



THE LOFFLEX DIET

for Crohn's disease

A Guide for Dietitians

Background to the LOFFLEX diet

The LOFFLEX diet was originally developed in the 1990's by a team of Gastroenterology Research Dietitians working with Professor Hunter at Addenbrooke's Hospital, Cambridge, UK.

It has been updated in 2013 by Gastroenterology Specialist Dietitians who have worked with Professor John Hunter and at Addenbrookes Hospital.

Re-introduction of foods following a period of enteral nutrition for induction of remission was initially done using an elimination diet (one by one daily food reintroduction). This was time consuming, took several months to complete and required significant self motivation and medical, dietetic and family support and often still led to non adherence.¹ Therefore an alternative method of food reintroduction was sought to improve adherence and to enable a varied and nutritionally balanced diet to be started as soon as remission was achieved.

Regular reviews of individuals with Crohn's disease following the elimination diet enabled compilation of a list of foods that most commonly (in >5%) triggered symptoms on food reintroduction and which were therefore excluded on the basic LOFFLEX diet. Many foods identified fell in to the broad categories of high fat and high fibre, therefore these food types were excluded.¹ This fitted with the theory that fibre would be less likely to produce obstructive symptoms in the presence of inflammatory strictures. It would also reduce stool weight and slow the rate of intestinal transit. It was also concurrent with evidence from a meta-analysis conducted at Addenbrooke's hospital which showed that enteral feeds with higher contents of long chain triglyceride fats negatively correlated with remission rates.²

The original LOFFLEX diet aimed to provide ~ 50g total fat per day and ~ 10g non starch polysaccharide (NSP) fibre per day. Excluded foods were replaced with suitable alternatives of a similar nutritional content.

Comparison of the efficacy of the elimination diet and the LOFFLEX diet in maintaining remission following treatment with enteral nutrition demonstrated similar remission probabilities at 2 years.¹

Further details are published in the following scientific journal: Woolner, J.T., Parker, T.J, Kirby, G.A. & Hunter, J.O. The development and evaluation of a diet for maintaining remission in Crohn's disease. JHND., 1998; 11: 1-11 ¹

About this guidance

The following notes are intended as a guide to help Dietitian's best advise individuals with Crohn's disease who are following the LOFFLEX diet. The following is based on the experience of Gastroenterology Specialist Dietitians who have worked with Professor John Hunter and at Addenbrooke's Hospital, Cambridge, UK.

Guidance on the basic LOFFLEX diet

Starting the basic diet

The LOFFLEX diet was designed as a method of reintroducing foods following a period of exclusive enteral nutrition with the aim of helping to maintain disease remission.

A disease activity index e.g. Crohn's Disease Activity Index (CDAI), Harvey Bradshaw Index (HBI) may be helpful to objectively assess degree of disease activity before commencing treatment with enteral nutrition and before starting the LOFFLEX diet

The basic LOFFLEX diet can be started alongside medications for maintenance of remission, however it is best that the reintroduction stage is not started until these medications have taken effect and are at a stable dose so as not to mask the effect of food reintroduction on symptoms (see reintroduction stage for further details).

In clinical practice, the LOFFLEX diet has been used successfully in some individuals with mild disease activity without prior treatment with enteral nutrition; however there is no published evidence for its effectiveness in these cases.

Initial few days on the diet

It has been suggested that the initial few days of the diet include only a few plain foods with minimal fat and fibre content in small quantities regularly throughout the day. Although this was not specified in the original LOFFLEX diet, this has generally been recommended in clinical dietetic practice and is usually better tolerated. It can also help to relieve anxiety about initial food reintroduction. If symptoms remain settled after a few days, other foods suitable on the basic diet can be introduced in gradually increasing portion sizes.

Foods included/excluded on the basic diet

A review and update of the LOFFLEX diet has been undertaken to take into account the far wider range of products now available and to provide more specific product guidance. The reasons for inclusion/exclusion of certain foods are stated in the table below. Some foods may need to be negotiated on an individual basis.

Where 'small quantities' of foods have been allowed, it is recommended that Dietitians use their clinical judgement to advise on suitable quantities as this will in part depend on the individuals body weight/ size, toleration of other foods and usual portion sizes.

