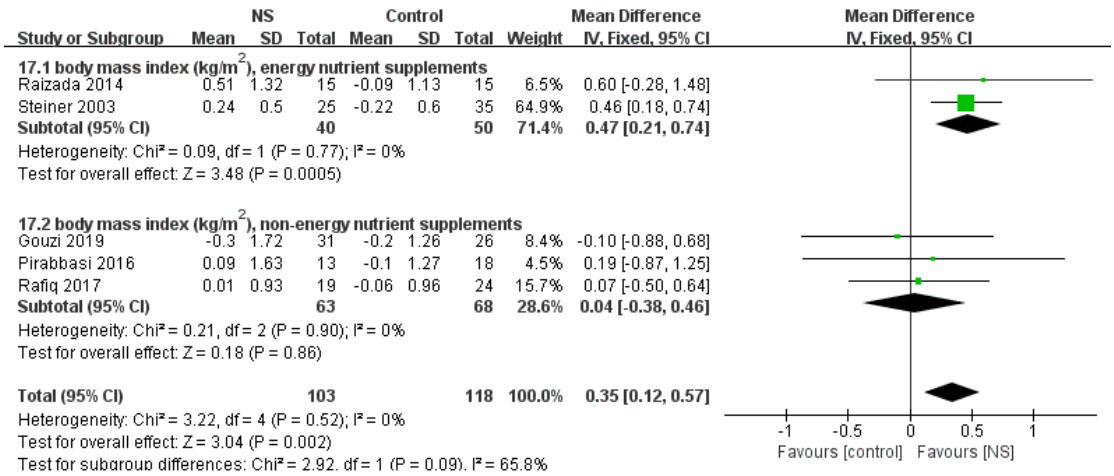

Figure S17. Forest plot of subgroup analysis results from body mass index changes in response to nutrient supplements (NS) based on the types of NS in people with chronic obstructive pulmonary disease.

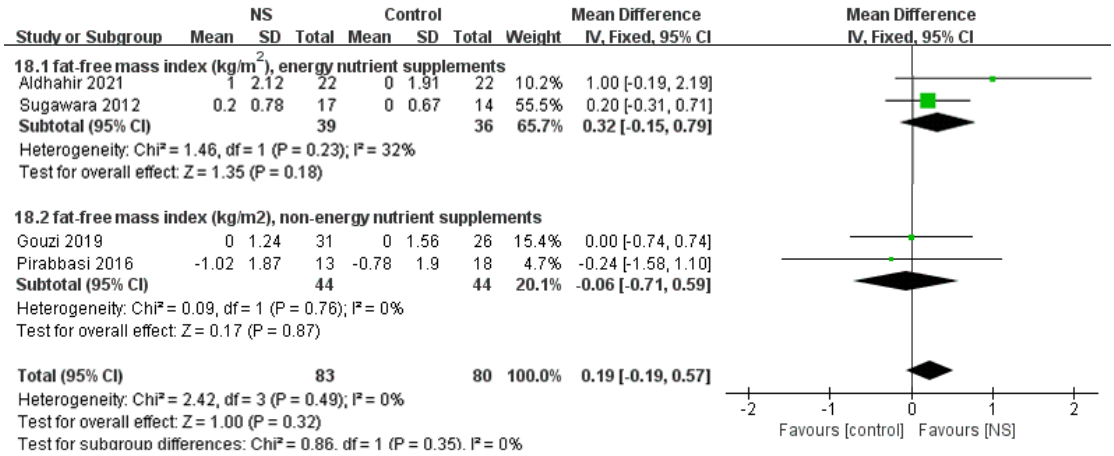

Figure S18. Forest plot of subgroup analysis results from fat-free mass index changes in response to nutrient supplements (NS) based on the types of NS in people with chronic obstructive pulmonary disease.

