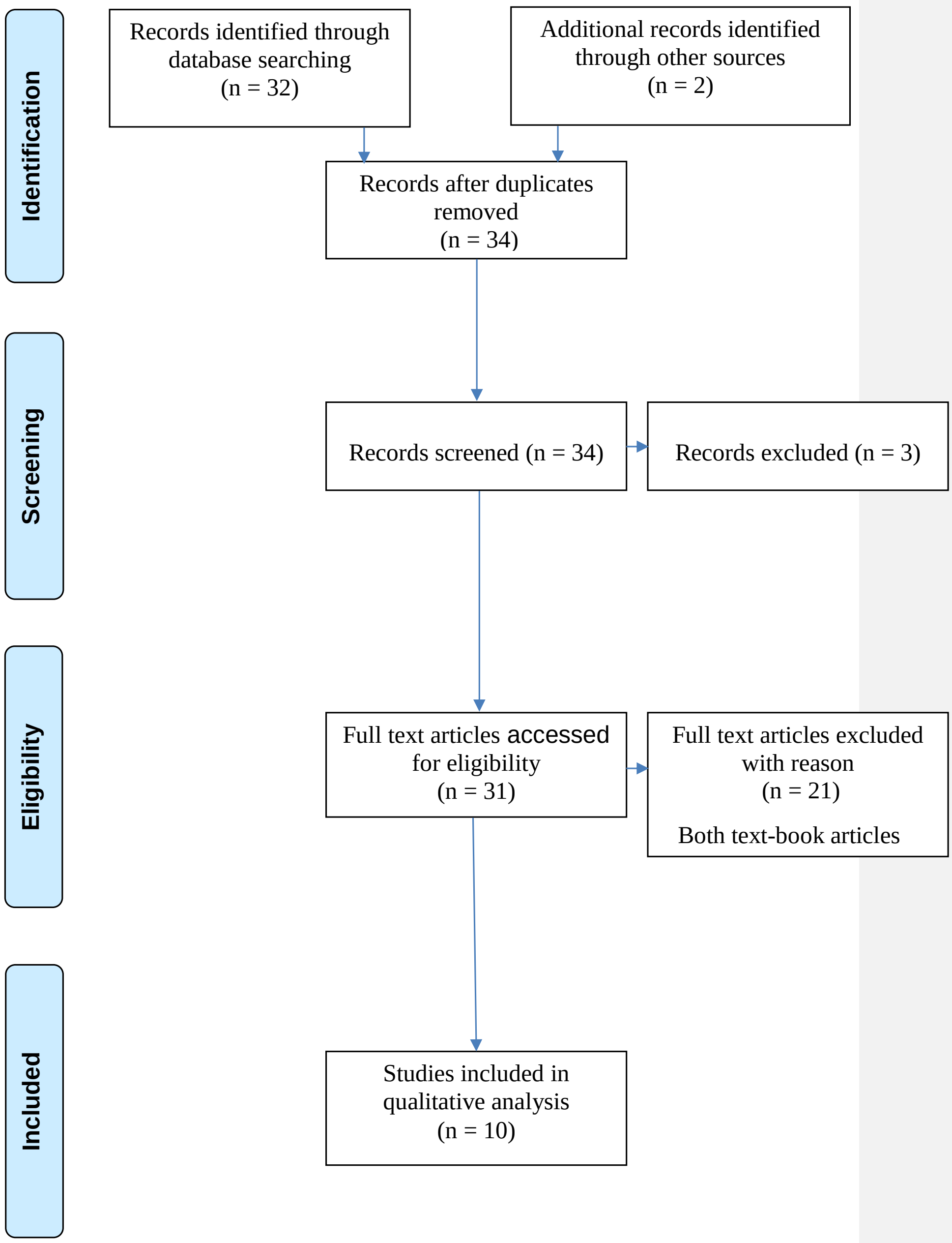
Appendix 1: Classification of overweight and obesity after spinal cord injury



Appendix 1: Nutrition Education and Weight Management Programmes

2.1: Evidence of nutrition education being effective in treatment or prevention of overweight or obesity in people with a SCI

Author	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
1. Buchholz, AC & Bugaresti JM Bucggolz AC, Bugaresti JM. A review of body mass index and waist circumference as markers of obesity and coronary heart disease risk in person with chronic spinal cord injury. Spinal Cord 2005: 43, 513-518.	Review article/ Literature review	NA	NA	SCI	Consider SCI specific BMI; Also consider Waist circumference as surrogate measure of visceral adipose tissue and CHD.	Review	D
2. Emmons et al, 2009 Emmons RR, Cirnigiliaro CM, Moyer JM, Spungen AM, Kirshblum SC, Bauman WA.	Case Control	Visceral fat was measured by abdominal ultrasound, Total body fat by DEXA Waist and hip circumference	NA	SCI and Able-bodied control	Visceral fat measured by ultrasonography could be use as body composition assessment tool in SCI patients.	Chronic SCI Little female subject (42 males, 5 female) When is acute?	C

Abdominal ultrasongraphy compared to traditional body composition assessemnts in SCI. J Spinal Cord Med 2009: 32, 484-485.							
3. Emmons et al, 2011 Emmons RR, Garber CE, Cirnigliaro CM, Kirshnlum SC, Spungen AM, Bauman WA. Assessment of measures for abdominal adiposity in persons with spinal cord injury. Ultrasound in Medicine and Biology 2011: 37, 734-741.	Case-control study	Abdoimal US, wasit and hip circumference versus DEXA	NA	SCI	Ultrasound may be useful alternative in clinical practice for the measurement of visceral fat in weight loss program	Men only; no female subjects	C

4. Yarar-Fisher et al, 2013 Yarar-Fisher C, Chen Y, Jackson AB, Hunter GR. Body mass index underestimates adiposity in women with spinal cord injury. Obesity 2013: 21, 1223-1225.	Case-control study	BMI, DEXA	NA	SCI	Women with SCI had higher softtissue percent fat than control. Using BMI have limitations in assessessing body composition in women with SCI.	24 womne with SCI Vs 23 able bodied control women	C
5. Eriks-Hoogland et al, 2011 Eriks-Hoogland, Hilfiker R, Baynberger M, Balk S, Stucki G, Perret C. Clinical assessment of obesity in persons with spinal cord injury: validity of waist circumference, body mass index, and anthropometric index. J Spinal Cord Med 2011: 34, 416-422.	Cross-sectional study	Waist circumference, BIA	NA	SCI	Good agreement between BIA and anthropometric index: waist circumference Correlation between WC and BMI just moderate	23 men with SCI. Complete paraplegia No women.	C

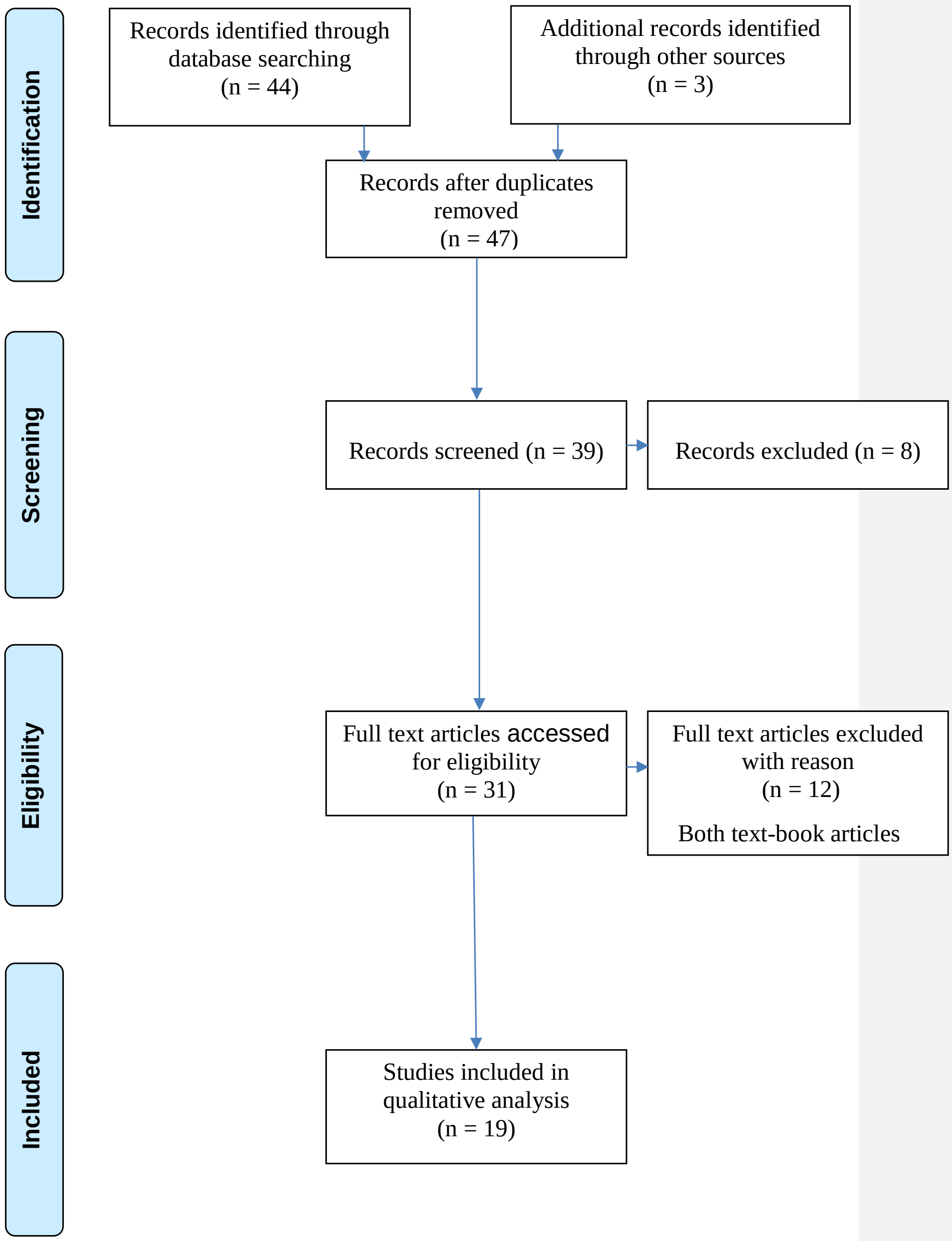
6. Gorget et al, 2011 Gorgey AS, Mather KJ, Poarch HJ, Gater DR. Influence of motor complete spinal cord injury on visceral and subcutaneous adipose tissue measured by multi-axial magnetic resonance imaging. J Spinal Cord Med 2011: 34, 99-109.	Observational sutdy	DEXA, MRI for visceral adipose tissue and subcutaneous adipose tissue. Waist circumference	NA	SCI	Single slice cross-sectional area can modestly predict the volume of multi-axial slices in SCI patients	13 motor complete SCI. Expesnive cost Not routine available for body composition assessemnt	C
7. Laughton et al, 2009 Laughton GE, Buchholz AC, Martin KA, Goy RE, SHAPE SHAP. Lowering body mass index cutoffs better identifies obese persons with spinal cord injury. Spinal Crod 2009: 47, 757-762.	Cross-sectional study	BMI, BIA	NA	SCI	BMI cutoff of 30 failed to identify 73.9% of obese participants vs lowered cut-off (25) BMI>22 should considered at overweight	77 chronic SCI	C
8. Buchholz et al, 2003 Buchholz AC, McGillivary CF, Pencharz PB. The use of bioelectrical impednace analysis to measure fluid compartments in subjects	Cross-sectional study	TBW using deuterium dilution, extracellular water by corrected bromide space	NA	SCI	BMI has excellent specificity but poor sensitivity in distinguishing obese from non-obese paraplegic patients.	31 paraplegia	C