Food group	Food	Comments
Cooking oils	Spray oils	Some of these contain alcohol and xanthan gum (high in fibre), however the content is minimal therefore they have been considered suitable.
Meat and poultry	Pre-packaged cooked meats	Check for unsuitable ingredients e.g. milk derivatives, wheat. Encourage fresh meat cuts and avoid packaged and 'ready' meat meals where possible as they are less likely to contain unsuitable ingredients.
Meat alternatives	Soya and Quorn and products of these	These are not suitable as they are high in fibre and usually contain unsuitable ingredients such as wheat, egg, corn, dairy, onion. It may be advisable for those following a vegetarian diet to include these initially while monitoring symptoms since there are limited protein sources on the LOFFLEX diet. In these cases, it may be preferable to include soya products rather than quorn as they usually contain less unsuitable ingredients.
	Tofu	<i>Firm tofu</i> has been considered unsuitable due to its high fibre content but it may be suitable as an ingredient in soya products such as cheese. It may be advisable for individuals following a vegetarian diet to include tofu initially while monitoring symptoms since there are limited suitable protein sources on the basic diet. <i>Silken tofu</i> has a lower fibre content and has been considered suitable in small amounts e.g. as an ingredient for making sauces and dips.
Fish	Oily fish	Oily fish is high in fat but it has been considered suitable in quantities in line with current advice for healthy eating (1 portion per week). In addition, although more recently refuted, ³ some research has suggested that omega 3 fats may be helpful in Crohn's disease. ⁴ Alternative advice may be required depending on the individuals cardiovascular risk and if healthy eating guidance changes.
Dairy alternatives	All	A large variety of suitable milk alternatives are available. Calcium enriched varieties are encouraged as calcium requirements in Crohn's disease are higher than the general population ⁵ and dairy products and many high fibre foods rich in calcium (e.g. pulses, nuts, wholemeal cereal foods) are excluded on the basic diet.

Food group	Food	Comments
Dairy alternatives	Soya milks	Check for other unsuitable ingredients e.g. apple juice, chocolate flavouring.
	Coconut milk	<i>Full fat tinned coconut milk</i> is high in fat, therefore not suitable on the basic diet Half-fat or low fat tinned coconut milk is lower in fat compared to full fat tinned coconut milk but higher in fat than fresh coconut milk. It is considered suitable in small quantities to give variety to the diet. <i>Fresh coconut milk (carton)</i> is much lower in fat and therefore considered suitable as a milk substitute.
	Soya milk products	Many soya milk products contain corn and are not suitable. Chocolate flavour soya puddings are not suitable because they contain cocoa. Some soya milks contain citric acid but this has been allowed as an ingredient (see miscellaneous). Advise individuals to check ingredients lists.
	Soya cream and soya ice cream	These are high in fat, however they have been considered suitable in small quantities to add variety to the diet.
	Soya cheeses	These are unsuitable if they contain corn/maize and/or yeast. Some also contain firm tofu which is considered as a suitable ingredient as it is present in such small quantities.
Potato	Oven chips	Check ingredients for wheat which is sometimes used as a coating.
Bread, flours, cereals and grains	Rice and rice products	White rice and rice products are preferable over brown rice and rice products due to their lower fibre content. Some products are only available as brown rice e.g. rice cakes. These have been considered suitable in order to extend the variety of the diet and since overall, their fibre content is relatively low when considering the portion size consumed.
	Gluten-free/ 'Free-from' products	These are unsuitable as they frequently contain yeast and corn.

