A Systematic Review of Enteral Feeding by Nasogastric Tube in Young People with Eating Disorders

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Abstract

Background

Adolescents with severe restrictive eating disorders often require enteral feeding to provide lifesaving treatment.

Nasogastric feeding (NGF) is a method of enteral nutrition often used in inpatient settings to treat medical instability, to supplement minimal oral intake or to boost nutritional intake. This systematic review sets out to describe current practice for NGF.

Methods

A systematic review following PRISMA guidelines was conducted by searching AMED, EMBASE and MEDLINE databases from 2000-2020. Inclusion terms were: enteral feeding by nasogastric tube, under 18 years, eating disorders, and primary research. Exclusion terms: mental disorders other than eating disorders; non-primary research; no outcomes specific to NG feeding and over 18 years. Titles and abstracts were screened by all authors before reviewing full length articles. Quality assessment, including risk of bias, was conducted by all authors.

Results

29 studies met the full criteria. 86% of studies were deemed high or medium risk of bias due to the type of study: 34.4% retrospective cohort and 10.3% RCT; 17.2% were qualitative. Studies identified 1) a wide range of practices in different countries, settings, and the reason for initiation; 2) In the UK, standard practice is to introduce NGF if either oral intake is not met or patients are medically unstable; 3) NGF may enable greater initial weight gain due to increased caloric intake; 4) there are 3 main types of feeding regime: continuous, nocturnal and bolus; 5) high calorie feeds are not typically associated with increased risk of refeeding syndrome; 6) complications included nasal irritation, epistaxis, electrolyte disturbance, distress and tube removal; 7) length of stay in hospital is dependent on reason of initiating NGF; 8) psychiatric and medical wards differ in approach; 9) concurrent therapy is often used to facilitate NGF.

Conclusions

NGF is currently often implemented in specialist settings where oral intake has been refused or insufficient, in hospital due to medical instability, nocturnally to supplement day-time oral intake, or continuously as standard protocol. Due to high risk of bias as a result of the nature of the studies conducted in adolescents with ED, recommendations for clinical practice cannot yet be justified.

Plain English Summary

Young people with eating disorders often restrict dietary intake to a degree which is detrimental to their physical health. During UK inpatient admission, dietary intake is usually encouraged however occasionally the patient may either continue to decline food, or be in a condition requiring more intensive intervention. In these circumstances, a nasogastric (NG) tube may be placed from nose to stomach to pass nutrition. This systematic review sets out to review the current reported evidence of NG in young people. Results have shown that NG feeding may be administered through different methods such as continuously, multiple single meals (bolus), or overnight to supplement day-time oral intake. Routine NG feeding may allow greater initial caloric intake, which does not increase risk of medical complications, and may actually increase initial weight gain thus reducing time in hospital. NG feeding is used commonly in the hospital setting to treat medical instability as a result of severe malnourishment, and in the specialist ED unit due to failure to meet oral intake. Differences may be due to variable expertise of staff. Side effects are minimal but may include nasal bleeding or irritation, and imbalances in blood electrolytes which can be reduced by providing supplementation.

1. Background

There are currently over 700,000 individuals in the UK with an eating disorder (ED)[1]. EDs usually manifest prior to adulthood, with an average age of onset of approximately 15 years, although this is decreasing; with new research from NICE demonstrating that incidence in children aged 12 and under had increased between 2005-2015 in the UK.[2,3] Patients with restrictive eating disorders, including anorexia nervosa (AN), bulimia nervosa (BN) and eating disorder not otherwise specified (EDNOS), are predominantly female (91%) and Caucasian (92%), with incidence being approximately 0.014 for females.[3] Compared to other mental illnesses, EDs have a high mortality rate with young people (YP) with anorexia nervosa (AN) on average 6-10 times more likely to die than the general population.[4,5] Death is often caused by cardiac abnormalities associated with extremely low bodyweight.[6] For this reason, acute medical intervention is often warranted in order to reduce mortality. Nasogastric (NG) feeding use in YP with ED is generally seen as a “last resort” to provide lifesaving

treatment.[7,8] However, refeeding is a critical component to recovery and NG feeding will often be utilised if a YP has been unable to manage oral intake.[9,10]

NG feeding involves a fine bore tube passed via the nasal passage into the stomach in order to administer nutrition. There is a low risk of complications associated with NG feeding if staff receive adequate training and protocols are enforced to ensure that the tube has been passed correctly.[11] Different methods of NG may be utilised safely, with NG feeds often given as large bolus, continuously through a pump or overnight in order to supplement daytime oral intake.[12,13] Recent guidance from the British Dietetic Association[14] for NG feeding under restraint advised 1-2 bolus feeds per day even in those with high risk of refeeding syndrome (RS); it also concluded further research into this area was required. The National Institute for Clinical Excellence has produced guidance for providing nutrition recommending a graded approach.[19] Neither of these guidelines are specific for young people.

Most EDs will be treated in an outpatient setting with hospitalisation generally reserved for those with severe malnutrition resulting in physical symptoms such as bradycardia, hypotension or dehydration as set out in the MARSIPAN guidance.[15] Research on NG feeding in YP has tended to focus on the acute refeeding phase in paediatric or psychiatric wards to reduce the risk of RS.[16] RS can manifest as hypophosphatemia (HP), hypomagnesemia, hypokalemia and other electrolyte imbalances that result in cardiac arrhythmias, seizures and in some cases sudden death.[17] During the acute refeeding phase the need for weight restoration must be balanced against the risk of developing RS. In practice, most patients (96%) however present less severely with serum hypophosphataemia and no clinical signs.[18] Although there is a significant body of research into this, the role of NG feeding remains ill-defined.[16]

Moreover, there is currently conflicting guidance on how to manage NG feeding in YP with ED, in particular how and when to transition between oral and NG feeding.[20,21] This has resulted in a variety of NG feeding practices across different settings, with many medical wards tending to provide continuous NG feeds and cease oral intake in order to medically stabilise the patient;[20,22-26,] in contrast mental health wards may be more likely to use syringe bolus feeds to provide food when meals are refused, thus encouraging oral intake and aiding normalisation of eating.[9,17,27-31] This is further supported in a systematic review[32] whereby 9/10 studies in hospitalised ED patients are given continuous or overnight supplemental NG feeding.