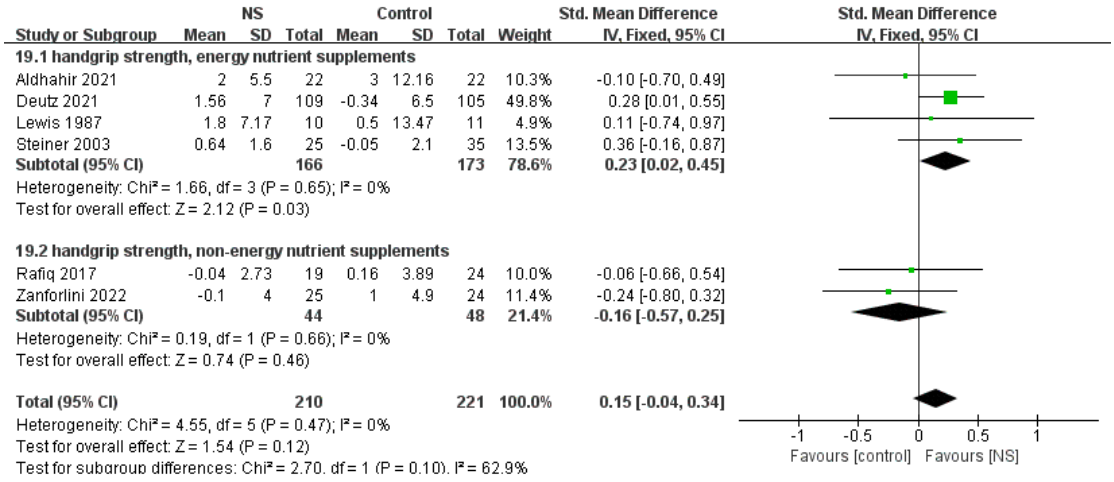

Figure S19. Forest plot of subgroup analysis results from handgrip strength changes in response to nutrient supplements (NS) based on the types of NS in people with chronic obstructive pulmonary disease.

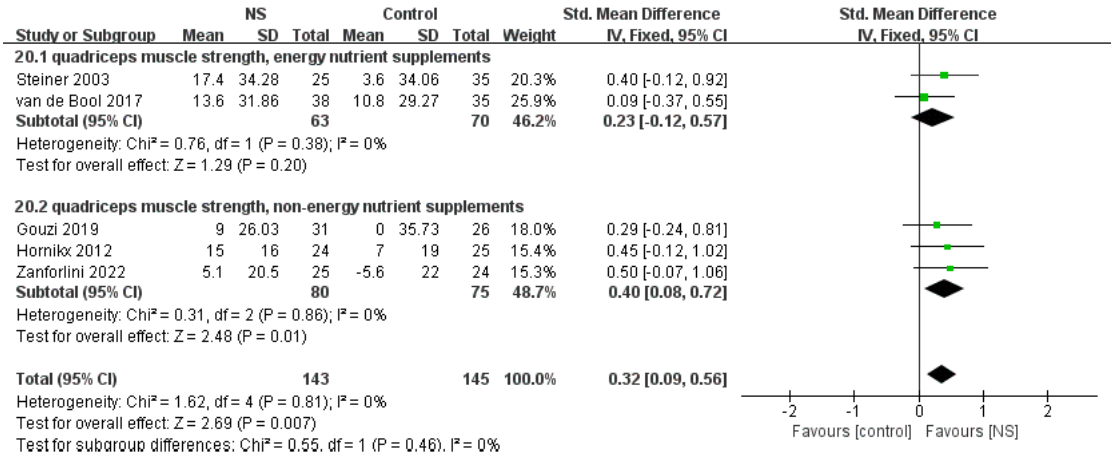

Figure S20. Forest plot of subgroup analysis results from quadriceps muscle strength changes in response to nutrient supplements (NS) based on the types of NS in people with chronic obstructive pulmonary disease.

