BDA The Association of UK Dietitians

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Renal Nutrition
Specialist Group

Dietary Advice Post Renal Transplantation

1.0 Executive Summary

The purpose of this toolkit is to provide health care professionals involved in the dietetic management of transplant recipients, with clear and practical guidance relating to food safety advice and other nutritional considerations. A recent survey highlighted that the majority of UK transplant centres provided food safety information; however, the wide variation in the information given suggested the need for the development of national guidelines to promote consistent advice (1). This toolkit aims to promote standardisation in clinical practice within the UK. It is designed to be used by health care professionals and is not intended as a resource for patients.

Infection is a recognised post-transplant complication due to increased susceptibility to a wide variety of pathogenic organisms (2). Statistics on foodborne infection rates in transplant recipients within the UK are not recorded so the actual increased risk is unknown (1). Additionally there is no research currently available that evaluates the effect of foodborne infection in immunocompromised patients (3). However, it is estimated that between 15% and 20% of this population have greater susceptibility than the general population to foodborne disease, i.e. are classed as immunocompromised (4).

This document outlines the current UK Government advice on minimising the risk of foodborne illness in this high risk population; including general food hygiene and specific high risk foods. The latter part of the document outlines other nutritional considerations after transplantation, including potential drug-food interactions and renal transplant bone disease.

This guidance was developed from consensus amongst UK renal dietitians who have considered the diversity of food safety information available and the current lack of evidence-based practice. Where practice recommendations are given, these are the opinion of the RNG working party after reviewing the available information and other consensus based practice recommendations.

1.1 Aim

To standardise dietary advice provided post renal transplant throughout the United Kingdom, leading to patient care that is both equitable and best practice.

1.2 Objectives

To enable dietitians to:

- Provide food safety advice at a level appropriate for the renal transplant recipient to reduce the risk of foodborne illness post-transplant
- Ensure good bone health after transplant to prevent osteoporosis and fracture risk
- Maintain an evidence-based approach to recommendations with review every 3 years by the working party under the auspices of the Renal Nutrition Group of the British Dietetic Association

1.3 Terminology

For the purpose of this toolkit the term ‘transplant’ relates to kidney transplants (deceased brain death and deceased circulatory death donors, living related and living unrelated donors); simultaneous kidney-pancreas transplant (SKPT), and pancreas after kidney transplant (PAK).

1.4 Government Strategies

The Food Standards Agency (FSA) has developed a number of strategies designed to reduce foodborne disease in the UK as it is estimated that around a million people in the UK suffer a foodborne illness every year (5). The principles surrounding the food safety advice in this toolkit have been referenced from current FSA strategies:

- Food Standards Agency (FSA) Foodborne Disease Strategy 2010-2015: An FSA programme for the reduction of foodborne disease in the UK (5)
- The Food Standard Agency's Listeria Risk Management Programme (LRMP) 2010-2015 (6) and the Draft FSA reducing risk of Listeria Review (7)
- The 4 Cs of good food hygiene strategy, which outlines safe handling of food in the home using 4 Cs messages (cooking, cleaning, cooling and avoiding cross-contamination) (8)

2.0 Why is Food Safety Important after a Transplant?

Following a transplant, patients will need to take one or more immunosuppressive medications e.g. Tacrolimus, Sirolimus, Ciclosporin, Mycophenolate Mofetil (MMF), Mycophenolate Sodium (Myfortic), Azathioprine and Prednisolone. Immunosuppressants help prevent the immune system from attacking or rejecting the new organ by dampening down the body's own natural defence system.

These immunosuppressive medications weaken the immune system's ability to fight infections, increasing the risk of all types of infection, including foodborne. Bacteria, viruses or parasites present in food are all potential sources of infection (2, 9). It is therefore important to recommend the use of good food hygiene when choosing, preparing and storing foods; and the avoidance of certain high risk foods known to carry certain bacterium such as Escherichia coli, Listeria or Salmonella and viruses such as hepatitis E (8). Further information regarding the common pathogens associated with foodborne illness is summarised in Appendix 1.

Symptoms of foodborne infections can vary, but may include mild flu-like symptoms such as headache, high temperature and a sore throat or vomiting and diarrhoea. During periods of vomiting or diarrhoea, hydration may not be sustained and essential medications not absorbed which can result in severe dehydration and potentially risk organ rejection. It is important to ensure that the medical team caring for a transplant recipient is made aware of any concerns.

Following food safety guidance is important for all transplant recipients, but is particularly important when high doses of immunosuppressive medication are recommended or when dose adjustments are being made. This is likely to be the case within the first six months after transplantation but this will vary for each patient.

Basic food safety principles should continue for the lifetime of the transplant as the immune system will remain suppressed, particularly if there are changes to the immunosuppressive medications.

2.1 Advising the Neutropenic Transplant Recipient

There is a low risk that an individual's immune system may become over suppressed which can lead to a low neutrophil count. For those transplant recipients with a low absolute neutrophil count, the risk of foodborne infections is greater, and the food safety advice provided needs to be adjusted appropriately.