Previous reviews[32,33] have examined use of NG feeding in ED, including the safety and efficacy of NG feeding as well as short-term and long-term outcomes. However, this will be the first systematic review on the use of NG feeding specifically in YP with ED. Due to the anticipated paucity of studies in this area any research where a meaningful conclusion or result can be drawn regarding NG use in YP with ED will be included. This review aims to examine NG feeding outcomes for patients and its impact on staff, it's effect on length of stay in hospital, complications and factors affecting NG implementation in patients. The use of NG primarily for medical stabilisation will be compared to its use in the psychiatric treatment of YP with ED where possible, and when this is not stated in the study, the setting (medical ward or psychiatric ward) will be utilised to give an indication. The different types of feeding technique (for example bolus and continuous feeds) will be analysed, and any indications given about how and when to commence or cease NG feeding.

2. Methods

A comprehensive database search of AMED, EMBASE, APA Psychinfo and MEDLINE was performed with no language restriction from January 2000 to July 2020. Search strategies combined keywords with controlled vocabulary terms (MeSH, Thesaurus); both quantitative and qualitative research were included. The search criteria was peer reviewed by a researcher from the University of York's Child and Adolescent Mental Health Intervention Centre. References were exported and duplicates were removed using the title and abstract.

2.1 Screening for Eligible Studies

The full search is available in **Appendix 1**. The inclusion criteria were: NG feeding, under 18 years, eating disorders, published since 2000 and primary research. The outcomes of interest were: Opinions of YP and staff using NG, amount of YP requiring NG, any interventions that impacted on NG feeding, complications of NG feeding, interventions to mitigate the complications, the setting (medical ward, psychiatric ward or outpatient), the NG method and whether this changed when restraint was required. The exclusion criteria included: No ability to discern results specific to NG feeding, mental disorders other than eating disorders being the focus, where the results do not focus on YP under 18 or it is impossible to separate results for adults from YP, reviews or other non-primary research and research published before 2000.

Studies published in languages other than English were translated prior to being reviewed. The PRISMA flowchart was used (**Figure 1**). Abstracts identified from the initial search were screened in a secondary review process, and full text papers were obtained of those meeting the inclusion criteria or where there was uncertainty. One article published prior to 2000 was included in the full text review due to it requiring translation prior to assessing it against the criteria. Key studies were manually reviewed for additional research, but none were identified that were not already included. There was no disagreement between CF and KH who assessed which studies were included.

2.2 Assessing Study Quality

There is no validated method to assess the retrospective and qualitative nature of studies included therefore we could not conduct a formal quality assessment or statistical method to evaluate the results. The risk of bias was estimated into high, medium or low using an adapted version of the Agency for Healthcare Research and Quality risk of bias tool as described in Myers[34] which included an assessment of the bias in the selection of participants, sample size, tools used to assess change and whether the study involved blinding. The studies were analysed for risk of bias independently by CF, KH and JM. The risk of bias was deemed to be medium or high (see **Table 1**) for the majority of the studies included due to the nature of their design, being case series or retrospective cohort studies. Studies included and imperative data can be visualised in **Table 2**.

3. Results

3.1 Prevalence and Epidemiology

In 13 studies in which NG was not implemented as standard protocol for all patients, the amount of ED YP administered NG feeding was between 6% - 66%.[9,17,28,29,31,35-37,41-11,47] Other studies implemented NG feeding as standard practice.[21-23,26,39] YP were often admitted to hospital for medical instability[9,17,22,28,39,23,20,47,25] with medical instability being treated using NG either continuously or for sustained periods of time.[22,44,23,20,24,25,26] In other cases, NG was implemented due to acute refusal of food or inability to meet oral intake.[43,9,10,17,28,31] According to Maginot and colleagues[17] NG was more likely to be required in severely malnourished patients where patients were treated by NG due to inability to manage oral intake in hospital. O'Connor and colleagues[31] detected no correlation with high calorie initial feeding plans and increased use of NG feeding, where NG was implemented due to recommended oral intake not being met. Nehring and colleagues[37] found that NG feeding was more likely to be required in: patients of a lower age at admission (14.3 compared to 15.3 years old, $P<0.05$), those with a shorter time period between disease onset and admission to hospital ($P<0.0001$), and longer time since last discharge ($P<0.05$). The reasons for initiating NG feeding are not discussed in this article. NG feeding is prescribed more commonly in Early onset (EO) AN than adult onset (20% compared to 0%, $P<0.05$) in a female epidemiological study.[43] Clausen[46] described NG as the most frequently used involuntary measure in psychiatric practice and is most commonly used in 15-17 year olds. Bayes and colleagues[47] indicated that male requirements for NG are similar to those of females from a case report of 10 patients (high bias risk).

3.2 Setting

3 studies[27,28,36] reviewed NG treatment for YP in different settings (one of which was high risk of bias[28]). Fuller and colleagues[27] demonstrated discrepancies in treatment provided to YP in different settings with specialist ED units being less likely to use pumps to deliver continuous feeds, tending to give bolus feeds of higher volume. This may be due to difference in staff ability, resources available or differences in treatments between mental health (MH) and medical settings. Akgul and colleagues[36] (Turkey) concluded a general paediatric ward was a viable alternative for treatment (including NG) of YP with medical instability as a result of ED when specialist mental health ward admission is not possible. Specialist ED units were superior due to expertise of staff and resources available. Street et al[28] (UK) showed that patients admitted to a paediatric ward due to medical instability who were given NG due to acute refusal of oral intake may benefit from joint child and adolescent MH services (CAMHS) and paediatric input. These studies highlight that a MH ward with expertise in ED, where available, may be beneficial for treatment of ED requiring NG feeds compared to a medical ward setting if the YP is medically stable.

Almost all studies reporting initial weight gain were in a medical ward setting apart from Silber et al[21] which was in a MH ward setting (and is high risk of bias). Studies focusing on refeeding protocols and daily calorie intake were mainly conducted in medical ward settings [9,17,22,24,31] (**Table 3**). Studies focusing on patient and staff experience of NG feeding[40,45,48] were set in a MH setting apart from Neiderman and colleagues.[40]

This review detected that the majority of studies were conducted in affluent countries with a Caucasian majority. There were no studies from Asia, South America or Africa. In the UK three studies described NG use when there is a medical need for nutrition after oral intake is

refused[27,28,40] or oral diet does not fully meet the nutritional needs.[31] Neiderman et al[38] case reports (high risk of bias) described instances where 4 patients received NG due to medical instability. Falcoski et al[30] (high risk of bias) also described 3 cases, representative of a larger group, where NG was used to manage medical instability. A similar approach was found in studies from Germany[37,43] and Turkey.[35,36] In Australian based studies, NG was given due to refusal of oral intake in two studies[9,10] as well as to treat medical instability.[26,47] A retrospective cohort study[24] compared NG given continuously or as a nocturnal supplement with oral intake. Studies from North America also focused on medical instability for NG use.[17,21,39,41]

3.3 Reported Initial Weight Gain

Agostino et al study[23] compared a higher calorie (1200-2000kcal) continuous NG fed cohort to lower calorie (800-1500kcal) oral intake; results showed greater initial weight gain in NG fed cohort with oral intake body mass change by -2.9 to +2.6kg average in the first week in the oral intake group. 51% patients in oral group lost or made no change to weight in first week. This was only 6% in NG fed cohort. There was no significant difference in groups baseline at the start. There was also greater weight gain in nocturnal NG refeeding than oral intake alone in Silber et al study[21] (high risk of bias) where all male AN patients after a specific date received nocturnal NG feeding as standard practice.