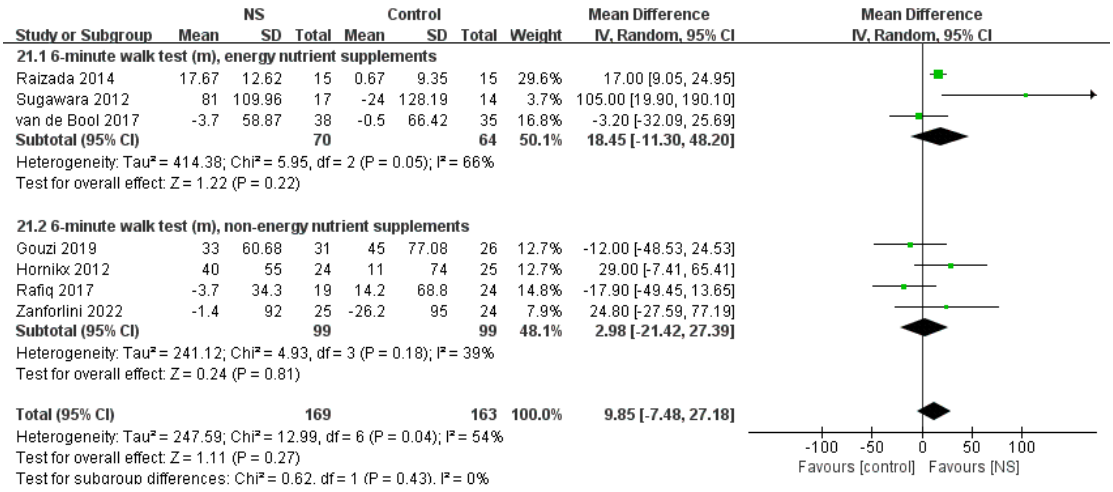

Figure S21. Forest plot of subgroup analysis results from 6-minute walk test changes in response to nutrient supplements (NS) based on the types of NS in people with chronic obstructive pulmonary disease.

Table S1. Search formulas employed to screen electronic databases for literature search

PubMed	Search for query	Results
#1	"Pulmonary Disease, Chronic Obstructive"[Mesh]	64,282
#2	((((((((((Chronic Obstructive Lung Disease[Title/Abstract]) OR (Chronic Obstructive Pulmonary Diseases[Title/Abstract])) OR (COAD[Title/Abstract])) OR (COPD[Title/Abstract])) OR (Chronic Obstructive Airway Disease[Title/Abstract])) OR (Chronic Obstructive Pulmonary Disease[Title/Abstract])) OR (Airflow Obstruction, Chronic[Title/Abstract])) OR (Airflow Obstructions, Chronic[Title/Abstract])) OR (Chronic Airflow Obstructions[Title/Abstract])) OR (Chronic Airflow Obstruction[Title/Abstract]))	79,298
#3	#1 OR #2	100,554
#4	((((((((((((supplement*) OR (nutritional intervention*)) OR (nutrition intervention*)) OR (nutrition support)) OR (nutritional support)) OR (nutritional recommendation)) OR (nutrition recommendation)) OR (nutritional therapy)) OR (nutrition therapy)) OR (enriched meal*)) OR (ONS)) OR (FSMP)) OR (sip feed)) OR (sip nutrition)) OR (oral nutrition)	841,984
#5	"Sarcopenia"[Mesh]	7,913
#6	((((((((((((((((((((((((((((((((((((((sarcopeni*[Title/Abstract])) OR (myopeni*[Title/Abstract])) OR (muscle loss[Title/Abstract])) OR (muscle depletion[Title/Abstract])) OR (muscle wasting[Title/Abstract])) OR (muscle reduction[Title/Abstract])) OR (reduced muscle[Title/Abstract])) OR (depleted muscle[Title/Abstract])) OR (muscle attenuation[Title/Abstract])) OR (muscle alteration[Title/Abstract])) OR (loss of muscle[Title/Abstract])) OR ("Muscular Atrophy"[Mesh])) OR (muscular atrophy[Title/Abstract])) OR (muscle atrophy[Title/Abstract])) OR ("Muscle, Skeletal"[Mesh])) OR (skeletal muscle[Title/Abstract])) OR (muscle mass[Title/Abstract])) OR (psoas muscle[Title/Abstract])) OR (fat free mass[Title/Abstract])) OR (lean mass[Title/Abstract])) OR (muscle index[Title/Abstract])) OR (muscle size[Title/Abstract])) OR (muscle thickness[Title/Abstract])) OR ("Body Composition"[Mesh])) OR (body composition[Title/Abstract])) OR ("Malnutrition"[Mesh])) OR (malnutrition[Title/Abstract])) OR ("Muscle Strength"[Mesh])) OR (muscle strength[Title/Abstract])) OR (muscular strength[Title/Abstract])) OR (muscle power[Title/Abstract])) OR (muscle function[Title/Abstract])) OR ("Hand Strength"[Mesh])) OR (Hand Strength[Title/Abstract])) OR (handgrip strength[Title/Abstract])) OR (grip	677,897