Advice differs according to absolute neutrophil count and is based on low (0.5-2 x 10^9/L) or very low (<0.5 x 10^9/L) levels. The BDA Oncology Specialist Group (2016) has published a policy statement on neutropenic dietary advice for Haematology patients and provides consensus based advice that would be suitable for advising neutropenic transplant patients (10).

2.2 Minimising the Risk of Getting Foodborne Illness

The consensus of the working group is that the level of food safety advice needed for the majority of post-transplant patients falls in line with the Food Standards Agency (FSA) and NHS choices latest guidance for reducing risk of food poisoning for the general public and during pregnancy (5, 7, 8, 11, 12). See Appendix 2 for a summary of food safety advice for renal transplant patients outlined in this toolkit.

The FSA recommend following the **4Cs** of good food hygiene:

1. Wash your hands properly and keep them **clean**
2. **Cook** food properly
3. **Chill** food properly
4. Avoid **cross-contamination**

See appendix 3 for detailed patient information summarising the current FSA recommendations.

2.3 High Risk Foods to be Avoided

Transplant recipients should be advised to avoid foods which pose a higher risk to contracting foodborne illness (8, 12), these include:

- Raw meat and poultry
- Raw eggs, unpasteurised milk and unpasteurised soft cheeses
- Raw shellfish
- Slush puppies and ice cream from ice cream vans and other soft-serve machines (e.g. Mr Whippy)
- Ready-to-eat foods such as pâté, rotisserie chickens and cured meats (see 2.3.1)
- Foods from salad bars and deli counters
- Unwashed fruits, vegetables and salad

A note about rice: It is important to note that rice must be served hot, eaten immediately after it is first cooked and must not be reheated. Uncooked rice can contain spores of Bacillus cereus, which survive during cooking. If cooked rice is left at room temperature these spores can grow into bacteria which produce toxins, and can cause food poisoning. The toxin is also resistant to heat and therefore will not be destroyed by thorough cooking or reheating (12).

The same applies for take-away establishments or restaurants/cafes; it is advisable to recommend that the transplant recipient prepares their own rice at home when ordering take-away (e.g. Indian or Chinese). When eating-in at a restaurant or café it is advisable to check the cooking methods used with the chef prior to ordering (10).

2.3.1 Meat and Poultry

These are generally safe to eat providing they are cooked as per the manufacturer's instructions and served piping hot. However, the following foods are considered high-risk and transplant recipients should be advised to avoid:

- Bought rotisserie chickens
- Deli counter meat/fish/poultry – advise to buy pre-packed if able
- Raw meat or poultry (e.g. steak tartare)
- Buffets (if unavoidable try to be first in the queue and avoid going back for seconds where there is increased risk of contamination)
- Meat and vegetable pâté (tinned pâté is considered a low risk product and therefore can be included)
- Barbecues increase the risk of foodborne illness when undercooked meat/poultry is consumed. The FSA recommend to pre-cook meat or poultry in the oven first and then finish it off on the barbecue for flavour (8)

A note about cured meat: Many cold meats such as salami, Parma Ham, chorizo and pepperoni are cured and fermented but not cooked so there is a potential risk. To reduce the risk the meat can be frozen for four days at home before consumption. The meat should then be defrosted thoroughly in the fridge for 24 hours before consumption and leftovers discarded. There is no need to freeze before using if the cured meats are to be cooked. They are safe to include in cooking, if cooked thoroughly and until piping hot (e.g. pepperoni on pizza or chorizo in paella). Caution should be taken when ordering these foods in restaurants. Cured meats should be purchased in sealed packets rather than from the deli counter to reduce the risk of cross-contamination (11).

A note about cooked meats: There is a risk associated with sliced meats bought either pre-packaged or loose from the deli counter (3, 8, 10). To reduce the risk of cross contamination cooked meat and poultry should be purchased in sealed packets in the chilled section of the supermarket. It is important to keep refrigerated and consume within the use by date specified on the packaging or within the manufacturers' recommendations after opening.

*Please note tinned pâté, cured meats and processed meats such as ham, bacon and sausages are often high in salt and should be eaten in moderation.

Recent reports: Hepatitis E and pork products:

There is emerging evidence that undercooked pork and pork products such as sausages and offal may contain Hepatitis E (13). Current FSA guidance states that all whole cuts of pork, pork products (e.g. sausages) and offal should be thoroughly cooked until piping hot throughout, the meat is no longer pink and the juices run clear (8).

2.3.2 Fish and Shellfish

These are safe to eat providing they are cooked as per the manufacturer's instructions and served piping hot. Transplant recipients should be advised to:

- Purchase only pre-packaged fish, smoked fish and shellfish to reduce the risk of cross-contamination. It is important to keep these foods refrigerated and consumed within the use-by-date specified on the packaging or within the manufacturers' recommendations after opening
- Fish and shellfish must be cooked until piping hot and all raw versions avoided such as sashimi, oysters and caviar

A note about smoked fish: The FSA draft document on reducing Listeria states there is a risk associated with the consumption of *smoked fish such as salmon and trout and ready-to-eat fish and shellfish eaten cold. Should an individual wish to consume these products cold they should be eaten within 24 hours of opening the packaging (7, 10). Thoroughly cooked (piping hot) smoked fish and shellfish e.g. prawns can be consumed safely as it reduces the risk of Listeria.