O'Connor et al (UK) study[31] examined the effects of a higher calorie refeeding protocol compared to standard protocol; it showed that calorie intake as low as 1200kcal per day did not cause any initial reduction in body weight. NGF was routinely used to supplement oral intake in this study. Madden et al[25] (Australia) prescribed higher than standard protocol initial calories using routine continuous NG feeding aiming for 2400-3000kcal per day and did not identify any initial drop in weight of patients.

3.4 Patient and Staff Experience of Nasogastric Feeding

4 studies used qualitative methods to analyse patient, parent and professional opinions on NG feeding.[10,40,45,48] Nursing assistant's views centred around: NG being an unpleasant practice, becoming sensitized or desensitized, and the importance of developing coping mechanisms to manage the distress. Assaults on nursing assistants were also described (in a study with high risk of bias), such as head butting, hitting and abuse as a result of restraining patients during NG feeding.[48] 82% of Dietitians considered NG feeding a necessary procedure if oral diet is inadequate.[10]

YP viewed being NG fed as: an unpleasant experience, a necessary intervention, a psychological signifier of illness, and an emphasis in an underlying struggle for control by Halse and colleagues.[45] Some described NG feeds as easier than eating as it "disguised" the amount due to no swallowing; others felt it was a form of punishment for not gaining enough weight. YP described manipulating the tube or syringing out the feed to prevent weight gain. Others found NG feeding a helpful motivator for oral intake.[40] Neiderman and colleagues[40] (high risk of bias) found 71% of YP in the study did not consent to being NG fed and 66% had to be restrained to NG feed, however later in their treatment many reflected that they understood the necessity of the procedure. Conversely the YP in Paccagnella and colleagues[20] research stated NG was helpful, particularly initially when an oral diet was challenging to manage.

3.5 Feeding Regime and Calorie Intake

A variety of different feeding regimes were identified in this review which are summarised in **Table 3**. Refeeding protocols daily calorie intake varied greatly between studies particularly as many studies were evaluating the outcome of higher calorie refeeding protocols.[9,17,22,24,31] Most studies tailored the calorie requirements to the individual patient, accounting for initial weight for height percentage and signs of medical instability. The majority commenced on daily intake of less than 2000kcal and increased periodically.

3.6 Nutritional Information of Enteral Nutrition Administered via Nasogastric Tube

Only 5 studies reported on the nutritional content of feeds in the review.[17,20,23-25] YP in the NG cohort in Maginot and colleagues [17] and Agostino and colleagues[23] were supplied with a formulation containing 44% carbohydrate. In Paccagnella and colleagues[20] all YP displaying signs of medical instability were commenced on solely NG feeding again using a formulation containing 44% carbohydrate with 19.7% protein and 36% lipids. Madden et al[25] described NG feeds containing 30% fats and less than 50% carbs. NG formula used in Parker et al[24] commenced at 1kcal/mL, however 1.5kcal/mL and 2kcal/mL formulae were also used in order to increase total calorie intake. Dietary intake could also be supplemented with oral nutrition supplement drinks at 300-400kcal each.[24] 15/17 dietitians stated that they used vitamin and mineral supplementation prophylactically or therapeutically, More than 33% Australian dieticians reported that they administered this regardless of risk of refeeding syndrome in a cross sectional study.[10]

3.7 Complications Associated with NG Feeding

Complications associated with NG feeding found in this review are summarised in **Table 3,** with the most frequently described being nasal irritation or epistaxis, anxiety related to the procedure and electrolyte disturbance (which occurred with both oral and NG refeeding). Overall, this review found 5 studies[9,17,23,24,29] reported some incidence of electrolyte disturbance, 3 studies[21,29,39] described epistaxis and 2 studies[39,40] described behavioural problems associated with the procedure. No study reported a YP developed RS and Nehring and colleagues[37] concluded that NG feeding had no impact on growth, recovery or presence of psychiatric co-morbidities.

Kezelman and colleagues (Australia) 2018[26] used validated measures of anxiety and depression to assess the impact of these symptoms and core ED symptoms on weight restoration, using NG in adjunct to oral intake as part of a rapid refeeding regime. During admission symptoms reduced but this was not attributed to weight restoration in itself suggesting a high calorie rapid refeeding schedule would not exacerbate or ameliorate ED and other psychiatric symptoms.

3.8 Length of Time Receiving NG feeding

Agostino and colleagues[23] delivered nutrition on a medical ward solely via NG for 14 days before commencing oral diet in addition to NG feeding. The average length of time on NG feeding in this study was 20.7 days; NG was terminated as YP accepted more than 50% oral caloric quota compared to theoretical reported quota. Madden et al[22] determined the duration of NG feeding was a minimum of 14 days, using biochemical markers of medical instability in a hospital setting. Conversely, Akgul and colleagues[36] described the average time YP required NG feeding as only 2.5 days before transitioning to an oral diet, where NG feeds are delivered on a hospital ward due to medical instability (Turkey).

3.9 Length of Stay Associated with NG Feeding

Length of stay was reported in studies from medical and MH ward settings, however, the specific package of treatment YP received in each study was different depending on the country of origin. For example, in Australian studies medical wards tended to include high levels of psychiatric treatment alongside medical treatment.[26] Any hospital admission was significantly longer ($P<0.0001$) for a YP requiring NG feeding compared to those managing an oral diet in a German retrospective cohort study.[37] However, this study does not discuss the reasons NG was implemented. Silber and colleagues[21] highlighted that supplemental overnight NG feeding was associated with a shorter length of stay (LOS) for medical stabilisation, than those YP consuming oral intake alone (36 days compared to 39.9 days). Agostino and colleagues[23] supported this, demonstrating that YP on medical wards having NG feeds had a mean LOS of 33.8 days compared to those in the same setting having an oral diet who had a mean of 50.9 days, however, the oral diet was lower in calories therefore taking longer for weight recovery and medical stabilisation.