	strength[Title/Abstract])) OR ("Muscle Fatigue"[Mesh])) OR (muscle fatigue[Title/Abstract])) OR ("Muscle Weakness"[Mesh])) OR (muscle weakness[Title/Abstract])) OR (muscular weakness[Title/Abstract])	
#7	#5 OR #6	677,897
#8	"randomized controlled trial[Publication Type] OR randomized[Title/Abstract] OR placebo[Title/Abstract] "	962,772
#9	#3 AND #4 AND #7 AND #8	143
Embase		
#1	'chronic obstructive lung disease'/exp	160398
#2	chronic obstructive lung disease:ab,ti OR chronic obstructive pulmonary diseases:ab,ti OR coad:ab,ti OR copd:ab,ti OR chronic obstructive airway disease:ab,ti OR chronic obstructive pulmonary disease:ab,ti OR airflow obstruction, chronic:ab,ti OR airflow obstructions, chronic:ab, ti OR chronic airflow obstructions:ab,ti OR chronic airflow obstruction:ab,ti	133746
#3	supplement* OR (nutritional AND intervention*) OR (nutrition AND intervention*) OR (nutrition AND support) OR (nutritional AND support) OR (nutritional AND recommendation) OR (nutrition AND recommendation) OR (nutritional AND therapy) OR (nutrition AND therapy) OR (enriched AND meal*) OR ons OR fsmp OR (sip AND feed) OR (sip AND nutrition) OR (oral AND nutrition)	2610573
#4	sarcopenia/exp	16356
#5	muscle atrophy/exp	53789
#6	skeletal muscle/exp	403428
#7	body composition/exp	118449
#8	malnutrition/exp	193323
#9	muscle strength/exp	83882
#10	hand strength/exp	34844
#11	muscle fatigue/exp	14083
#12	muscle weakness/exp	423971
#13	sarcopeni*:ab,ti OR myopeni*:ab,ti OR muscle loss:ab,ti OR muscle depletion:ab,ti OR muscle wasting:ab,ti OR muscle reduction:ab,ti OR reduced muscle:ab,ti OR depleted muscle:ab,ti OR muscle attenuation:ab,ti OR muscle	280184

	alteration:ab,ti OR loss of muscle:ab,ti OR muscular atrophy:ab,ti OR muscle, skeletal:ab,ti OR muscle mass:ab,ti OR psoas muscle:ab,ti OR fat free mass:ab,ti OR lean mass:ab,ti OR muscle index:ab,ti OR muscle size:ab,ti OR muscle thick ness:ab,ti OR body composition:ab,ti OR malnutrition:ab,ti OR muscle strength:ab,ti OR muscular strength:ab,ti OR muscle power:ab,ti OR muscle function:ab,ti OR hand strength:ab,ti OR handgrip strength:ab,ti OR grip strength:ab,ti OR mu scle fatigue:ab,ti OR muscle weakness:ab,ti OR muscular weakness:ab,ti	
#14	randomized controlled trial:ab,ti OR randomized:ab,ti OR placebo:ab,ti	1051911
#15	#1 OR #2	186603
#16	#4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13	1223202
#17	#3 AND #14 AND #15 AND #16	243
The Cochrane Library		
#1	MeSH descriptor: [Pulmonary Disease, Chronic Obstructive] explode all trees	6337
#2	(Chronic Obstructive Lung Disease):ti,ab,kw OR (Chronic Obstructive Pulmonary Diseases):ti,ab,kw OR (COAD):ti,ab,kw OR (COPD):ti,ab,kw OR (Chronic Obstructive Airway Disease):ti,ab,kw OR (Chronic Obstructive Pulmonary Disease):ti,ab,kw OR (Airflow Obstruction, Chronic):ti,ab,kw OR (Airflow Obstructions, Chronic):ti,ab,kw OR (Chronic Airflow Obstructions):ti,ab,kw OR (Chronic Airflow Obstruction):ti,ab,kw	22954
#3	#1 or #2	23242
#4	(supplement*) OR (nutritional intervention*) OR (nutrition intervention*) OR (nutrition support) OR (nutritional support) OR (nutritional recommendation) OR (nutrition recommendation) OR (nutritional therapy) OR (nutrition therapy) OR (enriched meal*) OR (ONS) OR (FSMP) OR (sip feed) OR (sip nutrition) OR (oral nutrition)	139294
#5	MeSH descriptor: [Sarcopenia] explode all trees	616
#6	MeSH descriptor: [Muscular Atrophy] explode all trees	990
#7	MeSH descriptor: [Muscle, Skeletal] explode all trees	13303
#8	MeSH descriptor: [Body Composition] explode all trees	5697
#9	MeSH descriptor: [Malnutrition] explode all trees	4728
#10	MeSH descriptor: [Muscle Strength] explode all trees	6700
#11	MeSH descriptor: [Hand Strength] explode all trees	1725