* Please note these are often high in salt and should be eaten in moderation.

Sushi

The safest way to enjoy sushi is as follows (11):

- All shop-bought sushi will have had the fish frozen, destroying any potential parasites, therefore is safe to consume
- Sushi-specialist restaurants normally freeze their product before serving – if unsure double check with a member of staff
- Avoid all sushi made with shellfish
- Always check the use-by date and consume within that time
- Ensure food is appropriately chilled when buying and packaging is intact
- If it is not eaten immediately after buying (or making) it should be stored in the fridge as soon as possible
- If sushi is made at home, farmed fish, which does not need to be frozen, should be used. If using wild fish then freeze the fish for at least four days before using to destroy any potential parasites. Allow the fish to thaw in the fridge for 24 hours prior to using and discard any leftovers. Store the sushi in the fridge once made and ideally consume immediately or within 24 hours

Preferable options include:

- Cooked seafood and fish e.g. cooked eel or shrimp, farmed salmon/farmed fish in general
- Vegetable-based sushi e.g. cucumber/avocado (California roll)
- Well cooked egg

Dietetic rationale: Raw wild fish, often used in sushi, can contain parasitic worms; freezing for a minimum of four days kills this worm making the fish safe to eat (11). Farmed fish does not pose the same risk, therefore does not need to be frozen. Manufacturing regulations stipulate sushi must be frozen before consumption for this very reason so sushi sold in shops or by specialist restaurants should conform to this regulation.

2.3.3 Eggs

These are safe to eat providing they are thoroughly cooked (12).

- Eggs can sometimes contain salmonella bacteria. It is best practice to buy eggs that are Lion Quality stamped and they should be stored in the fridge away from other foods e.g. in the box
- Eggs should be well cooked (avoiding any runny eggs)
- Certain sauces, desserts and dressings may also contain raw or undercooked eggs e.g. homemade mayonnaise, aioli, Caesar salad dressing, homemade ice cream, chocolate mousse, egg-nog, meringue, hollandaise sauce, and béarnaise. If raw egg ingredients are present then they are best avoided. When dining out clarification from the chef is advisable
- Consider using pasteurised liquid egg in dishes requiring raw or partially cooked eggs
- Avoid eating raw cookie dough or cake batter

2.3.4 Milk and Dairy Products

All milk and dairy products such as yoghurt and cheese should be pasteurised or ultra-heat treated (UHT). This includes cow's milk, goats and sheep milk, soya, rice, oat and nut-based milks (e.g. almond milk) (8, 11).

Cheese

Harder cheeses like cheddar are often made from pasteurised milk but some softer cheeses may be unpasteurised. Ideally cheeses on the deli counter should be avoided and the purchase of pre-packaged cheese encouraged, reducing the risk of cross contamination.

A note on hard cheese: Current guidance (11, 12) states that all hard cheese is safe to consume whether made from pasteurised or unpasteurised milk. Hard cheese such as Cheddar, red Leicester, Edam, Gouda, Stilton and Parmesan has a low moisture content and is less likely to provide the environment suitable for the growth of bacteria. The risk associated with hard blue cheese such as blue Stilton is also considered low.

Many soft cheeses can be bought in pasteurised form. However it is recommended to check the product label to ensure it has been pasteurised e.g. cottage cheese, mozzarella, feta, cream cheese, paneer, labneh, ricotta, halloumi, hard goat's cheese and processed cheeses such as Dairylea and Laughing Cow. Unpasteurised soft cheeses are safe to consume if cooked thoroughly.

Most mould-ripened soft cheeses such as Brie, Camembert and certain goat cheese (e.g. Chevre) are unpasteurised and should be avoided, unless cooked until piping hot. Similarly, soft blue-veined cheeses such as Danish Blue, Gorgonzola, Dolcelatte and Roquefort are only safe to eat if they have been cooked.

A note on soft cheese: All unpasteurised soft cheese should be avoided. Soft cheeses that have not been pasteurised pose a risk due to their less acidic nature and moisture content. This provides a suitable environment for bacteria such as Listeria to grow. These are only safe to eat if they have been cooked until piping hot (11, 12).

Table 1: Cheese products

High risk - should be avoided	Safer alternative
All unpasteurised soft cheese unless cooked until piping hot	Pasteurised soft cheese (check the label*) e.g. cottage cheese, mozzarella, feta, cream cheese, ricotta, halloumi, hard goats cheese, paneer and labneh. Processed cheeses such as cheese spreads (e.g. Dairylea)
Cheeses on the deli counter	It is best to buy pre-wrapped cheese
Soft cheeses – mould-ripened (white rind) Brie, Camembert and certain goats cheese like Chevre	Mould-ripened cheeses if cooked until piping hot
Blue-veined cheese e.g. Danish Blue, Gorgonzola, Roquefort	Blue-veined cheeses if cooked until piping hot
	All hard cheese (pasteurised and unpasteurised) e.g. Cheddar, red Leicester, Edam, Gouda, Stilton, Pecorino and Parmesan
Dolcelatte	Pasteurised version
Homemade cheeses e.g. labneh/paneer	Shop-bought pasteurised versions

*Some brands of cheese may not be pasteurised. It is best to check the label to ensure it has been pasteurised.