with chronic paraplegia. Arch Phy Med Rehab 2003: 84, 854-861.					TBW and ECW can predicted using single frequency BIA		
9. Emmons et al, 2010 Emmons RR, Garber CE, Cirnigliaro CM, Moyer JM, Kirshblum SC, Galea MD, Spungen AM, Bauman WA. The influence of visceral fat on the postprandial lipemic response in men with paraplegia						Men only studies 10 men with paraplegia Vs 10 AB control	
10. Edwards et al, 2008 Edwards LA. Bugaresti JM, Buchholz AC. Visceral adipose tisue and the ratio if visceral to subcutaneous adipose tissue are greater in adutls with than in those without spinal cord injury, despite	Observational study	Waist circumference, total adipose tissue, visceral adipose tissue and subcutaneous adipose tissue by CT at L4-		SCI	SCI had 58% higher mean VAT, 48% greater VAT:SAT and 26% greater mean TAT than matched AB control.	15 SCI vs 16 AB control	C

matching waist circumference. Am J Clini Nutr 2008: 87, 600-607		L5.			WC at all sites was correlated with VAT. WC may be a valid surrogate measure of VAT		

11. Buchholz et al, 2003 Buchholz AC, McGillivary CF, Pencharz PB. The use of bioelectrical impednace analysis to measure fluid compartments in subjects with chronic paraplegia. Arch Phy Med Rehab 2003: 84, 854-861.	Cross-sectional study	TBW using deuterium dilution, extracellular water by corrected bromide space	NA	SCI	BMI has excellent specificity but poor sensitivity in distinguishing obese from non-obese paraplegic patients. TBW and ECW can predicted using single frequency BIA	31 paraplegia	C

Appendix 1: How should body composition be measured in spinal cord injury people



Appendix 1: How should body composition be measured in spinal cord injured people

Author	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
1. Buchholz et al, 2003 Buchholz AC, McGillivary CF, Pencharz PB. The use of bioelectric impedance analysis to measure fluid compartments in subjects with chronic paraplegia. Arch Phys Med Rehabil 2003: 84, 854-862.	Cross sectional study	TBW by deuterium dilution ECW by corrected bromide space BIA (single freq and multi freq) BMI	NA	31 SCI	BMI have excellent specificity but poor sensitivity in distinguishing obese from non obese paraplegic. BIA is recommeded to predict FFM and FM	31 SCI with paraplegia 19 men and 12 women Vs 62 AB control	C
2. De et al, 2010 De JT, Giangregorio LM, Craven BC. Body composition screening criteria after chronic SCI. J Spinal Cord Med 2010: 33, 177-178.	Cross-sectional observational study	BMI DEXA	NA	65 men with SCI	Recommend at risk patient should be screening using SCI – specific BMI and Total hip threshold from DEXA	65 SCI (46men) With C2 to T12	C

3.	Edwards et al, 2008 Edwards LA, Bugaresti JM, Buchholz AC. Visceral adipose tissue and the ratio of visceral to subcutaneous adipose tissue are greater in adults with than in those without spinal cord injury, despite matching waist circumference. Am J Clin Nutr 2008: 87, 600-608.	Prospective cross-sectional study	CT to quatify abdominal adipose tissue (L4 – L5 level)		15 SCI And 16 AB	High level of VAT in young people with SCI who classifised themselves as active. WC may be a valid surrogate measure of VAT	31 subjects 15 SCI, 16 AB	C
4.	Emmons et al, 2011 Emmons R, Garber C, Cirnigliaro M, Kirshblum C, Spungen M, Buman W. Assessment of measures for abdominal adiposity in	Prosective, observational study	DEXA Abdominal US Waist circumference Hip circumference Waist to hip ratio		24 men with SCI Vs 20 AB men	Ultrasound may be a useful tool for the measurement of VF in weight loss programs and for assessment of cardiometabolic disorders	24 SCI men and 20 AB men	C

	persons with spinal cord injury. Ulrasound in medicine & biology 2011: 37, 734-							
5.	Emmons et al, 2009 Emmons RR< Cirnigiliaro CM, Moyer JM, Spungen AM, Kirshblum SC, Bauman WA. Abdominal ultrasonography compared to traditional body composition assessments in SCI. J Spinal Cord Med 2009: 32, 484-485.	Prospective observational study	Abdominal US to measure visceral fat DEXA Waist and hip circumference Waist to hip ratio	NA	47 SCI	Ultrasound may be valuable body composition assessment tool in SCI population.	47 SCI (42 males and 5 females) Vs 24 AB control	C

6.	Eriks-Hoogland et al, 2011 Eriks-Hoogland I, Jilfiker R, Baumberger M, Balk S, stucki G, Perret C. Clincal assessment of obesity in persons with spinal cord injury: validity of waist circumference, body mass index, and anthropometric index. J Spinal Cord Med 2011: 34, 416-422.	Comparative cross-sectional study	WC BIA BMI	NA	23 men complete SCI	BIA seems to be a valid proxy to estimate obesity.	23 men with SCI	C
7.	Gargiulo et al, 2010 Gargiulo P, Kern H, Carraro U, Ingvarsson P, Knutsdottir S, Gudmundsdottir V, Yngvason S, Vatnsdal B, Helgason T. Quantitative color	Observational study	CT	NA	NA	Quantitative color three-dimensional CT	Radiation	C

	three-dimensional computer tomography imaging of human long-term denervated muscle.							
12.	Gargiulo et al, 2011 Gargiulo P, Helgason T, Reynisson PJ, Helgason B, Kern H, Mayr W, Ingvarsson P, Carraro U. Monitoring of muscle and bone recovery in spinal cord injury patients treated with electrical stimulation using three-dimensional imaging and segmentation techniques:	Observational study	FES CT	NA	NA	Spiral CT technology could be a tool to assess structural information.	Radiation	C

	Methodlogical assessment. Artificial organs 2011: 35, 275-281.							
8.	Gater et al, 2013 Gater D, Dolbow D, Moore J, Novak T, DeVries A, Siegel J, Gorgey A. Body composition assessment after motor complete spinal cord injury. J Spinal Cord Med 2013: 36,	Prospective descriptive comparison study	Hydrostatic weighing, air displacement plethysmography (BodPod), DEXA, BIA, skin-fold, BMI		54 chronic SCI patients	Body fat in SCI population is roughly twice as general population. SCI specific predictive equation is warrentd to assess Body Composition	No control	C

9.	Gorgey et al, 2010 Gorgey AS, Chiodo AE, Zemper ED, Hornyak JE, Rodriguez GM, Gater DR. Relationship of spasticity to soft tissue body composition and the metabolic profile in persons with chronic motor complete spinal cord injury. J Spinal Cord Med 2010: 33, 6-16.	Observational , Longitudinal study	DEXA RMR Abdominal circumference	NA	10 chronic SCI	Spasticity may indirectly influence glucose homeostasis and lipid profile by maintaing lean body mass. Spasticity may be defense the deterioration afer SCI	10 AIS: A / B chronic SCI patients	C
10.	Gorgey et al, 2013 Gorgey AS, Poarch HJ, Adler RA, Khalil RE, Gater DR. Femoral bone marrow adiposity and cortical bonbe cross-sectional areas in men with motor complete spinal cord injury.	Observational , cross sectional study	DEXA	NA	8 SCI and 6 age matched AB control	After SCI, cortical bone CSA becomes thinner and associated with greater accumulation of yellow BMA.	8 SCI 6 AB control	C

	PM and R 2013: 11, 939-948.							
11.	Gorgey et al, 2011 Gorgey S, Mther J, Poarch J, Gater R. Influence of motor complete spinal cord injury on visceral and subcutaneous adipose tissue measured by multi-axial magnetic resonance imaging. J Spinal Cord Med 2011: 34, 99-110.	Observational, comparative study	MRI to measure Visceal AT and Subcutaneous AT, DEXA to measure whole body fat and muscle mass, waist circumference	NA		Single slice cross-sectional area (CSA) can modestl predict the volume of multi-axial slices in SCI patients	NA	C

13.	Jones et al, 2003 Jones LM, Legge M, Goulding A. Healthy body mass index values often underestimate body fat in men with spinal cord injury. Arch Phy Med Rehab 2003: 84, 1068-1072.	Cross sectional study	DEXA for total fat and muscle mass	NA	19 SCI men with 19 AB control	Body fat was greater for any given BMI in the SCI group. BMI may underestimate body fat in men	19 men and 19 AB control men No women	C
14.	Laughto et al, 2009 Laughton GE, Buchholz AC, Ginis KAM, Goy RE. lowering body mass index cutoffs better identifies obese persons with spinal cord injury. Spinal Cord 2009: 47, 757-763.	Cross-sectional study	BMI BIA CRP	NA	77 adult chronic SCI patients	Chronic SCI patient with BMI >22 should consider as high risk of obesity	77 chornic SCI paients No acute	C

15. Maruyama et al, 2008 Maruyama Y, Mizuguchi M, Yaginuma T, Kusaka M, Yoshida H, Yokoyama K, kasahara Y, Hosoya T. Serum leptin, abdominal obesity and the metabolic syndrome in individuals with chornic spinal cord injury. Spinal Cord 2008: 46, 494-500.	Cross sectional study	DEXA Waist circumference Leptin	NA	28 paraplegic and AB control	SCI individuals are predisposed to excessive of abdominal obesity	No tetraplegic	C
16. McDonald et al, 2007 McDonald CM, Abresch-Meyer AL, Nelson MD, Widmand LM. Body mass index and body composition measure by dual x-ray absorptiometry	Observation comparative study	DEXA BMI	NA	60 SCI 50 paraplegic 10 tetraplegic 60 AB control	SCI patients have significant less muscle mass and bone mineral content and increased fat mass. Traditional BMI cutoff therefore significantly underestimate obesity in this population.	60 SCI Vs 60 control	C