#12	MeSH descriptor: [Muscle Fatigue] explode all trees	1050
#13	MeSH descriptor: [Muscle Weakness] explode all trees	609
#14	(sarcopeni*):ti,ab,kw OR (myopeni*):ti,ab,kw OR (muscle loss):ti,ab,kw OR (muscle depletion):ti,ab,kw OR (muscle wasting):ti,ab,kw OR (muscle reduction):ti,ab,kw OR (reduced muscle):ti,ab,kw OR (depleted muscle):ti,ab,kw OR (muscle attenuation):ti,ab,kw OR (muscle alteration):ti,ab,kw OR (loss of muscle):ti,ab,kw OR (muscular atrophy):ti,ab,kw OR (muscle atrophy):ti,ab,kw OR (skeletal muscle):ti,ab,kw OR (muscle mass):ti,ab,kw OR (psoas muscle):ti,ab,kw OR (fat free mass):ti,ab,kw OR (lean mass):ti,ab,kw OR (muscle index):ti,ab,kw OR (muscle size):ti,ab,kw OR (muscle thickness):ti,ab,kw OR (body composition):ti,ab,kw OR (malnutrition):ti,ab,kw OR (muscle strength):ti,ab,kw OR (muscular strength):ti,ab,kw OR (muscle power):ti,ab,kw OR (muscle function):ti,ab,kw OR (Hand Strength):ti,ab,kw OR (handgrip strength):ti,ab,kw OR (grip strength):ti,ab,kw OR (muscle fatigue):ti,ab,kw OR (muscle weakness):ti,ab,kw OR (muscular weakness):ti,ab,kw	86904
#15	#5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14	92503
#16	#3 AND #4 AND #15	371
Web of Science		
#1	TS=(Pulmonary Disease, Chronic Obstructive or Chronic Obstructive Lung Disease or Chronic Obstructive Pulmonary Diseases or COAD or COPD or Chronic Obstructive Airway Disease or Chronic Obstructive Pulmonary Disease or Airflow Obstruction, Chronic or Airflow Obstructions, Chronic or Chronic Airflow Obstructions or Chronic Airflow Obstruction)	105,404
#2	TS=(supplement* or nutritional intervention* or nutrition intervention* or nutrition support or nutritional support or nutritional recommendation or nutrition recommendation or nutritional therapy or nutrition therapy or enriched meal* or ONS or FSMP or sip feed or sip nutrition or oral nutrition)	694,069
#3	TS=(Sarcopenia or sarcopeni* or myopeni* or muscle loss or muscle depletion or muscle wasting or muscle reduction or reduced muscle or depleted muscle or muscle attenuation or muscle alteration or loss of muscle or Muscular Atrophy or muscular atrophy or muscle atrophy or Muscle, Skeletal or skeletal muscle or muscle mass or psoas muscle or fat free mass or lean mass or muscle index or muscle size or muscle thickness or Body Composition or body composition or Malnutrition or malnutrition or Muscle Strength or muscle strength or muscular strength or muscle power or muscle	859,315