Ice-cream

Many bought ice-cream products are made with pasteurised milk and eggs, therefore any associated risk is reduced; this includes soft scoop ice cream. Caution should be taken to ensure ice-cream is not thawed and re-frozen. There is a risk associated with the consumption of soft serve ice cream such as whipped ice-cream from an ice cream van, due to potential issues with storage and cleaning storage (10).

When making homemade ice cream, pasteurised egg substitute should be used or an egg-free recipe should be encouraged.

Yoghurt and Starter Cultures

All yoghurt is produced through the fermentation of milk by live bacterial starter cultures such as *Lactobacillus bulagaricus* and *Streptococcus thermophiles*. These cultures have been safely used within the industry and are considered non-pathogenic. Historically, transplant recipients have been advised to avoid 'live' yoghurt, and to choose pasteurised products. However, labelling suggesting that the product is pasteurised often relates to the pasteurised milk used. The majority of yoghurt is not pasteurised post-production and therefore contains live bacterium. These starter cultures are unable to survive the acidic nature of the stomach. Adolfsson *et al* in 2004 (14) found no reports of infection in humans associated with fermented milk products. Therefore it is suggested that live yoghurt is safe to consume within the use-by date and poses no risk post transplantation.

There is limited evidence around the safety of probiotics in renal transplant recipients. The Haematology Subgroup of the BDA Oncology Group (2013) stated that there is currently a lack of legislation surrounding production of live cultures or probiotics, highlighting the risk that some yoghurt may contain unlabelled probiotic bacteria (10). However, it was considered unlikely that the numbers of probiotic bacteria added would be significant unless being marketed for its probiotic use. The group suggests that unless the product specifically makes reference to its probiotic nature, the product does not need to be avoided. Due to the lack of clear definition of the term 'bio' the group felt these products should be avoided. On this basis best practice advice is provided in table 2 below as per the current Haematology food safety guidance for grade I neutropenia (10).

Table 2: Yoghurt products

High risk – should be avoided	**Safer/ Alternative option**
Yoghurt which is described on the label as 'bio' or 'probiotic' (e.g. Onken, Yeo valley, Rachel's, Activia)	Any yoghurt that does not describe itself as bio or probiotic including live, plain/natural, sour cream, Greek and fruit yoghurts (e.g. Muller, supermarket own, lassi)
Probiotic drinking yoghurts such as Yakult, Actimel, Supermarket own versions Any form of unpasteurised yoghurt	Prebiotic yoghurt/product (these contain substances which promote the growth of healthy bacteria. They do not contain any live bacteria themselves)

It is advisable to avoid the purchase of large 'sharing' pots due to potential contamination, but instead to use small pots and consume within the use by dates.

Homemade yoghurts, such as Keffir, and purchased home starter yoghurt kits should be avoided due to their probiotic nature. The way in which these products are made could also increase the risk of bacterial contamination which may not be deemed safe in patients who are taking immunosuppressive medication.

2.3.5 Ready-to-Eat Sandwiches

The current NHS choices statement (12) in conjunction with the draft FSA Listeria advice report (7) suggests vulnerable groups such as those with a weakened immune system may wish to avoid pre-packed or freshly made sandwiches and rolls that contain high risk foods (e.g. cured meat or smoked salmon). Sandwiches containing low risk foods or toasted/hot sandwiches that have been thoroughly heated can be safely consumed. Pre-packaged sandwiches should be stored appropriately and consumed within the use-by date.

2.3.6 Fruit, Vegetables and Salad

These are safe to eat providing they are washed thoroughly to remove all traces of soil and visible dirt (12). A recent draft FSA Listeria advice report recommended that vulnerable groups avoid raw-sprouted seeds and unpasteurised fruit juice or smoothies (7). Although these foods have a relatively low risk regarding *Listeria*, these products can be a source of other pathogens such as *E-Coli* or *Salmonella*. It is therefore advisable to thoroughly cook sprouted seeds and choose pasteurised fruit juice and smoothies.

2.3.7 Bottled Water

Recommendations regarding the avoidance of bottled and mineral water differ nationally. Bacteria such as Campylobacter and Legionella have been isolated in bottled water. The Haematology Subgroup of the BDA Oncology Group (2012) recommend the avoidance of non-carbonated bottled water and mineral water during neutropenia ($<0.5x10^9/L$) (10). However certain renal units may specify otherwise, regardless of the absolute neutrophil count. It is therefore advisable to discuss this further with your individual transplant team.