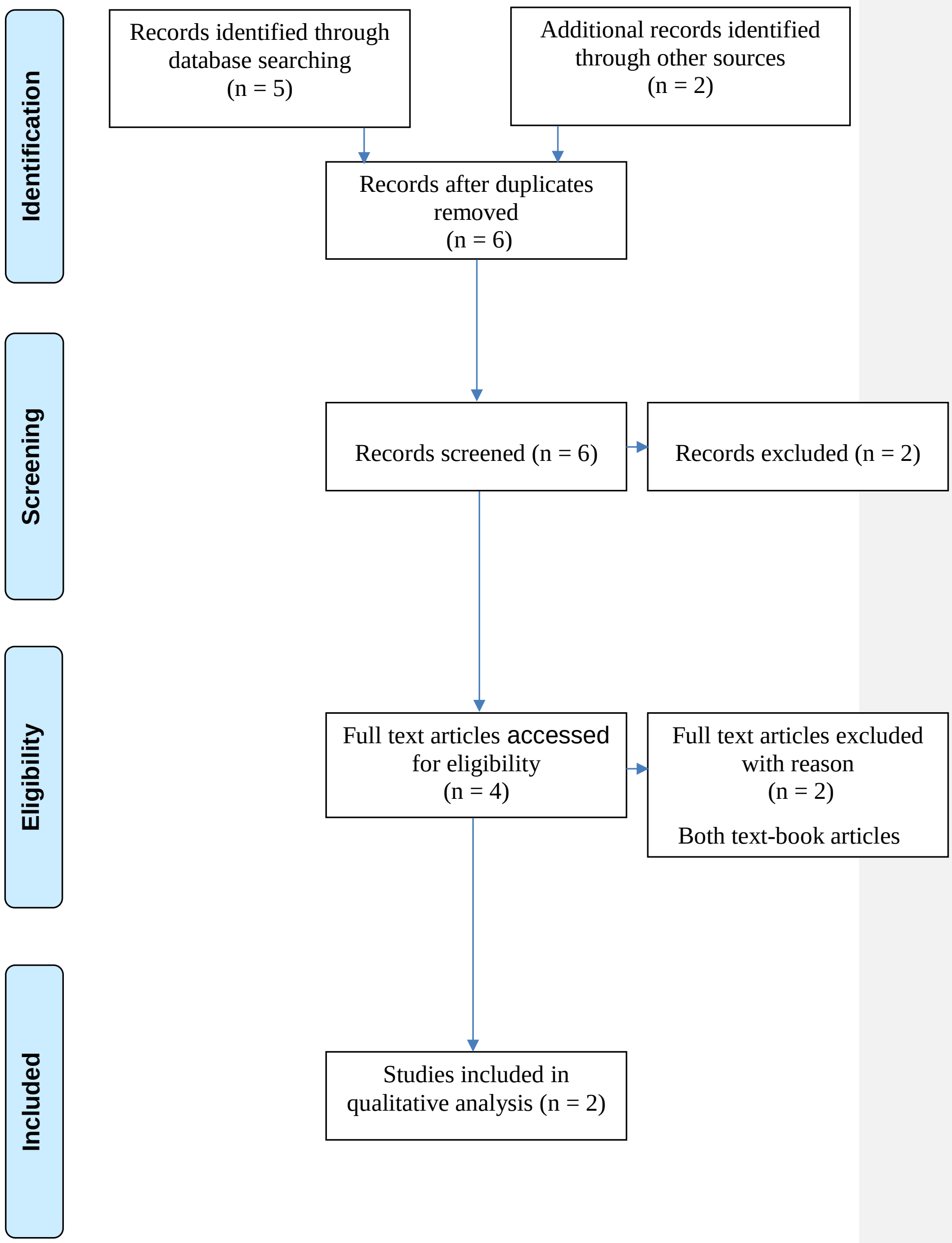
in patients aged 10 to 21 years with spinal cord injury. J Spinal Cord Med 2007: 30, S97-NaN.							
17. Ravensbergen et al, 2012 Ravensbergen HJC, Keenleyside MC, Lear SA, Claydon VE. What is the best marker for obesity in individual with spinal cord injury. Clin Autonomic Research 2012: 22	Observational comparative study	BMI WC WHR Waist to height ratio Neck circumference DEXA	NA	30 SCI	Significant correlation between WC, WHT and WhtR and total fat. BMI require wheelchair scale (Telemedicine)	30 SCI	C

18. Spungen et al, 2003 Spungen AM, Adkins RH, Stewart CA, Wang J, Pierson RN, Waters RL, Bauman WA. Factors influencing body composition in persons with spinal cord injury: a cross-sectional study. J of Applied Physiology 2003: 95, 2398-2407.	Observational Comparetive study	DEXA BMI	NA	133 men with chronic SCI	Advancing age was strongly associated with less muscle mass and greater adiposity in those with SCI.	No women	C
19. Yara-Fisher et al, 2013 Yara-Fisher C, Chen Y, Jackson AB, Hunter GR. Body mass index underestimates adiposity in women with spinal cord injury. Obesity 2013: 6, 1223-1225.	Observational study	DEXA BMI	NA	24 women with SCI vs 23 AB control women	Limited use of BMI in measuring adiposity in women with SCI, particular in tetraplegic. Lower BMI cutoff to define obesiy (28 para and 21 for tetra) need further study to confirm	Only female	C

72

Appendix 1: Nutrition Education and Weight Management Programmes

2.1: Evidence of nutrition education being effective in treatment or prevention of overweight or obesity in people with a SCI?



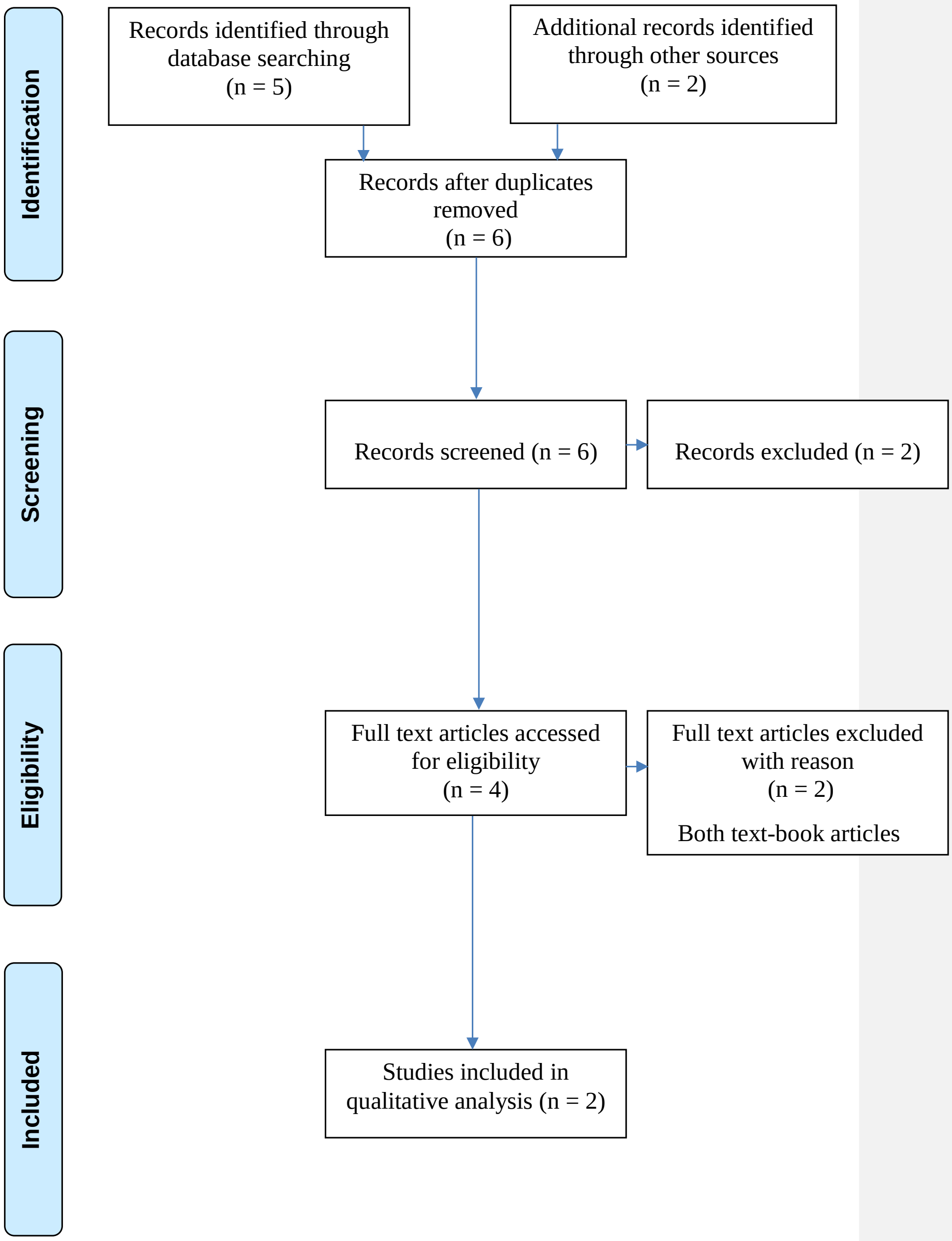
Appendix 1: Nutrition Education and Weight Management Programmes

2.1: Evidence of nutrition education being effective in treatment or prevention of overweight or obesity in people with a SCI

Author	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
Chen *et al.*, (2006)	A single group uncontrolled trial	Weight management programme of nutrition, exercise and behaviour management	12 weeks, 6-month follow-up	SCI	Improvement in BMI, body fat, dietary behavior in 12 weeks but some regain after session ended	16 patients only, 3 lost to follow up	C
Radomski *et al.*, (2011)	A single group uncontrolled trial	Exercise and weight management session	12 weeks	SCI below cervical	Improvement in weight, weight, skinfold body fat percent, hip and waist girth	13 patients only, all loss to follow up	C

Appendix 1: Nutrition Education and Weight Management Programmes:

2.3: Evidence for optimal duration (including frequency of contact) of weight management programmes for people with a SCI



Appendix 1: Nutrition Education and Weight Management Programmes:

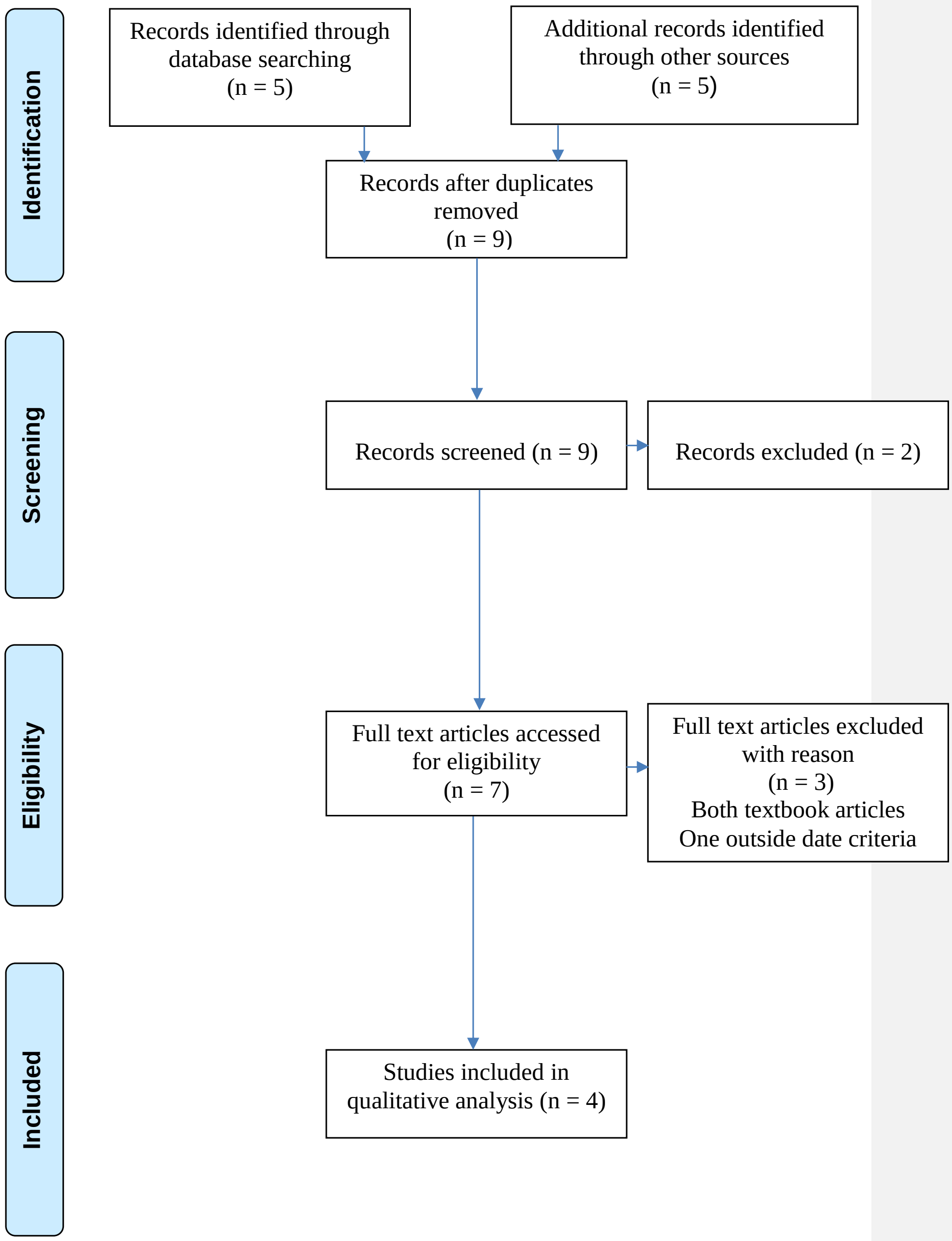
2.3: Evidence for optimal duration (including frequency of contact) of weight management programmes for people with a SCI

Author,	**Study type**	**Intervention**	**Duration**	**Population**	**Outcomes**	**Limitation**	**Grading**
Chen *et al*., (2006) .	A single group uncontrolled trial	Weight management programme of nutrition, exercise and behavior management	12 weeks, 6-month follow-up	SCI	Improvement in BMI, body fat, dietary behavior in 12 weeks but some regain after session ended	16 patients only, 3 lost to follow up	C

Radomski *et al.*, (2011)	A single group uncontrolled trial	Exercise and weight management session	12 weeks,	SCI below cervical	Improvement in weight, skinfold thickness, hip and waist girth	13 patients only, all loss to follow up	C

Appendix 2: Nutrition Education and Weight Management Programmes:

2.4: Evidence for weight loss goals for people with a SCI



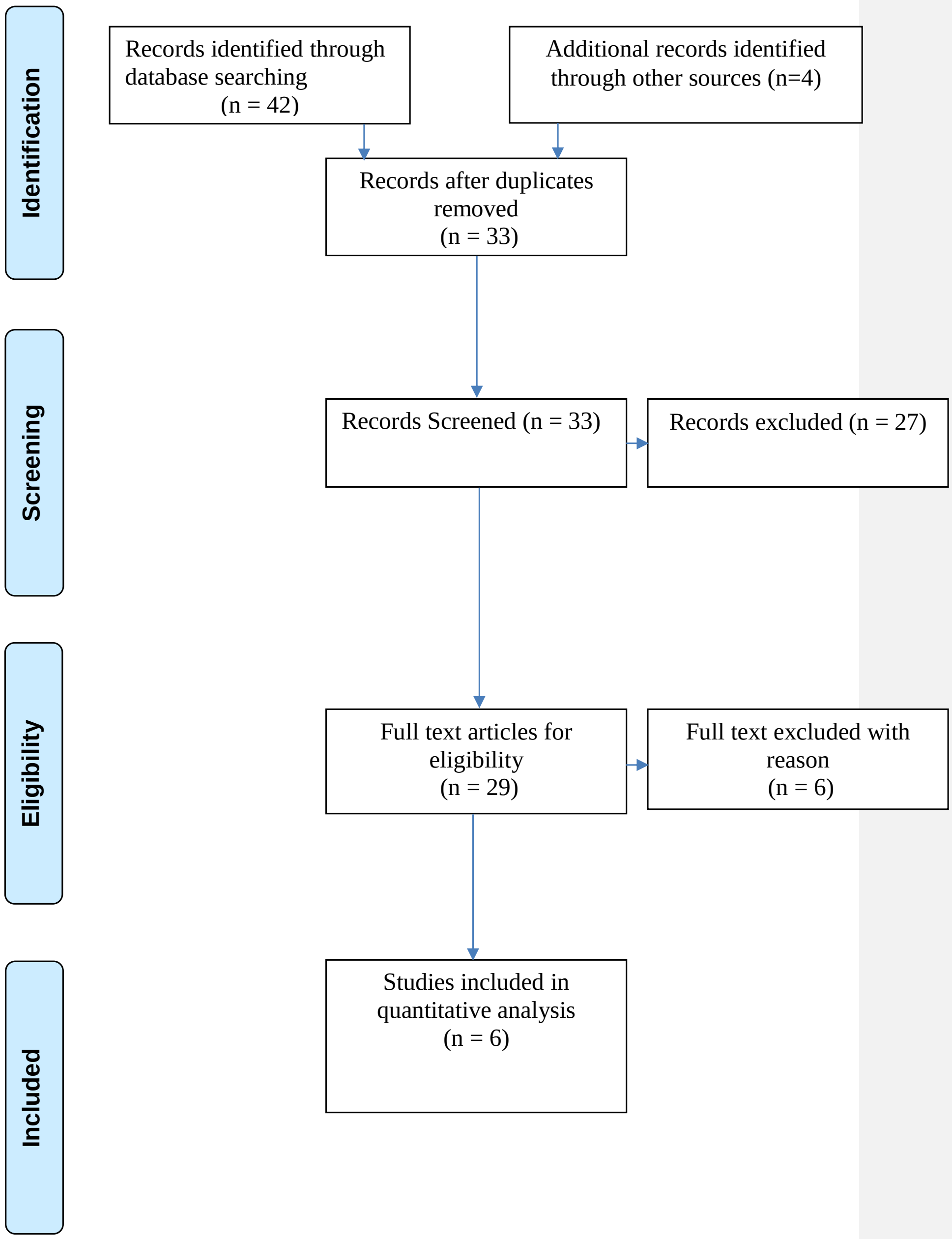
Appendix 1: Nutrition Education and Weight Management Programmes:

2.4: Evidence for realistic weight loss goals for people with SCI

Author,	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
Rajan *et al.*, (2008)	Literature review	Review of literature of method to classify obesity and weight management programme	N/A	SCI	No consensus on tool to determine obesity	Expert opinion, not systematic	D
Bucholz *et al.*, (2003).	Case controlled Cross-sectional study	Measurement of body composition and energy expenditure	N/A	Paraplegic SCI compared to BMI matched able-bodied population	RMR (resting metabolic rate) in paraplegic lower and Fat mass higher than able-bodied	Low numbers, mixture of complete and incomplete injuries	C
Spungen *et al.*, (2003)	Cross-sectional study	Measurement of body composition	N/A	SCI	SCI had >5Kg more fat mass	Compared to reference population	C
Weaver *et al.*, (2007).	Retrospective review	Measurement of body mass index	N/A	SCI	Whilst BMI lower in SCI does not account for % fat mass	Retrospective observation	D

Appendix 1: Dietary Interventions

3.1: Evidence for altered resting metabolic rate/predictive equations in people with a SCI



Appendix 1: Evidence analysis for Dietary Interventions

3.1: Evidence for altered resting metabolic rate/predictive equations in people with a SCI

Author	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
Bauman *et al.*, (2004).	Case control	Measured Resting Energy Expenditure (REE)	-	13 pairs of monozygotic twins. 11 with chronic paraplegia and two with tetraplegia.	REE (resting energy expenditure) significantly (9%- $p<0.05$) less than the co twin without SCI	Small numbers in study	B
Bucholz *et al.*, (2003	Case Control	Measured Resting Metabolic Rate (RMR)	-	34 Non-SCI and 28 people with chronic paraplegia	RMR significantly (12%) lower in paraplegia group than control Schofield Equation overestimated RMR by 5.5%	Small numbers in study. All paraplegia.	B
Collins *et al.*, (2010)	Descripti ve Study	REE Measured in 66 adults with SCI and energy expenditure (EE) in 170 adults with SCI for 27 physical activities	-	32 Adults with chronic Tetraplegia and 34 with Paraplegia	One MET (One Metabolic Equivalent) for a person with SCI 2.7ml/kg/min 23% less than One MET for non-sci.	REE for Adult males only. C5-C8 and T1-T4 injury only Mixture of Complete and Incomplete	C