Food group	Food	Comments
Bread, flours, cereals and grains	Barley malt extract	This has been allowed as an ingredient in breakfast cereals. Currently all Kellogg's cereals contain barley malt extract at a level that exceeds the Codex Standard ⁶ for gluten-free foods (applicable in Coeliac disease). It is possible that some individuals may not tolerate these levels and it may be prudent to avoid these. Many current supermarket own brands of breakfast cereals have a lower content of barley malt extract that falls within the current Codex standard; Advise on an individual basis. This may change if the Codex standard is revised or Kelloggs modify their products.
Drinks	Fruit squashes, cordials and flavoured water	Check for unsuitable ingredients e.g. citrus fruit and apple juice. Citric acid has been considered as a suitable ingredient (see miscellaneous). It may also be prudent to avoid sugar-free varieties containing polyols (sorbitol, mannitol, xylitol, isomalt) due to their possible laxative effect on the bowel. Advise on an individual basis. Sugar containing varieties are useful for adding energy to the diet.
	Decaffeinated tea and coffee	It is unknown how well these are tolerated. Herbal and fruit teas are preferable but decaffeinated varieties could be negotiated on an individual basis to aid adherence.
	Smoothies	Check for unsuitable ingredients e.g. dairy products, citrus and apple juices.
	Fizzy/ carbonated water, tonic water, soda water	These have not specifically been identified to trigger symptoms but it may be prudent to avoid these in order to reduce the possibility of abdominal discomfort from ingestion of gas. Advise on an individual basis.
	Alcoholic spirits/ drinks	Wine, beer and cider are unsuitable as they all contain yeast, beer contains barley and cider contains apples. There is insufficient data available to be able to distinguish between the effects of the various forms of alcoholic drinks. As alcohol is known to be an irritant to the gastrointestinal system, it would seem prudent to avoid all types, however it has been suggested that this be discussed with the Dietitian to advise on an individual basis.

Food group	Food	Comments
Miscellaneous	Tahini paste	Tahini paste is made from sesame seeds which are not suitable due to their high fibre content. However it has been suggested that this is suitable as an ingredient of a product or recipe if present in small quantities.
Miscellaneous	Citric acid	Citrus fruits are amongst the foods identified as more likely to trigger symptoms. However there is no evidence to suggest that citric acid per se is problematic, and many foods contain small amounts of this. To help increase variety, foods containing trace quantities of citric acid have been allowed.
	Sorbets	Check for unsuitable ingredients e.g. egg white, citrus fruit. Citric acid has been allowed as an ingredient (see above).
	Sauces	Check for unsuitable ingredients e.g. wheat, yeast, corn/ maize.
	Carob	Carob flour is high in fibre but has been considered suitable as an ingredient in small quantities. Carob confectionary is unsuitable as it is high in fat and often contains other unsuitable ingredients such as milk and wheat.
	Confectionary	Clear boiled sweets, mints and jelly sweets may be suitable; check for unsuitable ingredients e.g. wheat and corn starch. It may be sensible to avoid sugar-free varieties containing polyols (sorbitol, mannitol, xylitol, isomalt) due to their possible laxative effect on the bowel. Advise on an individual basis.
	Chewing/bubble gum	These have not specifically been identified to trigger symptoms but it may be prudent to avoid these in order to reduce the possibility of abdominal discomfort from ingestion of gas. It may also be sensible to avoid sugar-free varieties due to their possible laxative effect on the bowel. Advise on an individual basis.
	Xanthan gum	Xanthan gum is often used to improve the texture of gluten-free products. It is high in fibre but has been considered suitable in small quantities e.g. in free-from/ gluten-free breads or baked products (if these are introduced during the reintroduction stage).

Food group	Food	Comments
Fruit and vegetables		Fruit and vegetable portions have been increased from four to five portions per day in line with current healthy eating guidance and to increase dietary variety and provision of vitamins and minerals. Suitable portion sizes have been listed for guidance. It is recommended that skins, seeds, stalks and pips are removed to reduce their fibre content. As wide a variety of fruits and vegetables as possible is recommended to broaden provision of vitamins and minerals. Some individuals may need to gradually increase the quantity of fruits and vegetables to five per day depending on their tolerance. Consider vitamin and mineral supplementation in those individuals who cannot tolerate five portions per day in the longer term.

Vegetarian diets

Since protein sources are limited on the basic diet, it may be sensible for individuals following a vegetarian diet to include eggs and/or pulses and lentils and/or meat alternatives (soya/ quorn/ tofu). It is suggested that this be discussed with the individual.

Continuation of enteral nutrition/nutritional supplements on the basic diet

Enteral nutrition can be gradually reduced as food intake increases. However if individuals are unable to eat a sufficient dietary variety and/or to maintain their weight, continuation of enteral nutrition may be required as nutritional supplementation. Ingredients of nutritional supplements e.g. cow's milk protein should be considered.

Food and symptom diaries

It is recommended that individuals keep a food and symptom diary in order to help identify patterns between foods eaten and symptoms experienced, and to assess the nutritional adequacy of their diet.

These diary pages can be found online for printing.