Strik Lievers and colleagues[44] concluded that factors affecting LOS on a psychiatric ward included duration of AN, need for intensive care, adherence to oral intake, presence of a comorbidity, and requirement for NG feeding when NG was implemented due to medical instability. In this study the mean LOS was significantly increased: 117 days for YP managing oral intake compared to 180 days for those requiring NG. They concluded that the requirement for NG was an indication of severity and resistance to oral feeding.[44] Maginot et al study[17] in a medical ward (where NG was implemented due to insufficient oral intake) suggested that NG feeding was used for YP with more severe medical problems, (such as intractable vomiting and superior mesenteric artery syndrome) and therefore took longer to transition to oral diet resulting in a longer admission.

3.10 Concurrent Therapy in Adjunct to Nasogastric Feeding

6 studies[17, 22,26,29,38,39] discussed therapy as an adjunct to refeeding. In Madden and colleagues[25] YP participated in family-based therapy (FBT) during their admission. Couturier and Mahmood [29] (psychiatric unit, Canada) highlighted that meal support therapy reduced the requirement for NG feeding from 66.7% to 11.1%, criteria for NG feeding was the same in both groups throughout and oral intake was

encouraged. In Robb and colleagues study[39] YP were provided with meal support, planned group activities, daily group therapy, individual therapy, FBT three times per week, and expressive therapy twice per week (NG delivered using supplementary nocturnal feeds). Gusella and colleagues[41] (Canada) compared parent led therapy (PLT) to non-specific therapy (psychologist led talking therapy). PLT was based on FBT and included parents reducing child exercise and increasing oral intake. Results demonstrated that YP receiving PLT had a significantly reduced requirement for NG ($P<0.05$) (setting and indication for NG feeding not discussed). Maginot and colleagues[17] (USA) concluded that YP receiving NG often required behavioural interventions in the acute refeeding phase to manage the refusal of oral intake. Patients in this study were fed via NG if oral intake was refused. Kezelman et al[26] (Australia) described regular group therapy with an occupational therapist (OT) as well as a psychologist, and physiotherapy during nutritional rehabilitation with continuous followed by supplemental nocturnal NG feeds.

4. Discussion

There are a number of limitations to the conclusions that can be drawn from this review. The majority of studies included were retrospective and based around case note reviews which are subjective and therefore likely to be biased. A retrospective design also creates selection bias as those lost to follow up are not considered. Bias can also occur due to the different treatment groups being recorded at different times thus confounding variables may include different staff working at the setting and different methods of treating YP. Only 52% of studies were conducted prospectively. 3 studies were qualitative interview studies, examining patient or staff feelings towards NG feeding in practice which increases the risk of confirmation bias. The majority also had a relatively small sample size, again introducing the possibility of bias and reducing generalizability. 58% of the studies included only examined the effect of NG feeding as a secondary outcome of their study. It is not possible from these studies to make any comparison between NG feeding and oral intake due to the confounding effect that for the vast majority of studies only high risk, medically unstable YP were considered for NG feeding. Pragmatic, prospective studies that control for this confounder are required for any such comparison to be made.

Studies in this review included both male and female patients. However, out of 25 patient focused studies, most had a female majority, 6 studies [20,26,37,39,43,44] were conducted on female only cohorts, 2 studies[21,47] were on male only cohorts. 1 study[39] included only Caucasian participants however the majority of studies were conducted in affluent, Caucasian countries which limits the generalisability of this review. 31% of the studies included were set in Australia, interestingly only 14% were conducted in America. 16 studies included patients with AN only. [9,10,20,21,22,25,29-31,37-39,41,43,44,46]

It is evident that there is a wide variety of practices regarding NG feeding in YP with eating disorders globally.[9,21,28] Most studies identified that between 10-20%[9,17,29,43] of YP admitted to a psychiatric or medical ward for ED treatment required NG, although in some studies this was significantly higher.[42,44] These figures are from studies where NG is initiated due to either medical instability or inadequate oral intake and not when it is administered routinely. Given that Kodua and colleagues[48] stated the procedure can be painful for YP and can cause complications, there is an urgent need for research exploring this wide variation in use of NG feeding. A review conducted by Rizzo and colleagues[49] (2019), which focused on NG for acute refeeding, also found a wide variety of practices. This review supports their finding that, based on current research, it is not possible to determine whether a different NG feeding regime is required when the patient is acutely medically unstable compared to those who are stable but have inadequate oral diet.

From this systematic review it is evident that there are 3 focal methods of NG feeding: continuous,[23,25] nocturnal,[26,28,29] and bolus meal replacement.[9] It is not possible from this review to discern the advantages and disadvantages of each method as no study made a direct comparison. Medical wards used continuous feeding more frequently then MH wards but this tended to be for a short period of time while the YP was medically unstable, after this they would be transitioned to an oral diet.[22,23,25,26] It is probable that medical wards primarily manage YP for short periods to stabilise physical health, while MH wards seek primarily to treat psychological ED symptoms that are preventing the YP from managing an oral diet. This difference could account for the conflicting outcomes from studies on the impact NG has on the LOS.[21,23,44]

Qualitative studies indicated that YP found that they were able to manipulate the feed or tube if it was left in situ when they were not supervised.[40] NG feeding under restraint used bolus feeds due to concerns around the tube being removed once restraint had ceased.[45] There was no indication from studies that continuous or nocturnal feeds had a significant advantage in terms of health risks such as reducing RS, however, they were often utilised in studies when the YP required medical stabilisation.[22,25,26] Agostino and colleagues[23]

found that NG feeding does have the advantage of improving weight restoration compared to oral diet alone, however the calorie content of the NG fed cohort was greater than the oral fed cohort.

No study discussed in detail the strategy used to transition from NG feeds back to an oral diet. Those studies where NG was used for medical stabilisation often described a short period of NG before a quick transition back to an oral diet.[22,23,36] Studies using bolus feeds stated that oral intake was encouraged and it was only when this was not fully achieved that supplementary NG was used.[21,39] This appeared to be either after each meal, at set times during the day or once in the evening.[27,30] For nocturnal feeds, oral diet was encouraged during the day. In most studies the NG feed supplemented any deficit in oral intake but occasionally also provided additional calories above those prescribed in the meal plan.[22,25,39] In studies where continuous NG was provided, YP were sometimes not given the option of an oral diet so that their calorie intake could be closely monitored.[22-24,31] These studies discussed ceasing NG feeds after the risk of RS had reduced; most gave a time frame between 2-14 days.[24,44]

The main disadvantage to bolus feeding is that the NG tube requires reinsertion each time a feed is required, however, this should be weighed against the advantages found in this review including reducing the ability for feeds and the tube to be manipulated.[40] It also provides a tangible motivation to eat the full meal plan provided which should always be encouraged over NG feeding. Further research is required to assess whether there may be some advantages to bolus or nocturnal feeding over continuous NG feeding, which method is the safest and best aids transition back to a fully oral diet.