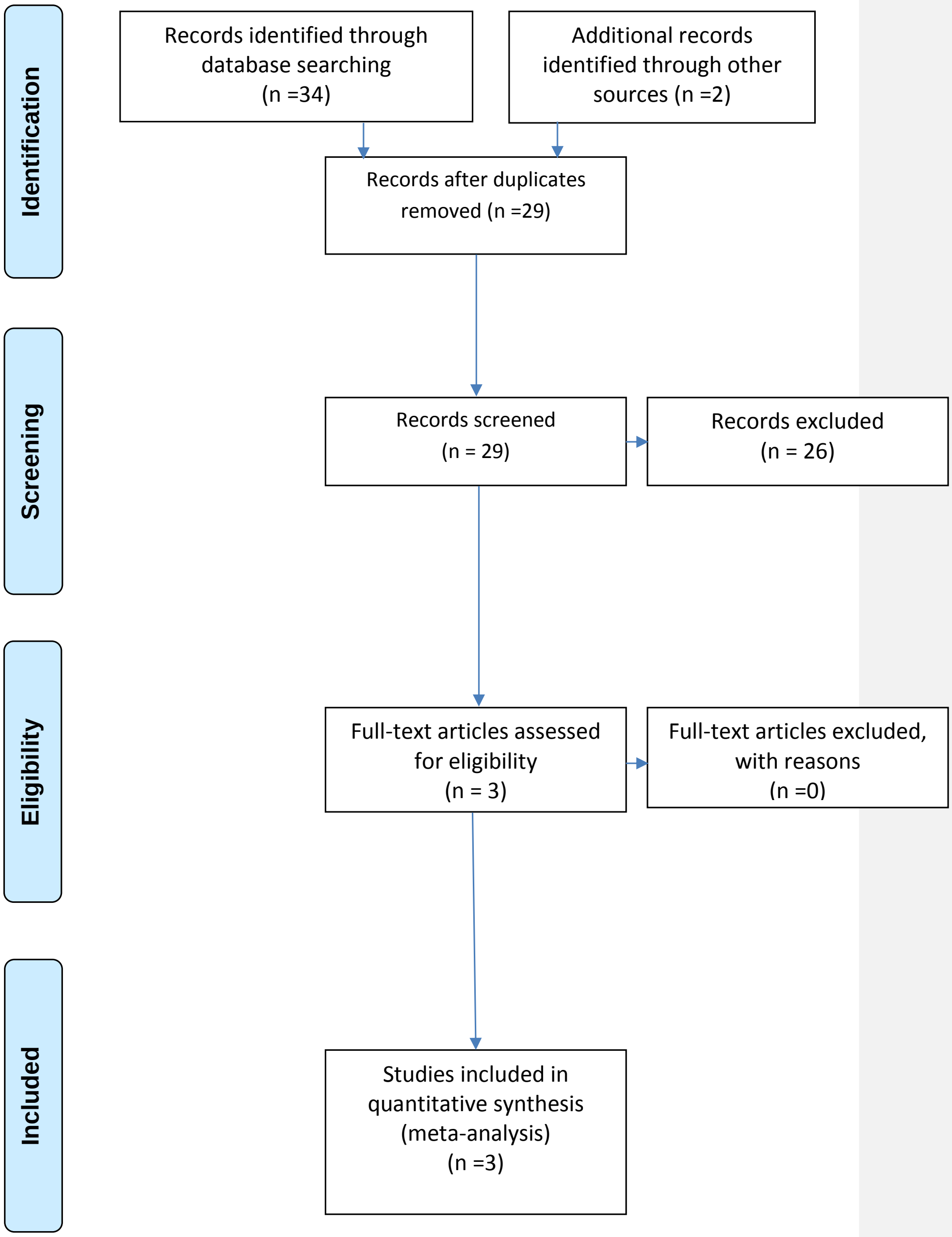
Perret and Stoffel-kurt, (2011)	Cross Sectional Observational	REE measured. Nutritional intake over 7 days measured	7 days	12 Acute and 12 Chronic SCI	No significant difference between REE between two groups	Small numbers in study	B
Lee *et al.*, (2010)	Descriptive Study	REE measured in 31 People with Paraplegia (PP) (and EE for 10 activities)	-	31 PP	One MET for PP was 3.1ml/kg/min 12 % less than one MET for people without sci	Small study Only PP	C
Yilmaz *et al.*, (2007)	Cross sectional	Measure BMR	-	20 people with SCI.13 with history of Autonomic Dysreflexia (T6 injury and above)	BMR lower in upper injury group though not q significant (p=0.07)	Small numbers	C

Appendix 1: Evidence analysis for Dietary Interventions

3.1: Evidence for altered resting metabolic rate/predictive equations in people with a SCI

Appendix 3: Evidence Analysis for Dietary Interventions

3.2: Calorie reduction in the dietary management of overweight and obesity in people with a SCI



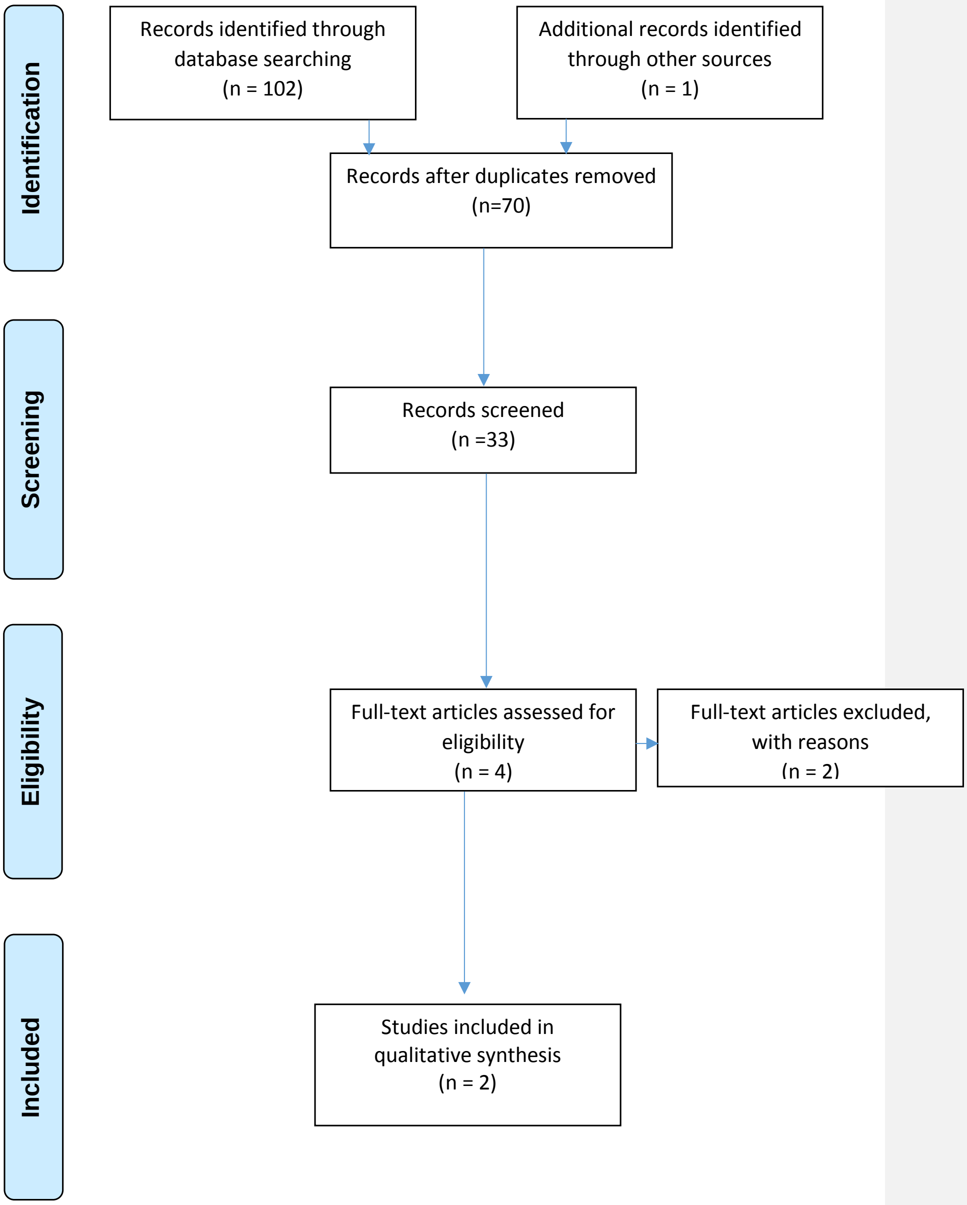
Appendix 1: Evidence analysis for Dietary Interventions

3.2: Calorie reduction in the dietary management of overweight and obesity in people with a SCI

Author	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
Chen *et al.*, (2006)	Single Group Uncontrolled Trial	12-week Weight Management programme	24 weeks	16 Chronic SCI, 4 with tetraplegia, 13 completed 24 weeks. 7 females 9 male	Weight loss average of 3.5kg (3.8%) at week 12 and 2.9kg (3.0%) at week 24 Lean mass maintained	Small numbers as pilot study, no control groups, Dietary recall (food frequency questionnaire) used for intake assessment	B
Radomski *et al.*, (2011)	Single group pre-post study	Exercise and education programme Individualized meal plan to lose weight	12 weeks	N=13, 10 Completed 4 females 6male, BMI>25 adults with chronic complete paraplegia	6% decrease in median weight and 8% in skinfold body fat percentage	Small numbers, short time scale, no control group	B
Wong *et al.*, (2011)	Single group uncontrolled study	Dietetic advice x3 healthy eating, behavior change and exercise	3months	19 patients with chronic SCI 29.6% Dropout, 7women 12 men completed 12 weeks	103.1 to 97.8kg wt loss P<0.001 = 3.7kg (3.5%) BMI and triceps skinfold (TSF) thickness reduced significantly	No long term follow up Use of anthropometry not DEXA scan Uncontrolled	B

Appendix 1: Evidence analysis for Dietary Interventions

3.3: Evidence for portion control or a 600-calorie deficit approach as an effective dietary treatment of overweight and obesity for people with a SCI