2.4 Eating Out and Takeaways

Eating out or consuming takeaways within the first 6-8 weeks after transplantation should be avoided. After this period, eating out can be enjoyed when following the basic principles outlined below.

Every business selling food (e.g. restaurants, pubs, cafes, takeaways, street vendors, hotels and supermarkets) will be given a food hygiene rating issued by the local authority. Inspections take place every 6 months to 2 years depending on the type of establishment or perceived risk. The food hygiene rating reflects the standards of food hygiene found on the date of inspection and there are six possible outcomes (from '0' urgent improvement needed to '5' highest rating indicative of good levels of food hygiene). This may provide relevant information with regards to the overall cleanliness of a business and whether it is a suitable place to eat. The Food Standards Agency website (http://ratings.food.gov.uk) will list all the ratings for both local and out-of-area food establishments as well as having these available to check on mobile phone applications (15).

Tips to enjoy eating out safely

- Check the eating area is clean and tidy
- Avoid all high-risk foods on the menu or enquire if unsure
- Try to order a plated meal that is cooked fresh to order
- Avoid foods from salad bars and deli counters
- Ensure your meal is piping hot and thoroughly cooked when it arrives
- Avoid rice that has already been cooked; ask for it to be cooked fresh or choose another option such as potato, pasta, chips, chapatti or noodles
- Beef burgers should be well done, even if freshly made, as there is a risk of food poisoning with minced/ground beef if not cooked thoroughly
- If transplant recipients need to eat from a buffet it is recommended to try to be first in the queue and not to go back for further servings as there is a risk the food may have been contaminated by other diners
- Consider the previous advice about raw egg in sauces, desserts, and other foods as previously listed (see 2.3.3)

Caution should be taken when eating foods from buffets, street vendors, delicatessen counters and salad bars. The food may have been stored at incorrect temperatures (e.g. less than 63°C for 2 or more hours for hot food and greater than 8°C for 4 or more hours for cold food), allowing the perfect environment for the growth of food borne bacteria (8). There is also the risk of contamination from other foods, people, insects and animals.

2.5 Eating Abroad

It is especially important to be very vigilant with food safety when eating abroad. It is recommended for those considering travelling abroad to discuss this with their transplant team in advance. The following tips will help reduce risk of food poisoning:

Drinks

- Avoid tap water, ice and beverages made from tap water and fresh fruit juice
- Drink bottled, canned and processed beverages
- Boil tap water if it is to be used
- Some people may prefer to brush their teeth with bottled or cooled boiled water to prevent any risk of contamination

Food

- Hot foods should be served piping hot
- Avoid any foods that may have been washed in tap water such as salads and fruit
- Select vegetables and fruit that can be peeled
- Many hotels offer buffet style restaurants; refer to information in section 2.4

Further information regarding the safe consumption of food and water abroad can be found on NHS Choices (16).

Transplant recipients should be encouraged to liaise with the chef or other catering staff if they have any concerns.

3.0 Foods that Interact with Medications

Some foods, plant compounds and herbal remedies can interact with immunosuppressive medications and change the bioavailability (17). It is not recommended to take any 'alternative' medicines (e.g. herbal or homeopathic) or high dose vitamins (e.g. vitamin C) without first discussing with the transplant team. Transplant recipients should be encouraged to always discuss with their doctor or pharmacist before taking any non-prescription medicines.

3.1 Grapefruit and Associated Plant Compounds

Grapefruit (Citrus paradis) and grapefruit juice can cause Ciclosporin, Tacrolimus and statin levels to become elevated and therefore grapefruit in any form should be avoided(17, 18)

Caution should be advised in consuming the following in large quantities due to potential drug-food interaction, as outlined in a review article in 2008 (19):

- Pomelo, shaddock and pamplelmousse (Citrus grandis) – limited evidence suggests pomelo juice can increase blood Ciclosporin and Tacrolimus levels
- Chamomile tea (Matircariarecutita) – a single case report has outlined the effect of consuming 1-2 L of chamomile tea per day on Ciclosporin levels as chamomile inhibits absorption causing a decrease in blood Ciclosporin levels (18)
- Earl grey tea (Citrus bergamia) – Earl grey tea is flavoured with bergamot oil. A single case report has suggested that consumption of Earl grey tea could modify Ciclosporin metabolism (18)
- Seville bitter orange (Citrus aurantia) -(often used in marmalades) may marginally increase blood Ciclosporin levels
- Star fruit (Averrhoa Carambola) – may cause a decrease in blood Ciclosporin levels

The following foods have been shown to have potential interactions with immunosuppressive medications from *in vitro* studies. However, human studies have not demonstrated any interactions. The author of a review article in 2008 outlined that *in vitro* testing methods of these foods could have led to errors in assessing the risks (19):

- Garlic
- Black and green tea
- Cranberry juice
- Pomegranate juice
- Tangerine juice

4.0 Do Previous Dietary Restrictions Need to Continue?

Prior to transplantation patients may have been advised to restrict their intake of salt, potassium, phosphate and fluid. Following transplantation many of these restrictions may be relaxed. For those with a good functioning graft, producing good volumes of urine, it may be possible to relax these restrictions and start following a healthy diet.