Similar to the review conducted by Hale and Logomarsino[33] who found RS to be a rare complication, it is reassuring to find that no study in this review reported YP developing RS despite some studies starting on high calorie NG feeding plans.[9,17,24,30,42] Although complications such as electrolyte abnormalities did occur there was no evidence that this was attributable to the NG feeding compared to oral diet.[9,17,23,24] The results of this review indicate that high calorie NG feeds can be safely administered and have the advantage of shortening LOS and therefore should be considered for those where adequate monitoring and vitamin or mineral supplementation can be provided. However, further research is required to assess the optimum NG feeding regime for YP at different levels of RS risk.

In two studies intensive meal support and concurrent therapy reduced the number of NG episodes (whereby NG was utilised when oral diet was inadequate) before managing a full oral diet.[29,41] This could have the advantage of reducing LOS in medically stable YP. Many of the studies based in Australia described significant levels of therapeutic input for YP on medical wards.[22,25,26] Kezelman and colleagues[26] described therapeutic input to YP admitted to an Australian medical unit and found a significant reduction in many core ED symptoms which was not attributable to weight restoration in itself. This review would support intensive therapeutic input provided from the start of the admission which, in a medical ward, may require outreach work or a day treatment centre from children's mental health services.

Studies in this review indicated that a number of YP in MH wards required restraint to NG feed with one study reporting this was required for 66% of YP.[24] NG under restraint was described as causing significant distress for staff and can risk injury to both staff and YP.[48] When NG under restraint is required it may be required for a significant duration; in one study[46] the average was 170 days.

5. Conclusions

This review describes the large differences in the use of NG for YP with ED in medical and psychiatric wards in a number of countries across the globe. NG feeding is an important aspect of treatment for YP with ED who are medically unstable or are unable to manage an oral diet. Due to the high level of bias in the studies, we are unable to make recommendations for clinical practice from this review. This review starkly highlights the lack of high quality evidence around the use of NG feeding in ED YP and the need to develop a robust global consensus on the type of NG, feed quantity, use of restraint, weaning technique and support needed for the YP and their family while NG is required.

Abbreviations

%IBW	percentage ideal body weight
AN	anorexia nervosa
AOED	adolescent onset eating disorder
CAMHS	child and adolescent mental health service
ED	eating disorder
EOED	early onset eating disorder
FBT	family-based therapy
HP	hypophosphataemia
LOS	length of stay
MH	mental health
NG(F)	nasogastric (feeding)
OT	occupational therapist
PLT	parent led therapy
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RDI	recommended daily intake
RS	refeeding syndrome
YP	young person/people

Declarations

Ethical Approval and Consent to Participate: No ethical approval or consent to participate required due to the nature of the study.

Consent for Publication: All authors have reviewed the document and consent to publication.

Availability of Supporting Data: All articles analysed in this study can be found in **Table 2** and can be traced back to primary articles using References on Page 16**.**

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Appendix

1. Naso-gastric or nasogastric or *enteric or *enteral or tube

2. (Anorexia or bulimia or eat* or feed*) NOT bowel NOT surgery NOT intestin*

3. (child* or paed* or adolescen* or teen* or young) NOT baby NOT toddler NOT infant NOT animal NOT maternal NOT parental NOT learning disabl* NOT learning disabil*

4. 1 AND 2 AND 3

Tables

Table 1 Risk of Bias of Studies Included in this Systematic Review of Enteral Feeding by Nasogastric Tube in Young People with Eating Disorders

Authors	Study design RCT=6 Prospective/cross section =4 Retrospective cohort =2 Case series =0	Sample size (<100=6 <50=4 <10=2 >10=0)	Unbiased cohort selection	Selection minimizes baseline differences in demographic factors	Sample size calculated	Validated method for ascertaining clinical status or participant group	Validated methods for assessing variables of interest	Validated methods for assessing outcome	Blind outcome assessment	Score 0-20= High risk, 21-40= Medium risk >40=Low risk
(Whitelaw et al., 2010)[9]	2	2	0	0	0	6	6	6	0	22
(Rocks et al., 2014)[10]	4	2	2	2	0	6	6	6	0	28
(Maginot et al., 2017) [17]	2	4	2	2	0	6	6	4	0	26
(Paccagnella et al., 2006)[20]	4	2	0	2	0	6	6	6	0	26
(Silber et al., 2004)[21]	2	2	0	0	0	6	6	4	0	20
(Madden et al., 2015b)[22]	6	4	4	4	0	6	6	6	6	42
(Agostino et al., 2013)[23]	2	6	0	0	6	6	6	6	6	38
(Parker et al., 2016)[24]	2	6	6	0	0	6	6	6	0	32
(Madden et al., 2015a)[25]	6	4	6	4	6	6	6	6	6	50
Kezelman et al 2018[26]	4	2	2	2	0	6	6	6	0	28
(Fuller et al., 2019)[27]	4	6	6	6	0	6	6	6	0	40
(Street et al., 2016)[28]	0	2	0	0	0	0	0	6	0	8
(Couturier and Mahmood, 2009)[29]	2	2	0	0	0	6	6	6	0	22
(O'Connor et al., 2016)[31]	6	2	4	4	6	6	6	6	6	46
(Falcoski et al.2020)[34]	0	0	0	0	0	6	6	6	0	18
(Akgul et al., 2016a)[35]	0	2	0	0	0	6	0	0	0	8
(Akgul et al., 2016b)[36]	2	2	0	0	0	6	6	6	0	22
(Nehring et al., 2014)[37]	2	6	4	2	6	6	6	6	0	38
(Neiderman et al., 2000)[38]	0	0	0	0	0	6	6	4	0	16
(Robb et al., 2002)[39]	4	6	4	4	0	6	6	6	0	36
(Neiderman et al., 2001)[40]	4	2	0	0	0	6	0	0	0	12
(Gusella et al., 2017)[41]	2	2	0	0	0	6	6	6	0	22
(Madden et al., 2009)[42]	4	6	6	6	0	6	0	0	0	28
(van Noort et al., 2018)[43]	4	6	4	4	0	6	6	6	0	36
(Strik Lievers et al., 2009)[44]	4	6	4	4	0	6	6	6	0	36
(Halse et al., 2005)[45]	4	2	2	2	0	6	6	6	0	28
(Clausen et al., 2018)[46]	4	6	6	6	2	6	6	6	0	42
(Bayes and Madden, 2011)[47]	0	2	2	0	0	6	2	4	0	16
(Kodua et al.2020)[48]	0	0	0	0	0	6	6	6	0	18

Table 1 displaying how Risk of Bias was calculated in studies included in this systematic review of enteral feeding by nasogastric tube in young people with eating disorders. Bias was assessed independently by CF, KH and JM before being amalgamated; there were no significant discrepancies between each authors outcome. Primary data from each study can be found by following References. Key: Clear evidence =6 Some evidence =4 Little evidence=2 No evidence =0.