If you are a healthcare professional please visit www.elemental028.com to access the pages.
If you are a patient/carer, please visit www.crohns.org.uk

Returning symptoms on the basic diet

Check for unsuitable ingredients mistakenly included in the basic diet and frequency of non adherence and eating out, before considering exclusion of additional foods.

Consider additional exclusion of any food eaten that contains unsuitable ingredients but has been allowed initially as per the above notes e.g. oily fish, alcohol, pulses, meat alternatives.

The food and symptom diary can be helpful to identify potential other 'trigger' foods.

Exclude additional foods for a further four to seven days or until symptoms have settled.

If multiple foods are identified as potential symptom triggers, it is best to additionally exclude all of these. These should be tested individually in the reintroduction stage.

If symptoms are significant, a short and temporary period e.g. a few days, back on exclusive enteral nutrition may be required to settle symptoms before re-commencing the basic diet.

If it is necessary to continue the basic diet for longer than 4 weeks, assessment of nutritional adequacy and nutritional supplementation as required is recommended.

Recipes

A recipe booklet has been provided to help increase variety and aid adherence. It may be helpful for individuals to cook larger quantities for freezing and to prepare meals in advance.

Tailoring the diet

If an individual feels unable to follow the LOFFLEX diet in full, it may be possible and beneficial to follow one aspect of the LOFFLEX diet e.g. low fibre, low fat or both low fibre and low fat without the other exclusions. Discuss with the individual.

Deviation from the diet

If an individual deviates from the diet (either mistakenly or intentionally), reassure them and recommend they return to the diet as soon as possible. It may take a few days for any symptoms that may have developed to settle and this may therefore extend the time needed to follow the basic diet.

Guidance on the reintroduction stage

Starting the reintroduction stage

If the individual has been on combined therapy of enteral nutrition alongside medications for induction of remission, it is preferable that medications are at a low dose. Ideally steroids should be 5mg or less or have stopped entirely before starting the reintroduction stage. It is also preferable that medications commenced for maintenance of remission e.g. immunosuppressant's have taken effect and are at a stable dose before food reintroductions begin. This is to avoid masking the effects of food reintroductions and may necessitate an extended period of time on the basic diet.

Order of reintroduction

A suggested order of reintroduction has been given which has been modified from the original LOFFLEX diet. The suggested order is intended to introduce more useful foods earlier on, to achieve a balance of food groups in order to increase variety of foods and nutrients quickly and to enable balanced meals. It may also help avoid an individual becoming 'stuck' if a particular food type e.g. cereal grains, is not well tolerated. However if an individual wishes to change the order of reintroduction, this can be negotiated, using clinical judgement and taking tolerance to foods already introduced into account.

Foods that are never/ rarely eaten can be tested later in the reintroduction stage.

If an individual suspects that they are very likely to get symptoms from a particular food, they may also prefer to test this later on.

It is preferable but not compulsory to test these suspected foods at some stage to confirm tolerance or non-tolerance as they may appear as an ingredient of foods included in their normal diet without them being aware; it is helpful to explain this.

Only key foods are listed for reintroduction. Additional foods not listed can be added to the end of the listed reintroductions and tested twice a day for four days in their usual portion size.

Portion sizes to test

It is recommended that each food is reintroduced in the individual's normal portion size in order to ascertain whether their preferred intake is within their level of tolerance. This is especially relevant for foods with a higher fibre and fat content and for drinks containing caffeine.

Duration of each introduction

It is recommended that each food is tested twice a day for four days. This is to allow for both sufficient exposure to a food and enough time for any symptoms to develop.

Increasing fibre and fat during the reintroduction stage

As foods are gradually added to the diet, the overall fibre and fat content of the diet will gradually increase. Steps to check on the tolerance of fibre provided by wheat products and the tolerance of fat provided by dairy products are suggested (see below). For other foods, (especially those reintroduced later on), it is worth considering that an overall increase in fat or fibre might explain symptoms following their reintroduction rather than an intolerance of the specific food itself.