High doses of immunosuppressive medications are often required initially after transplantation; this can cause hyperkalaemia therefore a gradual relaxation of dietary potassium restriction may be required.

Post transplantation, transplant recipients should still be encouraged to be careful with the amount of salt they consume, limiting their intake to less than 5-6 g a day as per national recommendations (20, 21, 22).

4.1 Delayed Graft Function

Post transplantation, graft function can vary with periods of reduced urine output and some individuals requiring dialysis. During this time certain dietary restrictions may be necessary, including potassium. Regular review with the transplant team, including the dietitian, is essential to enable appropriate relaxation of dietary restrictions. In some cases, the transplant recipient may be discharged home with delayed graft function (with or without the need for dialysis) and therefore follow up is essential to ensure the patient modifies their previous restrictions in accordance with improving graft function.

Food safety is paramount, as frequent changes to immunosuppressive medication can occur during this time.

5.0 Renal Transplant Bone Disease

Pre-existing bone disease may adversely affect bone health, even with normal post-transplant graft function. This may have been manifested by abnormalities of calcium, phosphorus, parathyroid hormone and/or vitamin D metabolism. The risk of bone fractures among kidney transplant recipients is four times that among the general population with post-menopausal women being most at risk of increased bone loss (23).

Transplant specific therapies, especially corticosteroids may further affect renal bone disease. Steroid treatment for a long period of time may cause osteoporosis.

Table 3: Effects of immunosuppressive medication on bone health

EFFECTS OF IMMUNOSUPPRESSION
Tacrolimus – increased bone turnover and bone loss
Ciclosporin – increase bone turnover and bone loss
Mycophenolate – no effect
Azathioprine – no effect
Sirolimus – no effect on bone volume, probably bone sparing
Steroids – reduced bone formation and increased bone resorption

There are various guidelines available from the UK, Europe, Canada and Australia providing best practice guidance on bone health post- transplant which include:

- KDIGO Clinical Practice Guideline for the Care of Kidney Transplant Recipients (2009) (24)
- KDIGO (2009) Clinical Practice Guidelines for the Diagnosis, Evaluation, Prevention and Treatment of Chronic Kidney Disease-Mineral Bone Disorder CKD-MBD (25)
- PEN: Practice-based Evidence in Nutrition (26)
- New South Wales Renal Services Network Transplant Working Group (Australia), Evidenced based practice guidelines for the Nutritional Management of Adult Kidney Transplant Recipients (2009) (27)
- The Royal College of Physicians London – Glucocorticoid-induced osteoporosis. A concise guide to prevention and treatment (2002) (28)
- National Kidney Foundation. K/DOQI clinical practice guidelines for bone metabolism and disease in chronic kidney disease (2003) (29)

5.1 Calcium and Vitamin D Recommendations

Appropriate nutrition interventions to minimise bone mineral density loss and the risk of fractures in adult kidney transplant recipients are summarised below.

- A diet containing adequate calcium-rich foods should be encouraged to meet the recommended dietary intake for calcium of **1000 mg/day (1300 mg/day post-menopause**) (24, 27) (See 5.1.1)
- A calcium supplement should be recommended if the diet does not provide adequate calcium (24, 27)
- The best source of vitamin D is from safe sunlight exposure (30); however transplant patients need to be careful in view of increased incidence of skin cancer (see 5.1.2)
- Small amounts of dietary vitamin D can be obtained from consumption of fortified margarine, dairy products and egg yolks.
- The treating physician should determine the necessary dose of supplementary vitamin D and the necessity of any other treatments for minimising bone mineral density loss, on the basis of available evidence
- Efforts to incorporate lifestyle habits that positively affect bone health should be encouraged

    - Encourage weight bearing, high impact and strengthening exercises (e.g. walking, tennis, dancing, weight training) within the limits of underlying disease (31)
    - Not smoking (27)
    - Drinking less alcohol or within current guidance (27)
    - Maintaining normal body weight (BMI 20-25 kg/m^2) (31)

5.1.1 Calcium

BEST PRACTICE RECOMMENDATION: Encourage a dietary calcium intake of 1000 mg a day or 1300 mg a day if post-menopausal and if concerned, discuss with the transplant team on an individual patient basis (27). Consider a calcium supplement if the diet does not provide adequate calcium.

Individuals with a functioning transplant should be encouraged to follow a healthy balanced diet ensuring an adequate calcium intake.

Table 4: Sources of calcium

HIGH SOURCES OF CALCIUM

- Milk* – all types
  If choosing non-dairy milk such as soya or rice milk check the label to make sure that it is fortified with calcium.
- Cheese – all types except cottage cheese and cream cheese
- Yoghurt and yoghurt drinks - plain or fruit, lassi
- Tofu
- Tinned fish especially sardines, pilchards and salmon (if the bones are eaten)
- Sesame seeds and tahini
- Instant porridge (fortified with calcium)

MODERATE SOURCES OF CALCIUM

- Cottage cheese
- Pulses especially baked beans, soya beans, broad beans, red kidney beans and chick peas
- Nuts – almonds, brazil nuts, hazel nuts
- Dried figs
- White bread and white flour products
- Fortified breakfast cereals (e.g. malted wheats, puffed rice)

**Lower fat varieties have just as much calcium as full fat products*

5.1.2 Vitamin D

BEST PRACTICE RECOMMENDATION: Encourage the consumption of vitamin D rich foods daily in the diet.