Table 2. Studies included in from database search and subsequently this systematic review of nasogastric feeding to treat young people with eating disorders.

References	Study Design	Country Set	Time Frame / Follow up years (months)	N total (Female)	Age Range (years)	Setting	Aims	NG Primary/ Secondary Outcome? (Reason for Implementing NG)	Main Outcomes	Risk of Bias
Whitelaw et al., 2010[9]	Cohort Study (retrospective)	Australia	TF 1	29 (not stated)	12-18	Adolescent Medical Ward	Assess whether more aggressive refeeding leaves patients at greater risk of HP	Secondary (Inadequate oral intake)	HP associated with lower %IBW and lower number of hospital admissions; 15% required NG feeding	Medium
Rocks et al., 2014[10]	Cross-Sectional Study (prospective)	Australia	TF 0 (3)	17 (n/a)	N/A	Variety of Settings	Describe practices of Australian dietitians in management of AN	Secondary (Inadequate oral intake)	All dietitians stated OR was offered first with supplementation. 82% recommended implementing NG feeding as part of re-feeding process.	Medium
Maginot et al., 2017[17]	Cohort Study (retrospective)	USA	TF 1	87 (73)	8-20	Medical Behavioural Unit	Safety of higher calorie nutritional rehabilitation protocol (NRP)	Secondary (Inadequate oral intake)	Lower %IBW on admission more important predictor of HP than initial calories. Malnourished patients started on lower calories more likely to have NG tube.	Medium
Paccagnella et al., 2006[20]	Cohort Study (prospective)	Italy	TF 1	24 (24)	11-32	"Hospital"	Define minimal criteria for "lifesaving" treatment and submit a patient to NG	Secondary (medical instability)	Symptomatology improved the day after NG; is beneficial especially when used for life saving treatment initially	Medium
Silber et al., 2004[21]	Cohort Study (retrospective)	USA	TF 10	14 (0)	12-18	Adolescent Inpatient Unit	Determine outcomes of supplementing oral refeeding with nocturnal NG supplementation	Primary (Routinely)	Maximum kcals were greater, weight achieved at discharge greater in treatment group compared to oral refeeding only	High
Madden et al., 2015[22]	RCT (prospective)	Australia/ USA	TF 3	82 (78)	12-18	Paediatric Medical Ward	Long term outcomes of treating to restore weight rather than just to medically stabilise	Secondary (Routinely)	No difference in hospital days used after initial admission, however therefore total fewer days in hospital for MS.	Low
Agostino et al., 2013[23]	Cohort Study (retrospective)	Canada	TF 8 FU 0 (6)	165 (158)	10-18	Paediatric Medical Ward	Difference in LOS between adolescent ED treated with short-term continuous NG feeding vs. managed with lower calorie meals	Primary (Routinely)	LOS reduced in the NG-fed cohort; No significant difference in complications or electrolyte abnormalities (90% NG cohort received prophylactic phosphate).	Medium
Parker et al., 2016[24]	Cohort Study (retrospective)	Australia	TF 3	167 (152)	14-19	Adolescent ED unit	Weight gain and complications associated with refeeding prescribed greater initial calories	Secondary (Medical instability)	Mean starting intake was 2611.7 kcal/day (58.4 kcal/kg) With inclusion of phosphate supplementation no increased risk of RS.	Medium
Madden et al., 2015[25]	RCT (prospective)	Australia	TF 1 (9)	78 (74)	12-18	Paediatric ED service	More rapid refeeding protocol promotes initial weight recovery and medical stability.	Primary (Medical instability)	Adequate weight gain and minimal adverse effects were observed. All patients gained weight in week 1 with no cases of HP or RS.	Low
Kezelman	Cohort	Australia	TF 1 (2)	31	15-19	Specialist	Explore the	Secondary	All patients received NG	Medium

et al., 2018[26]	(prospective)		FU 8-66 days	(31)		ED Adolescent medical ward	relationship between anxiety and weight restoration	(Medical instability)	initially. No established relationship between changes in anxiety and weight restoration.	
Fuller et al., 2019[27]	Cross-Sectional Study (prospective)	UK/ Ireland	TF 1	134 (n/a)	n/a	Variety of Settings	Identify common current practice and if specialist ED units are managing AN differently to other inpatient settings	Primary (Inadequate oral intake)	43.3% reported that they were able to facilitate NG feeding; 79% of units providing NG feeding were able to facilitate physical interventions	Medium
Street et al. 2016[28]	Case Reports (prospective)	England	TF 3 FU 1-2	31 (30)	10 - 17	Paediatric medical ward	Evaluate joint care ED pathway between CAMHS and paediatric wards	Secondary (Medical Instability)	Time-limited admissions with boundaried-care plans are easier to manage and enjoyed feeling supported by CAMHS	High
Couturier and Mahmood, 2009[29]	Cohort Study (retrospective)	Canada	TF 2 FU 1	21 (19)	11-17	Psychiatric Inpatient Unit	Understand whether implementing meal support therapy reduced need for NG	Primary (Inadequate oral intake)	Meal support therapy reduces need for NGT (66.7% to 11.1% after implementation (P<0.02))	Medium
Falcoski et al.,2020[30]	Case Series (prospective)	UK	TF 1	3 (2)	11-14	Specialist ED unit	Evaluate new dietetic guidelines for AN in clinical practice	Primary (variable)	Different use of NGT feeding to suit individual; use of continuous and single bolus feeds via NG tube	High
O'Connor et al., 2016[31]	RCT (prospective)	UK	TF 2	36 (34)	10-16	Paediatric medical Ward	Higher calorie refeeding anthropometric outcomes, cardiac and biochemical markers	Secondary (Inadequate oral intake)	Adolescents on high energy intake had greater weight gain. 11% participants required NG feeding for failure to meet 80% oral intake.	Low
Akgul et al., 2016[35]	Case Series (retrospective)	Turkey	TF 4	13 (0)	11-17	Paediatric Medical Ward	Describe medical, psychiatric, cultural features of adolescent males with an ED	Secondary (Inadequate oral intake)	Male:female increased (3.6:1 F:M); 2/13 given NG due to refusal to eat in hospital	High
Akgul et al., 2016[36]	Cohort Study (retrospective)	Turkey	TF 6	35 (28)	11-17	Paediatric Medical Ward	Explore paediatric unit where no specific ED unit for to discuss refeeding approaches and goals for discharge	Primary (variable)	Paediatric ward is acceptable where specialist ED inpatient unit not viable; specialist unit better however limited resources	Medium
Nehring et al., 2014[37]	Cohort Study (retrospective)	Germany	TF 10 FU 1-12	208 (208)	12-18	Psychiatric Inpatient Unit	Short-term and long-term outcomes of treating with EN compared to no EN	Primary (not discussed)	No significant difference in recovery following EN; 34% had EN during at least 1 hospitalisation	Medium
Neiderman et al., 2004[38]	Case reports (prospective)	England	FU 1	4 (3)	13-16	Adolescent Unit	Report of gastrostomy or jejunostomy use in 4 cases of AN	Secondary (Medical instability)	4/4 patients required NG feeding and progressed to require gastrostomy/jejuonostomy due to complications	High
Robb et al., 2002[39]	Cohort Study (retrospective)	USA	TF 6	100 (100)	12-18	Paediatric Medical Ward	Compare short-term outcomes of oral vs. supplemental nocturnal nasogastric refeeding	Primary (Routinely)	Weight gain significantly increased in treatment group, no significant difference in length of hospital stay	Medium
Neiderman	Cross-	UK	TF	58 (21	Patients	Paediatric	Analyse patient	Primary	71% patients said they did	High