	function or Hand Strength or Hand Strength or handgrip strength or grip strength or Muscle Fatigue or muscle fatigue or Muscle Weakness or muscle weakness or muscular weakness)	
#4	TS=(randomized controlled trial or randomized or placebo)	1,117,630
#5	#1 AND #2 AND #3 AND #4	187
Ovid		
#1	(Pulmonary Disease, Chronic Obstructive or Chronic Obstructive Lung Disease or Chronic Obstructive Pulmonary Diseases or COAD or COPD or Chronic Obstructive Airway Disease or Chronic Obstructive Pulmonary Disease or Airflow Obstruction, Chronic or Airflow Obstructions, Chronic or Chronic Airflow Obstructions or Chronic Airflow Obstruction).ti,ab,kw.	78236
#2	(supplement* or nutritional intervention* or nutrition intervention* or nutrition support or nutritional support or nutritional recommendation or nutrition recommendation or nutritional therapy or nutrition therapy or enriched meal* or ONS or FSMP or sip feed or sip nutrition or oral nutrition).ti,ab,kw.	410475
#3	(Sarcopenia or sarcopeni* or myopeni* or muscle loss or muscle depletion or muscle wasting or muscle reduction or reduced muscle or depleted muscle or muscle attenuation or muscle alteration or loss of muscle or Muscular Atrophy or muscular atrophy or muscle atrophy or Muscle, Skeletal or skeletal muscle or muscle mass or psoas muscle or fat free mass or lean mass or muscle index or muscle size or muscle thickness or Body Composition or body composition or Malnutrition or malnutrition or Muscle Strength or muscle strength or muscular strength or muscle power or muscle function or Hand Strength or Hand Strength or handgrip strength or grip strength or Muscle Fatigue or muscle fatigue or Muscle Weakness or muscle weakness or muscular weakness).ti,ab,kw.	302186
#4	(randomized controlled trial or randomized or placebo).ti,ab,kw.	737776
#5	1 AND 2 AND 3 AND 4	76
Scopus		

#1	TITLE-ABS-KEY ("pulmonary disease, chronic obstructive" OR "chronic obstructive lung disease" OR "chronic obstructive pulmonary diseases" OR "coad" OR "copd" OR "chronic obstructive airway disease" OR "chronic obstructive pulmonary disease" OR "airflow obstruction, chronic" OR "airflow obstructions, chronic" OR "chronic airflow obstructions" OR "chronic airflow obstruction") Show less	145,607
#2	ALL ("supplement*" OR "nutritional intervention*" OR "nutrition intervention*" OR "nutrition support" OR "nutritional support" OR "nutritional recommendation" OR "nutrition recommendation" OR "nutritional therapy" OR "nutrition therapy" OR "enriched meal*" OR "ons" OR "fsmp" OR "sip feed" OR "sip nutrition" OR "oral nutrition") Show less	62,032,663
#3	TITLE-ABS-KEY ("sarcopenia" OR "sarcopeni*" OR "myopeni*" OR "muscle loss" OR "muscle depletion" OR "muscle wasting" OR "muscle reduction" OR "reduced muscle" OR "depleted muscle" OR "muscle attenuation" OR "muscle alteration" OR "loss of muscle" OR "muscular atrophy" OR "muscular atrophy" OR "muscle atrophy" OR "muscle, skeletal" OR "skeletal muscle" OR "muscle mass" OR "psoas muscle" OR "fat free mass" OR "lean mass" OR "muscle index" OR "muscle size" OR "muscle thickness" OR "body composition" OR "body composition" OR "malnutrition" OR "malnutrition" OR "muscle strength" OR "muscle strength" OR "muscular strength" OR "muscle power" OR "muscle function" OR "hand strength" OR "hand strength" OR "handgrip strength" OR "grip strength" OR "muscle fatigue" OR "muscle fatigue" OR "muscle weakness" OR "muscle weakness" OR "muscular weakness") Show less	622,527
#4	TITLE-ABS-KEY ("randomized controlled trial" OR "randomized" OR "placebo")	1,440,348
#5	#1 AND #2 AND #3 AND #4	899