Good dietary sources of vitamin D include skimmed milk powder (with added vitamin D), margarine, low fat spread, and oily fish such as mackerel, fortified breakfast cereals and eggs. The action of sunlight on the skin is also an important source of vitamin D, particularly between the months of April and September (30). After a transplant it is recommended to keep covered up or wear sun block, which may mean that transplant recipients spend less time in the sunshine and consequently synthesise less vitamin D, increasing the risk of deficiency.

The New South Wales Renal Services Network Transplant Working Group recommends all kidney transplant recipients take vitamin D (or analogue) at a dose of at least 0.25microgram daily (27); however, the KDIGO CKD-MBD guidelines do not mirror this (24). KDIGO *suggests* that calcidiol (25-hydroxycholecalciferol) levels *might be measured* in patients with CKD stages 1-5T* and repeated testing should be determined by baseline values and interventions. Following this KDIGO suggests confirmed vitamin D insufficiency should be corrected using treatment strategies for the general population.

KDIGO recommends further research into observational studies to determine the level of bone mineral density (BMD) that is predictive of fracture risk, and randomised controlled trials looking at low BMD or low vitamin D status at the time of transplant and the effects of supplementation on subsequent fracture risk and other patient outcomes (24).

**The stages of CKD (Chronic Kidney Disease) are mainly based on measured or estimated Glomerular Filtration Rate in mL/minute (GFR). There are five stages, stage 1 GFR >90, stage 2 60-89, stage 3 30-59, stage 4 15-29, stage 5 <15. The addition of a "T" indicates that the person has a transplant.*

5.2 Phosphate

Post-transplantation it is common for serum phosphate to fall below the normal range. A phosphorus-rich diet is often recommended as a first-line approach; however the evidence is limited as to how efficacious this is. It is important to ensure phosphate binders, which may have been prescribed pre-transplant, have been discontinued. In certain situations, when the phosphate level is very low, the transplant team may recommend phosphate supplementation.

5.2.1 Hypophosphatemia

Hypophosphatemia occurs in a large proportion of kidney transplant recipients in the first few months after transplantation (26, 27). In the early transplant period, hypophosphatemia is related to tubular dysfunction and increased urinary loss, as well as persistent hyperparathyroidism. The effects are exacerbated by immunosuppressive medications.

Hypophosphatemia is usually transient and often resolves within 3 months post-transplantation; however, a systematic review of studies published between 1990 and 2008 reported that hypophosphatemia was still observed in 1.6 – 39% of renal transplant recipients at 6 months post-transplantation (26).

Late post-transplant hypophosphatemia is mainly related to persistent hyperparathyroidism. Supplementation of phosphate for periods longer than 3-7 months post-transplant may drive hyperparathyroidism and potentially mask phosphate deficiency. There is also concern that prolonged use of phosphate supplementation can delay the recovery of secondary hyperparathyroidism and lead to vitamin D deficiency (26, 27).

It is therefore important to monitor serum phosphorus, calcium and parathyroid hormone (PTH) levels regularly (24) and be aware that many clinicians may be reluctant to supplement phosphate after 3 months and would prefer a food-first approach (26).

Table 5 lists good dietary sources of phosphate. For vegetarians or those with a low dairy intake, phosphate supplementation may be of benefit.

Table 5: Sources of phosphate

Best sources

- Milk
- Cheese
- Yoghurt
- Well-cooked eggs
- Lean meat and offal
- Fish - especially tinned fish with soft edible bones (if the bones are eaten)
- Malted milk drinks and drinking chocolate (when made with milk)
- Milk puddings – such as rice pudding, semolina

Good sources

- Bakery products that include baking powder e.g. scones
- Pulses – baked beans, red kidney beans, lentils, broad beans
- Nuts

Best Practice Recommendations:

- Kidney transplant recipients should be advised to consume phosphate-rich foods, within a healthy balanced diet, as early as possible after transplantation once good graft function is achieved (27).
- Supplementation should start if hypophosphatemia persists despite adequate dietary phosphate intake. Consider oral or intravenous phosphate supplementation if serum levels are persistently lower than the normal range during the early post-transplant period. The dose and level at which phosphate supplementation should be considered are unclear and varies between renal units, therefore clinical judgment is required (KDOQI <0.81 mmol/L (29), KDIGO/PEN <1.0mmol/L (25, 26). Some clinicians and pharmacists may be reluctant to prescribe certain oral preparations such as Phosphate Sandoz due to poor palatability and compliance.
- Dose should be determined by the treating physician on the basis of serum phosphate concentration. In the late post-transplant period, phosphate supplementation has the potential to worsen hyperparathyroidism and may mask phosphorus deficiency. Phosphate levels should be monitored and supplementation reduced once levels reach >0.81 mmol/L (29).