et al., 2001[40]	Sectional Study (retrospective)		1-18	patients 37 parents) (19/21)	9-17 at start of study	Medical Ward	and parent views on NG feeding	(not discussed)	not consent to NG feeding; patients feared weight gain and loss of control over calorie intake	
Gusella et al., 2017[41]	Cohort Study (retrospective)	Canada	TF 13 FU 1	46 (43)	9-15	Outpatient ED team	Compare parent led treatment (PIC) to conventional treatment	Secondary (Medical Instability)	PIC had greater increase in %IBW, fewer hospitalisations, shorter admissions, less likely to receive NG feeding	Medium
Madden et al., 2009[42]	Cross-Sectional Study (prospective)	Australia	TF 3	101 (74)	5-13	Medical Ward and Psychiatric Inpatient Wards	Collect epidemiological data on EO-ED	Secondary (not discussed)	Most were hospitalised (78%), mean duration of hospitalisation was 24.7 days; 58% inpatients NG tube fed.	Medium
van Noort et al., 2018[43]	Cohort Study (prospective)	Germany	TF 3	120 (120)	9-19	Specialist ED unit	Evaluate characteristics of EO-AN compared with AO-AN.	Secondary (Inadequate oral intake)	NG tube feeding required more in EO-AN than AO-AN; Restrictive more common in EO.	Medium
Strik Lievers et al., 2009[44]	Cohort Study (prospective)	France	TF 8	213 (213)	12-22	Psychiatric Ward	Clinical variables influencing the length of stay (LOS) of inpatient treatment for AN	Secondary (Medical instability)	Requirement for tube feeding was predictor for LOS (longer) tube feeding required in 27% admissions.	Medium
Halse et al., 2005[45]	Cross-Sectional Study (prospective)	Australia	TF 1	23 (23)	12-20	Adolescent Medical Ward	Examine the meanings that patients attached to NG	Primary (N/A)	Categories: unpleasant physical experience, a necessary intervention, a physical and psychological signifier of AN, a focus in a struggle for control.	Medium
Clausen et al., 2018[46]	Cross-Sectional Study (retrospective)	Denmark	TF 13	4727 (4387)	10-40+	Psychiatric/ Medical Ward	Frequency of various involuntary measures in AN patients	Secondary (not discussed)	Involuntary tube feeding was most frequent measure used.	Low
Bayes and Madden, 2011[47]	Case Series (retrospective)	Australia	TF 2	10 (0)	10-13	Paediatric medical Hospital	Demographic and clinical features of male inpatients with EO ED	Secondary (Medical instability)	Only 3/10 participants met full criteria for AN; 60% required NG feeding.	High
Kodua et al.,2020[48]	Case Reports (prospective)	UK	TF 1	8 (n/a)	n/a	ED inpatient units	Nursing assistants' experiences of manual restraint for NG feeding	Primary (N/A)	3 primary themes were gathered: an unpleasant practice, importance of coping, becoming (de)sensitized to NG feeding.	High

Table 2 displaying all 29 studies included in this systematic review. Data included in this table is: reference, type of study, country of setting, time frame and follow up in years (months) where information has been given, number of participants (with number of females), main aims of the study, setting, reason for implementation of NG feeding, risk of bias, and primary outcomes from each study. Primary data from studies can be found by following the reference. Key: N = number of participants; FU = follow up; TF = Time Frame; NG = Nasogastric (Feeding); LOS = Length of Stay; ED = Eating disorder; EO = Early onset; AN = Anorexia nervosa; RS = refeeding syndrome; %IBW = percentage ideal bodyweight; HP = hypophosphataemia; OR = oral refeeding; RCT = randomised control trial.

Table 3 Nasogastric Feeding Protocol (in Relation to Setting) and Complications Identified in Studies Included in this Systematic Review.