Re-introduction of dairy products

The suggested order for dairy product reintroduction is designed to help identify if specific components of dairy products (ie milk fat, protein, lactose) are problematic. If any of these products do cause symptoms, alternative products are listed below according to which dairy component is likely to be responsible. Advise on an individual basis

Dairy product to test	What does this contain?	If not tolerated, or previous dairy reintroduction suggests unlikely to be tolerated, consider trying:
Butter	Milk fat Traces of milk protein Traces of lactose	- Reduced quantity per meal/snack - Low fat butters/margarines (be wary of other unsuitable ingredients not yet introduced).
Cheese (contains cows' milk and a hard variety e.g. cheddar)	Milk fat Milk protein Traces of lactose	- <i>Low fat and soft cheeses</i> - <i>Goats' and/or sheep's' varieties</i> - <i>Soya varieties (check other ingredients have been tested).</i>
Yoghurt (cows')	Milk fat Milk protein Lactose (lactose and protein are generally considered to be in a more easily digestible form)	- Lower fat varieties - Low lactose varieties - Goats' and/or sheep's' varieties - other varieties including soya and coconut (if not already tried).
Cows' milk	Milk fat Milk protein Lactose	- lower fat variety - low lactose variety - sheep's' and/or goats' variety - other varieties of non-dairy milks not yet tried (depending on foods tested so far).

Re-introduction of wheat and bread

The suggested order for wheat and bread reintroduction is designed to help identify if specific components of wheat products (ie wheat starch, gluten, yeast, fibre) are problematic. If any of these products do cause symptoms, individuals should be advised as follows on alternative products to test according to which component is likely to be responsible.

Product to test	Characteristics	If tolerated?	If not tolerated?
White wheat (flour, pasta)	Wheat & gluten containing Low in fibre Yeast free	Test wholegrain wheat (flour, pasta).	Test gluten free flour.
Wholegrain wheat (flour, pasta)	Wheat & gluten containing High in fibre Yeast free	Test white bread, then wholegrain bread.	Test soda bread (yeast-free) or gluten-free bread.
Normal bread	Wheat & gluten containing High fibre (wholegrain), low fibre (white)	Include this in 'safe' diet.	Test soda bread (yeast free) or gluten-free bread.
Soda bread	Yeast free Low fibre Wheat (Check for any non-tested or non-tolerated other ingredients).		

Reintroductions for individuals following a vegetarian diet

If excluded on the basic diet, it may be sensible to introduce eggs, pulses, lentils, soya products, tofu and quorn earlier on.

Reintroduction of oats

If oats are not tolerated on initial reintroduction and wheat is also not tolerated, it may be sensible for individuals to test *gluten-free* oats (if these have not already been tried) at the end of the reintroduction stage.

Symptoms on food reintroduction

If symptoms are significant on reintroducing any food, a short and temporary period of a few days on exclusive enteral nutrition may be required to settle symptoms again before returning to introducing a different food.

Analysis of the final 'safe' diet

Computerised dietary analysis of the nutritional content of the final 'safe' diet is recommended to ascertain any nutrient deficits (and make appropriate recommendations to correct these) and to reassure the individual.

Monitoring and follow up

To maintain motivation and adherence while following the diet, regular contact with the individual is recommended. Encourage individuals to contact you with questions/ difficulties or if adherence is waning.

References

1. Woolner, J.T., Parker, T.J, Kirby, G.A. & Hunter, J.O., 1998. The development and evaluation of a diet for maintaining remission in Crohn's disease. *JHND*, 11: 1-11.
2. Middleton SJ, Rucker JT, Kirby GA, Riordan AM, Hunter JO., 1995. Long-chain triglycerides reduce the efficacy of enteral feeds in patients with active Crohn's disease. *Clinical Nutrition*;14:229-36.
3. Turner D, Zlotkin SH, Shah PS, Griffiths AM., 2009. Omega 3 fatty acids (fish oil) for maintenance of remission in Crohn's disease. *Cochrane Database Syst Rev*. Jan 21;(1):CD006320. doi: 10.1002/14651858.CD006320.pub3.
4. Turner D, Zlotkin SH, Shah PS, Griffiths AM, 2007. Omega 3 fatty acids (fish oil) for maintenance of remission in Crohn's disease. *Cochrane Database Syst Rev*. Apr 18;(2):CD006320.
5. Lewis, N.R. & Scott, B.B., 2007. BSG Guidelines for osteoporosis in inflammatory bowel disease and coeliac disease. <http://www.bsg.org.uk>, June 2007.
6. Commission Directive (EC) No 41/2009 of 20 January 2009. *Official Journal of the European Union*. 21.1.2009.

Authors

Developed by Dietitians
Jenny Woolner, Sally Naylor and Jenny Lee