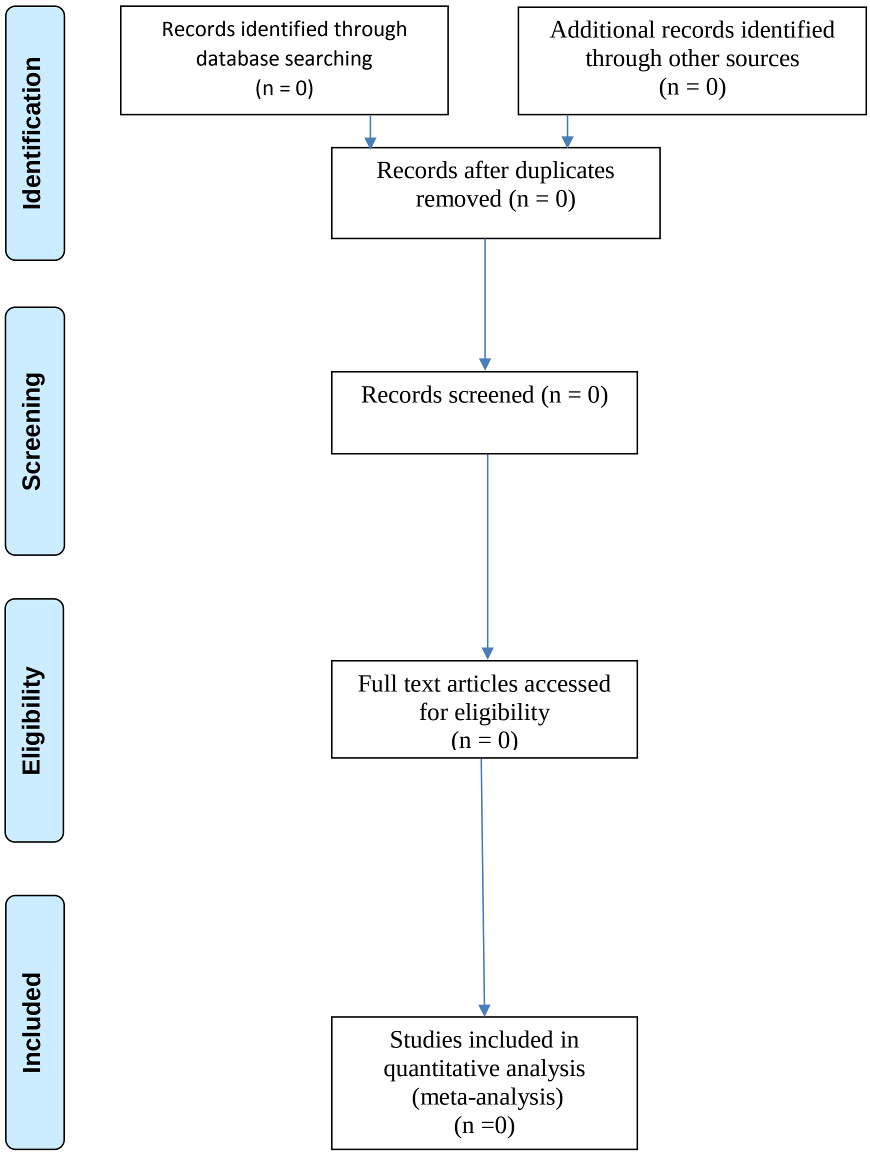
Appendix 1: Evidence analysis for Dietary Interventions

3.3: Evidence for portion control or a 600-calorie deficit approach as an effective dietary treatment of overweight and obesity for people with a SCI

Author	Study Type	Intervention	Duration	Population	Outcomes	Limitations	Grading
Wong *et al.*, (2011)	Single uncontrolled trial	Dietary advice Physical Activity Recomendations Goal Setting Dietitian Lead	12 week programme	Males & females with paraplegia and tetraplegia BMI>28 kg/m^2. >18 years N=27 N=19 final analysis	Significant reductions in: Weight 3.7kg / 3.5%, TSF. Increase in Mid Arm Muscle Circumferance No statistical difference between attendance at appointments and distance to the centre	No socio-economic information small population group No control group Attrition 29.6%	B
Chen *et al.*, (2006)	Cohort Study	Dietitian Lead Time Calorie Displacement diet Physical Activity Behaviour change	12 week programme Follow up at 24 weeks	SCI > 1 year >19 years of age Male and female BMI >25 N=16, N=13 completed 24 weeks	At 12 weeks 3.5kg weight loss (3.8% weight loss), decreased waist circumference Significant reduction in fat inake and an increase in fibre At 24 weeks: N=13, 6 continued to lose weight, 4 maintained and 3 gained.	The statistical power of the study was limited due to the small population group No control group High education level Ability to travel 19% attrition rate due to medical illness	B

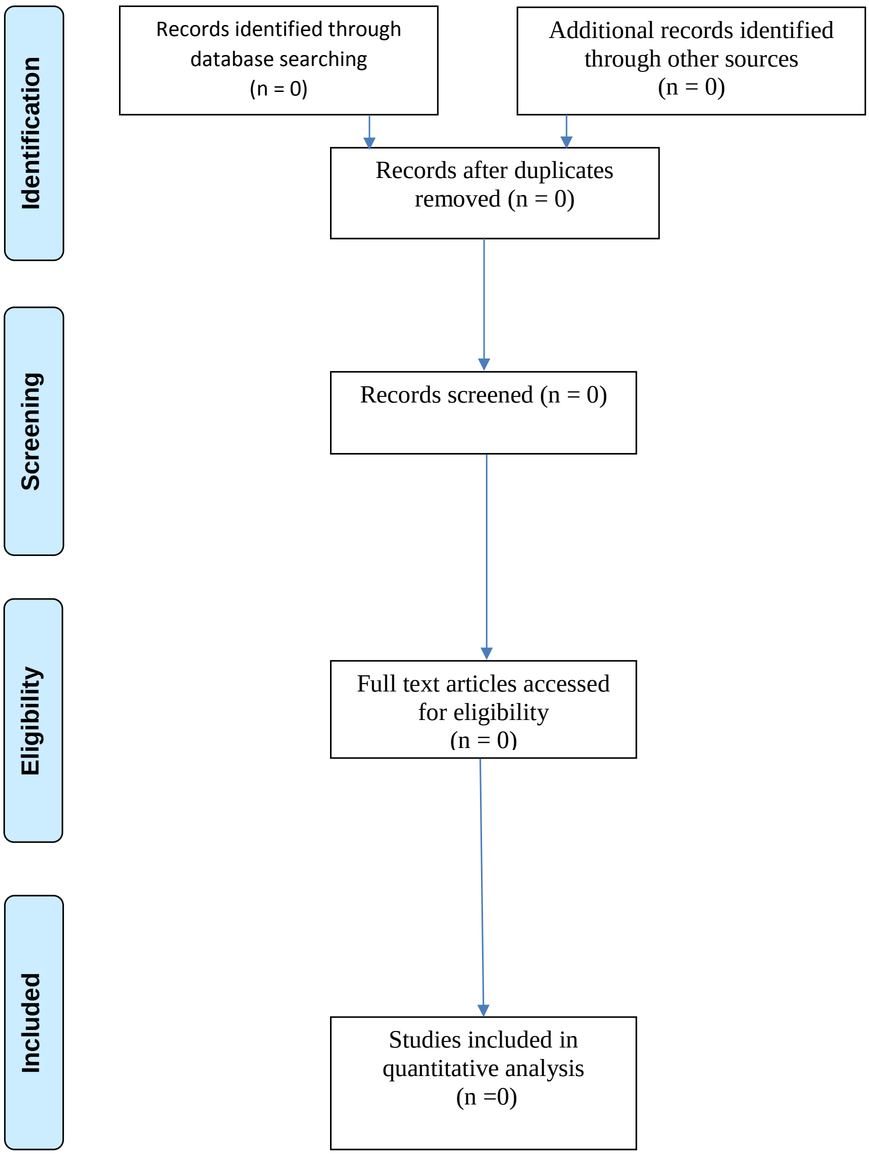
Appendix 1: Evidence analysis for Dietary Interventions:

3.4: Evidence for meal replacements and Very Low-Calorie Diets as an effective dietary treatment of overweight and obesity for people with a SCI



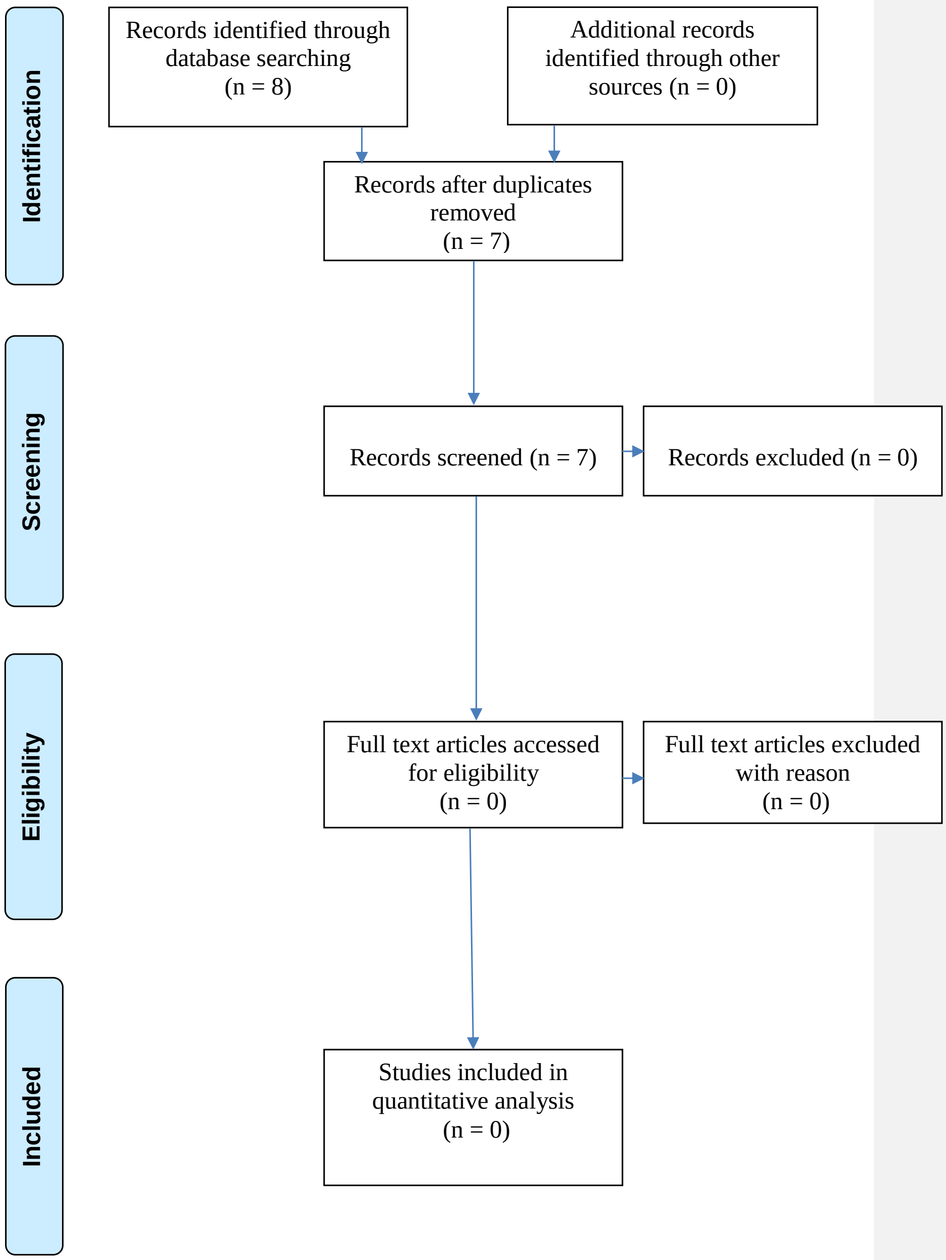
Appendix 1: Evidence analysis for Dietary Interventions:

3.5: Evidence for macronutrient manipulation (low glycaemic index, low carbohydrate or high protein) or commercial dietary approaches (such as weight watchers, sliming world or dietary supplements) as an effective in the treatment of overweight and obesity for people with a SCI

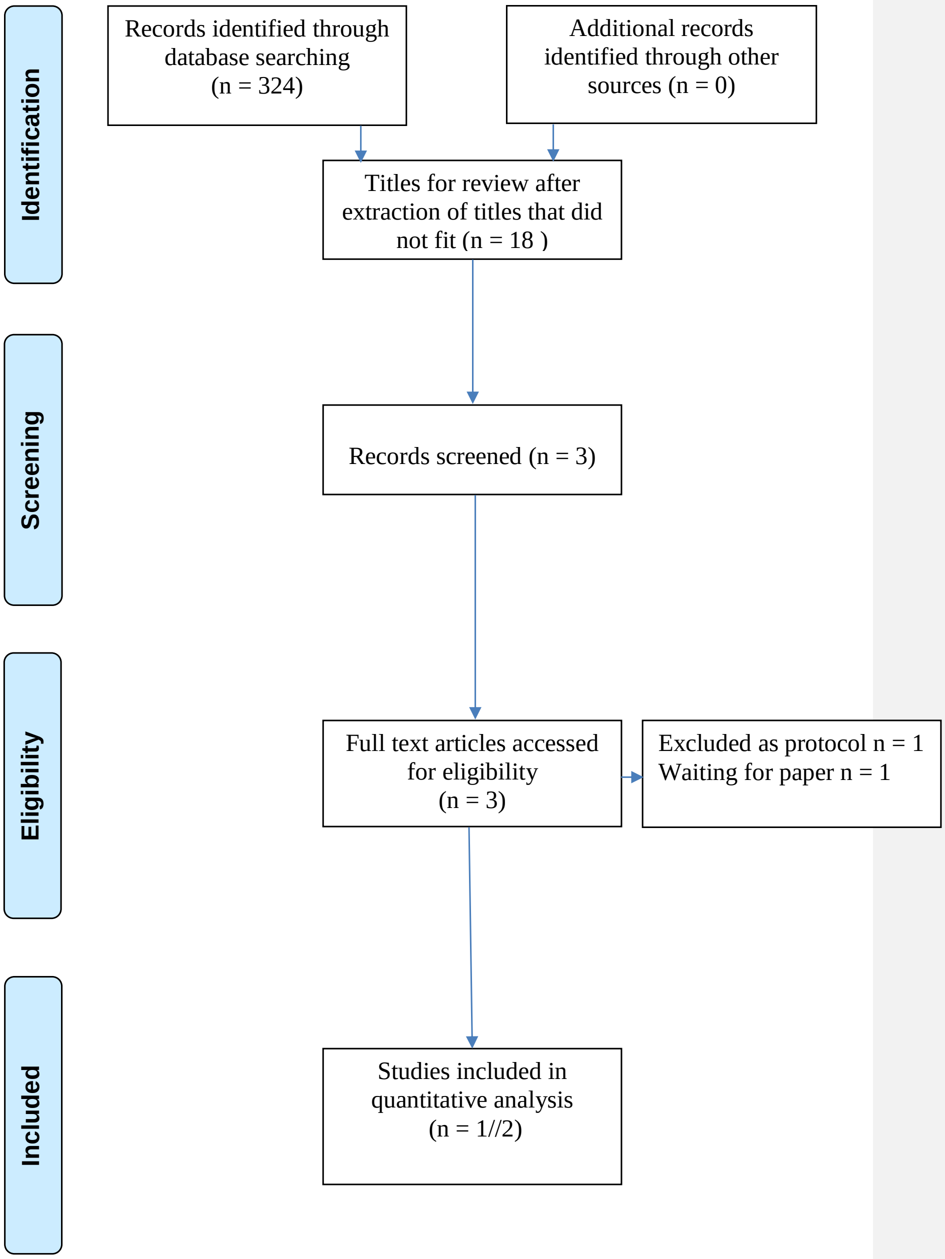


Appendix 1: Evidence analysis for Dietary Interventions:

3.6: Evidence for eating frequency as an effective treatment of overweight and obesity for people with a SCI



Appendix 1: Evidence analysis for Behavioural Therapy/ Psychology interventions



Appendix 1: Evidence analysis for Behavioural Therapy/ Psychology interventions

Author	Study Type	Intervention	Duration	Population	Outcomes	Limitations	Grading
Chen *et al.*, (2006)	Cohort Study	Time-Calorie displacement diet Nutritionist led; clinic based (once a week for 12 weeks) Goal-setting skills training Social support Stress management Relaxation training Behaviour change Problem solving	12 week & 24 week follow up	N=16	Weight reduction 12 week – x=- 3.5kg, p<0.001 24 week – x=-2.9kg, p=0.01 Physiologic/ Anthropometric Diet behaviour Psychosocial wellbeing	No Control Group Small sample Measures of psychological mechanisms of change not included (sample characteristics – high education)	B

Appendix 1: Evidence analysis for Physical Activity Interventions

(	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
Carvalho *et al.*, 2007	Non randomized Clinical Trial	Functional electrical stimulation (FES) with Partial Weight Bearing Treadmill Training (PWBTT)	6/12 follow up	N=15	CSA (Cross Sectional Area)	No ASIA documented for participants, no randomisation, no detail of control group conditions, small sample size	C
Giangregorio *et al.*, 2012	Randomised control Trial	FES with PWBTT	16-week trial period with 12 months follow up	N=34	CSA, Total Body Fat (TBF), LL Lean Body Mass (LBM)	Large drop out in control group, only in Incomplete Spinal Cord Injury (ICSCI) not possible to blind participant of assessors	B
D'Oliviera *et al.*, 2014	Case Control	Comparison of physically active versus non-physically active	N/A	N=12 PA N= 9 NPA	BW (Body Weight), BMI (Body Mass Index), FM (Fat Mass), FFM (Fat Free Mass)	No details of frequency, time, type in Physically Active (PA) group, Higher injuries in the Non-Physically Active NPA group, no dietary controls	C

Commented [LO1]: PRISMA

Commented [LO2]:

Appendix 5: Evidence analysis for Physical Activity Interventions

Author	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading

Koury *et al.*, 2013	Case Control	Comparison of physically active versus non-physically active	N/A	PA N=13 NPA N=9	BMI, FM, TBM	No details of frequency, time, type in PA group, small sample, no dietary control,	C
Tanhoffer *et al.*, 2014	Case Control	Comparison of physically active versus non-physically active	N/A	PA n=6 NPA N=7	BMI, BM (Body Mass), FFM, % BF (Body Fat,) Waist Circumference (WC), BW	All male sample, small sample, unclear recruitment, no dietary control, No details of frequency, time, type in PA group	C
Carty *et al.*, 2013	Quasi Experimental pre/post design	Neuromuscular Electrical Stimulation (NMES)	8 weeks	N=14	LL LBM	Protocol wanted improvement in aerobic capacity but not measured, small sample, no statistical analysis documented, home based intervention, short experimental phase	C

Appendix 1: Evidence analysis for Physical Activity Interventions

Author	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
Skold *et al.*, 2002	Non randomised clinical trial	FESCE	6 months	CON 8 INT 7	BW, Muscle Mass (MM)	Small Sample, low intensity intervention (twice weekly), no control, poor control outside of intervention, non- randomized	C
Clark *et al.*, 2007	Non randomised clinical Trial	NMES	5-month trial period, 6 months follow up	FES 23 CON 10	FM, LBM	Body Composition (BC) secondary measures, no documentation or control group, large drop out in FES group not mentioned, no blinding	
Ryan *et al.*,	Quasi Experimental pre/post design	NMES with resistance	16 weeks	N=14	Thigh MM, FM	Low intensity of intervention – twice weekly, no control or blinding, small sample, home based intervention, no controlling for diet/ exercise outside of study period	
Griffin *et al.*,	Quasi Experimental pre/post design	FESCE	10 weeks	N=18	LBM, Adipose tissue	Small sample, no control, comparing ISCI, Complete Spinal Cord Injury (CSCI), Para and tetra groups, poor control outside intervention, pragmatics low	

Appendix 1: Evidence analysis for Physical Activity Interventions

Author	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
Chen *et al.*,2006	Quasi experimental – single group pre-post intervention	MDT weight Management programme	0,12,24 weeks	N=16	DXA, skinfold and BMI	Small Sample, No control, No blinding, Their version of statistically significant poor	C
Radomski *et al.*,2011	Single group pre-post intervention	MDT Programme	12 week follow up	N= 13	Body fat percentage, skinfold and BMI	Small sample size. Sample biased towards people who were motivated to lose weight Measuring skinfold below the waist may be invalid in SCI population due to reduced muscle tone. Difficult to rule out other personal factors in quality of life (QOL) improvements and if these influence weight and adherence	C
Neto and Lopes 2011	Single group pre-post intervention	Physical Activity	29 days	N = 53	Fat mass, BW, lean body mass, and combinations of these	Time since injury not measured Intensity of exercise was not standardized Amount of exercise was not standardised Exercise is poorly defined	C

Appendix 1: Evidence analysis for Physical Activity Interventions

Author	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
Duran *et al.*,2001	Case Series	Physical Activity	Unknown	N=13	weight, percent body fat	No description of body composition measurements, no description of intervention, small sample, no dietary control, translated into English so perhaps lost in translation	C
Ginis (2012)	Non-systematic review article	All interventions for altering body composition	N/A	N/A	All measurements of body composition	Non-systematic review article	D
Bucholz *et al.*, 2012	Cohort Study	Physical Activity	18 Months	N= 63	Waist circumference, BMI	Only reported results for women which was smaller proportion of group – no change in men's group	C

Commented [LO3]: Ref

Author	Study type	Intervention	Duration	Population	Outcomes	Limitation	Grading
Akbar *et al.*, 2015	Case Control	Physically active vs. non-physically active	N/A	N=293	BMI	Comparison of two groups and no intervention	C
Author	**Study type**	**Intervention**	**Duration**	**Population**	**Outcomes**	**Limitation**	**Grading**