Study (Bias risk)	Setting	NG Feeding Type	Feeding Regime	Complications
Whitelaw et al, 2010[9] (Medium)	Medical Ward	Oral intake supplemented with bolus NG feeding if oral RDI not met	Minimum of 1900kcals on day 1 and increased by 300kcal per day	38% developed HP. HP was associated with lower %IBW on admission
Rocks et al, 2014[10] (Medium)	MH and Medical Wards	High energy supplements and NG feeds were commonly used to meet RDI.	The initial calorie intake recommended was between 800-1750kcals advised by dietitians in Australia.	Not discussed
Maginot et al, 2017[17] (Medium)	Medical Ward	Bolus NG feeds supplemental to oral intake if RDI not met	Average of 1185kcal average which increased to an average of 1781 kcals (range 1500–3000 kcals)	Hypomagnaemia and HP reported, HP was more likely in those under 80% %IBW
Paccagnella et al, 2006[20] (Medium)	Unknown	Continuous NG feeding until medically stable	15.9-19.7kcal/kg/day; increased to 30kcal/kg/day after 24 hours.	No patient developed nausea, vomiting, or worsened abdominal symptoms; 2 developed lower limb oedema despite slow infusion.
Silber et al, 2004[21] (High)	MH Ward	Nocturnal NG feeding to supplement daily oral intake vs oral refeeding only (control)	Nocturnal NG feeding regime patients were prescribed calories individually (max 4350kcal) and 3400 in the oral refeeding group (control).	Epistaxis, nasal irritation.
Madden et al, 2015[22] (Low)	Medical Ward	Continuous NG feeding until medically stable; followed by oral intake with supplemental nocturnal NG feeding until biomarkers stabilised.	NG feeding continuously for 1-2 days. Weight gain aim for 1kg per week. Weaning to oral diet occurred as soon as medically stable – average 14 days on NG with feed of 2400-3000kcal per day	Not discussed
Agostino et al, 2013[23] (Medium)	Medical Ward	Continuous NG feeding at a higher calorie intake compared to lower calorie standard oral intake.	Starting range for NG cohort 1200-2000kcal increased by 200kcal/day vs. 800-1200kcal increased by 150kcal/day (oral cohort). NG fed for 7 days then weaned over 3 days with kcal via NG reducing as meals replaced	Oral cohort 51% lost weight initially compared to 6% in the NG high kcal cohort. Hypokalaemia (although both cases were abusing laxatives), HP.
Parker et al, 2016[24] (Medium)	MH Ward	Continuous NG feeding or combination of oral intake with supplemental overnight NG feeding, or oral intake alone.	Start feed 2400kcal increasing to 2400-3400kcal/day at 100ml per hour	Peripheral oedema (4%), hypomagnaemia (7%), hypokalaemia (2%), HP (1%). No incidence of RS or delirium.
Madden et al, 2015[25] (Low)	Medical Ward	Continuous NG feeding until medically stable; followed by oral intake with supplemental nocturnal NG feeding until biomarkers stabilised. Average %IBW at initiation was 78	2400-3000kcal to meet weekly target of weight gain of 1kg/week. In the first week average weight gain was 2.79kg.	Stated no patients developed RS or HP
Kezelman et al 2018[26] (Medium)	Medical Ward	Continuous NG until medically stable followed by oral intake supplemented by nocturnal NG feeding	2400 kcal/day for 24hrs or until medically stable, changed to oral diet starting ~1800kcal increasing to a maximum of 3800kcal with nocturnal NG top up feeds stopped when BMI >18.5	Not discussed
Fuller et al, 2019[27] (Medium)	MH Ward	Results from questionnaire showed non-specialist psychiatric units gave 73% NG as syringe bolus, 27% as enteral pump. Specialist ED units gave 85% as syringe bolus, 15% as enteral pump.	Volume of bolus feed ranged from 330-1000ml average 564ml per feed. Bolus feed time ranged between 10-40 minutes average being 20 minutes. If delivered by pump it was >1 hour.	Not discussed
Street et al, 2016[28] (High)	Medical Ward	Bolus feeds	NG feeds were higher in calories than meals to motivate eating.	Not discussed
Couturier and Mahmood, 2009[29]	MH Ward	Bolus NG feeding if patient failed to gain 1kg/week or acute refusal of meals	Not discussed	Nausea, odynophagia, self-harm, epistaxis, anxiety, sadness, 38.4% patients experienced mild HP

(Medium)				
Falcoski et al, 2020[30] (High)	MH Ward	Oral calories supplemented with bolus NG feeds, single bolus of high calorie NG feeding, and 3 smaller single boluses.	Starting feed 1200kcal, increased by 200kcal per day to 2000kcal. 1 NG feed per day under restraint. Also described 1 bolus feed of 2000kcal due to no oral intake for 20 hours	Distress described during the procedure requiring Lorazepam
O'Connor et al, 2016[31] (Low)	Medical Ward	Supplemental bolus NG feeding if patients failed to meet 80% RDI. At initiation %IBW was <78%	Compared 500kcal starting diet with 1200kcal	HP (28%)
Akgul et al, 2016[35] (High)	MH Ward	Not discussed	Initiated at 750kcal per day and increased by 220kcal per day	HP described in 2 cases (unable to determine if this was in those requiring NG)
Akgul et al, 2016[36] (Medium)	Medical Ward	Not discussed, the majority of young people were under 80% %IBW	Started on an average of 975kcal. Average duration of NG was 2.5 days	HP described in 2 cases (unable to determine if this was in those requiring NG)
Robb et al, 2002[39] (Medium)	Medical Ward	Nocturnal NG feeding to supplement daily oral intake	Starting NG feed at 600 kcal. Ratio oral kcal to NG was approximately 2:1. NG feed via pump at 40 cc per hour for 4 hours then 60 cc per hour for 4 hours. Increases to 1200kcal NG feed over 3 nights. Weaned when the young person is 95%IBW.	Epistaxis (11.5%), anxiety (3.8%) treated with Lorazepam, removal of NG tube (5.8%), nasal irritation (28.8%).
Neiderman et al, 2001[40] (High)	Medical Ward	N/A	Calories individualised and increased to gain of 1-2kg/week.	Removal of tube (55%).

Table 3 displaying different refeeding methods, regimes and complications evaluated by studies in this review. Key: BMI Body Mass Index; NG nasogastric; MH mental health; RDI recommended daily intake; HP hypophosphataemia; RS refeeding syndrome; %IBW percentage ideal bodyweight.

Figures

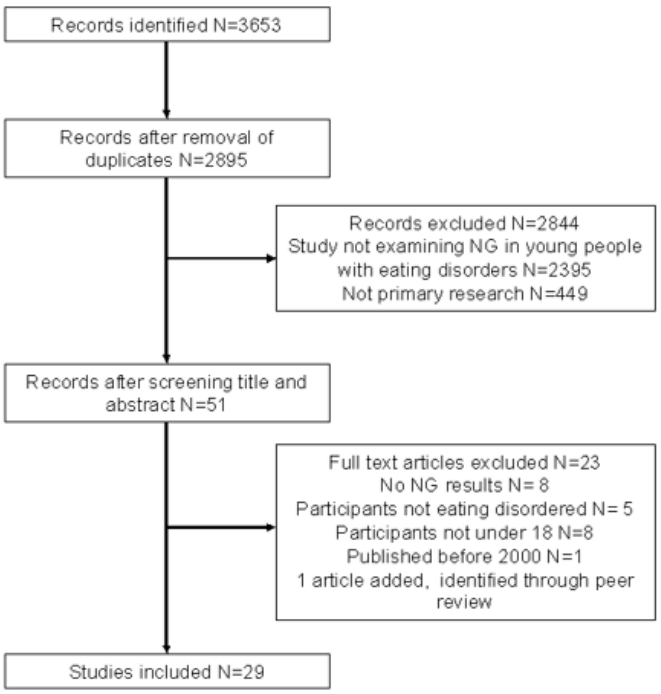

Figure 1

PRISMA Flowchart Figure displaying PRISMA flowchart of methodology utilised to search databases for this systematic review of enteral feeding in young people with restrictive eating disorders.