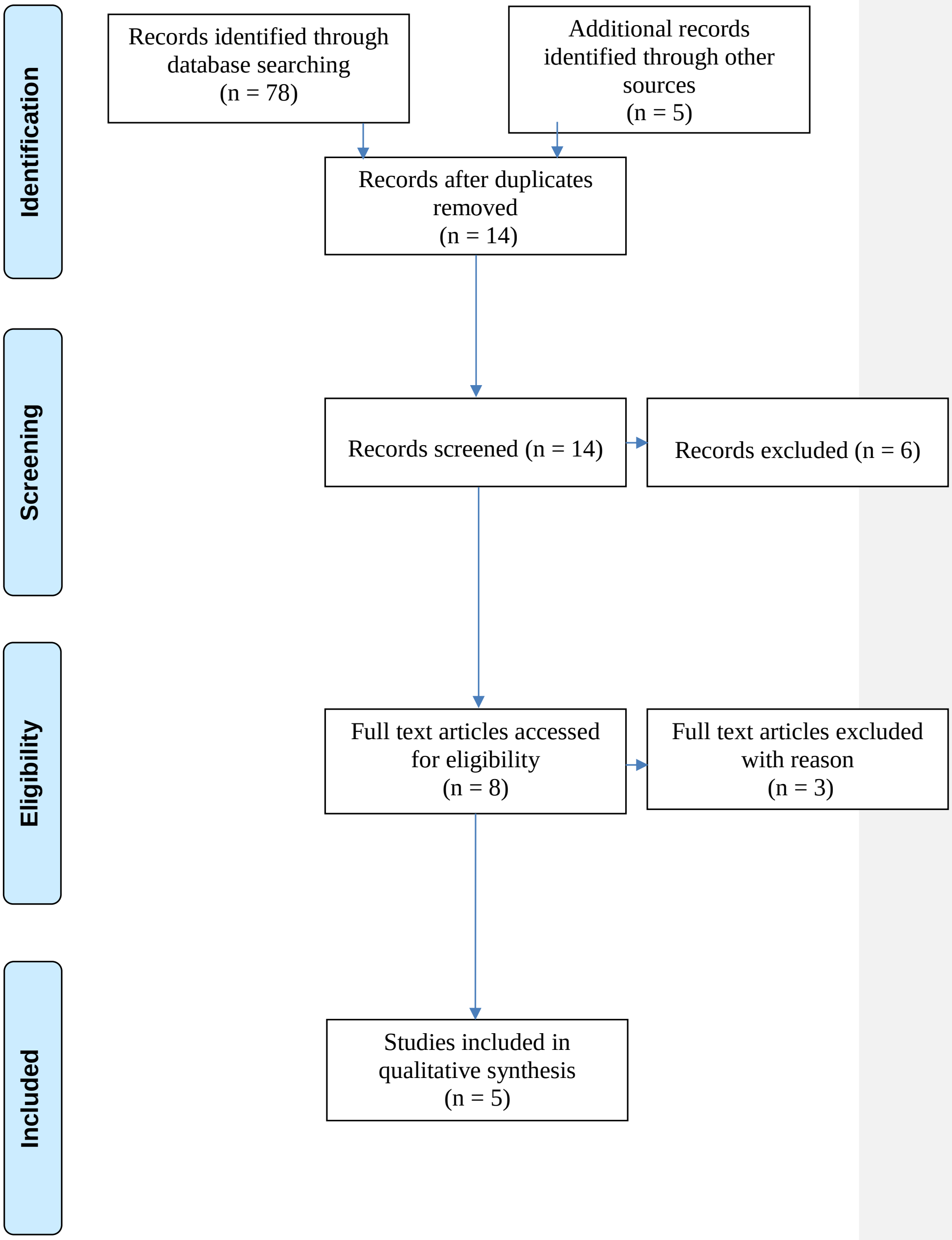
Appendix 1: Evidence analysis for Physical Activity Interventions

Hicks 2008	Non-systematic review article	All interventions for altering body composition	N/A	N/A	All measurements of body composition	Non-systematic review article	D
Hicks 2011	Systematic review	All interventions	N/A	N/A	All body composition measurements	Unable to synthesise results	B

Rimmer *et al.*, 2013	RCT	Exercise	4 months	16 exercise 11 – control	FM, LBM, DXA	Study was multiple pathology – spinal cord numbers subsection. Incomplete spinal cord injury only. Blinding done were feasible	B

Appendix 1: Evidence analysis for Medical Management of Obesity

6.2: Bariatric surgery



Appendix 1: Evidence analysis for Medical Management of Obesity

6.2: Bariatric surgery

Author	Study Type	Intervention	Duration	Outcomes	Limitations	Grading
Wong *et al.*,2013	Case report	Laparoscopic Roux- en-Y gastric by-pass (LRYGB) in 28-year-old man T12 AIS C SCI	7 months	Decreases in BMI 16.7%, waist-circumference 11.5%, mid-upper arm circumference 21.9%, triceps skinfold thickness 54.3%, mid-arm muscle circumference 10.7%; total cholesterol 22.2%, LDL 33.3%, triglycerides 26.7%; increases 6 min walking distance 58%, berg balance score 168%	Single case description	C
Alaedeen	Case report	Open Roux-en-Y gastric by-pass in 51-year-old man T7 AIS A SCI	1 year 21 months (BMI only)	At 1 year, decrease in BMI 15 points (from 48 to 33), HbA1C from 10.3 to 5.9% & cholesterol from 160 to 112mg/dL; Blood Pressure readings (not given); at 21 months BMI 32.7; Self-reported improvement in quality of life, mobility	Single case description	C
Lutrzykowski M	Case report (2 cases reported, 1 of SCI)	Duodenal switch procedure in a 49-year-old female T8 paraplegia	4 years	Reduced weight - 48.5%, BMI 47.6%, excess BMI 91.6%	Single case description	C

Commented [LO4]: Ref

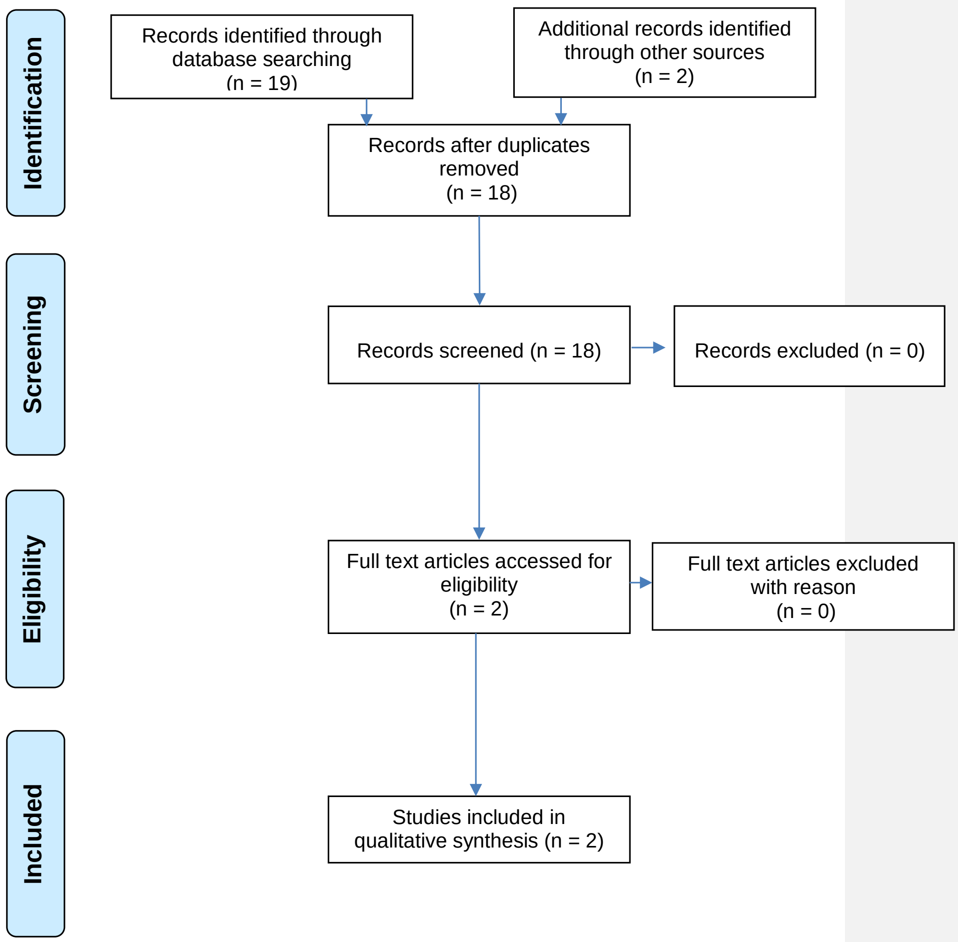
Commented [LO5]: Referance

Author	Study Type	Intervention	Duration	Outcomes	Limitations	Grading
Perrault *et al.*,	Case report	Gastric sleeve surgery in a 47-year-old C5 AIS D man	52 weeks, plus an additional 3 weeks each of coached & non- coached walking programme (total 58 weeks)	BMI decreased 34.3% by 52 weeks; 57.4% increase in 10-meter walk test, further 11.1% improvement after 3 weeks coached walking; 34.4% improvement in 6 minute walk test at 24 weeks, further gains of 8% & 3.1% at weeks 36 & 52 respectively; total steps covered per day increased by 47% at 52 weeks; at week 58 decreases in double leg stance of 38% & in base of support of 72%	Case report	C
Williams *et al.*	Case series	Laparoscopic roux-en- Y by-pass (LRYGB) or laparoscopic adjustable gastric banding (LAGB) in 15 wheelchair users, 5 had spinal conditions (spina bifida, spinal muscular atrophy, spina bifida, cervical spondylosis, spinal stenosis, traumatic paraplegia; 1 loss to follow up.	17 months for LAGB group; 20 months for LRYGB group	28.5% mean excess weight loss in LAGB group; 68% mean excess weight loss in LRYGB group. Self-reported improved mobility in 4/7 (57%) LAGB group & 6/7 (86%) LRYGB group	Small patient cohort - only 5 with spinal conditions; heterogeneity of diagnoses among those with spinal conditions; absence of control group; retrospective nature of study	C

Commented [LO6]: Ref

Commented [LO7]: Insert ref

Appendix 1: Evidence analysis for the implications for bowel management of dietary and pharmacological and surgical interventions on bowel management on people with a SCI



Appendix 1: Evidence for the impact of diet, pharmacological and surgical treatments on bowel management on people with a SCI

Author	Study Type	Intervention	Duration	Population	Outcomes	Limitations	Grade
Chen *et al.*, (2006)	Cohort Study	Time-Calorie displacement diet; clinic based Exercise Behavior Modification	12 weeks & 24 weeks follow ups	N=16	Weight reduction: 3.5 kg Significant reduction in fat and cholesterol intake Trend towards improvement in time for bowel movement	No Control Group Small sample (high education level)	**C**
Wong *et al.*,2013	Case Study	Very low-caloric diet, anti-obesity medication, active physiotherapy programme, Laparoscopic roux-en-y gastric bypass	12 months (7 months post-surgery)	N=1	Decreases in BMI 16.7%, waist- circumference 11.5%, mid-upper arm circumference 21.9%, triceps skinfold thickness 54.3%, mid-arm muscle circumference 10.7%; total cholesterol 22.2%, LDL 33.3%, triglycerides 26.7%; increases 6 min walking distance 58%, berg balance score 168%	Small sample Limited information bowel management	**C**

351