There is currently limited evidence for the efficacy of nutritional intervention for treating hypophosphatemia in kidney transplant recipients. Prospective controlled trials are required to investigate whether or not dietary phosphate is effective in preventing or treating post-transplant hypophosphatemia.

5.2.2 Phosphate Supplementation

Phosphate Sandoz effervescent tablets are often prescribed in the treatment of hypophosphatemia and the treating dose should be dictated by the transplant team and an experienced pharmacist.

The need for supplementation should be closely monitored. Adverse side effects include diarrhoea and gastrointestinal upset, and tolerance should be reviewed. These tablets should not be taken with aluminium, calcium or magnesium salts as these will bind phosphate and reduce its absorption.

Intravenous phosphate replacement is indicated if the recipient has severe hypophosphataemia or is symptomatic. Symptomatic hypophosphataemia is usually observed when serum phosphate <0.3 mmol/L. However the level at which intravenous phosphate is given varies between hospital trusts with some renal units supplementing intravenously when phosphate is <0.4 mmol/L. Hypocalcaemia should be corrected before replacing phosphate to prevent further hypocalcaemia (please refer to your individual Trust's reference range/policy).

Table 6: Phosphate supplements

Phosphate supplements commonly used:	
Phosphate Sandoz (per tablet)	16.1 mmol phosphate 20.4 mmol sodium 3.1 mmol potassium
Phosphate polyfusor (500 mL)	50 mmol phosphate 9.5 mmol potassium 81 mmol sodium
Joulies (Unlicensed product available at some Renal Units)	
Oral phosphate solution (15 mL)	15 mmol phosphate 11.4 mmol/L sodium
<u>For comparison – sources of dietary phosphate</u>	
Milk 570 ml (1 pint)	18 mmol
Lambs liver 100 g	16 mmol
Pilchards tinned 125 g	14 mmol
Salmon 100 g	10 mmol
Dairylea cheese spread 30 g	8 mmol
Cheddar cheese 50 g	8 mmol
Scone 48 g	8 mmol
Meat 100 g	6.5 mmol
Peanut butter 20 mg (Thickly spread on one slice bread)	2 mmol
Cashew nuts (10)	1.6 mmol
Peanuts 10 whole	0.8 mmol

5.3 Other Considerations

5.3.1 Activity

Weight-bearing exercise and resistance exercise are particularly important in improving bone density and helping prevent osteoporosis (31). Activity should be encouraged; however, it is recommended that individuals discuss this with their medical team before introducing regular activity. Weight-bearing exercises are exercises where your feet and legs support your weight. High-impact weight-bearing exercises, such as running, skipping, dancing, aerobics and even jumping up and down on the spot are all useful ways to strengthen muscles, ligaments and joints. Appropriate footwear that provides ankles and feet with adequate support, should be encouraged e.g. trainers or walking boots. Other weight-bearing exercises include brisk walking, keep-fit classes and tennis. Swimming and cycling are not weight-bearing exercises.

5.3.2 Overall Balance of the Diet

As with all renal dietetic interventions, consider the overall balance of the diet, and tailor/combine dietary advice. For example, when aiming to increase dietary calcium or phosphate, consider the impact on salt, fat, protein and overall calorie intake.

5.3.3 Failing Transplants

In patients with CKD stages 4–5T with known low BMD, KDIGO suggests management as for patients with CKD stages 4–5 not on dialysis (24). Calcium and phosphate dietary intake should be reviewed, especially when PTH and phosphate levels are rising. Dietary modifications and phosphate binders may need to be considered.

6.0 Managing Weight Gain

Eating healthily is important to maintain good health, reduce risk of diseases and help maintain a healthy weight. With relaxed dietary restrictions, a general feeling of wellbeing and possible steroid induced hunger, weight gain is common after a transplant. The majority of weight gain has been found to occur during the first 12 months after transplantation and has been reported to be up to 35% (27). Much of the weight gained is abdominal fat and steroids are known to have an adverse effect on body fat distribution and lipid metabolism (32, 33).

Obesity has been found to be an independent risk factor for poor graft survival, and obese recipients have a higher prevalence of cardiovascular disease, hypertension, hyperlipidaemia, stroke and diabetes (27). Early dietetic intervention and regular follow up post-transplant is recommended to prevent excessive weight gain. Dietary management can also help to address hypertension, dyslipidaemia and diabetes.

All members of the transplant team should monitor the weight of transplant recipients and refer to a dietitian if weight gain is a problem. If renal transplant function is stable (CKD stage 1-3T and stable 4T with normal serum potassium and phosphate levels), referrals for health promotion advice such as reduced sodium, reduced lipids and weight reduction could be directed to primary care dietetic services and community based weight management programmes.

7.0 Management and Reducing Risk of Developing NODAT

New-onset diabetes mellitus after kidney transplantation (NODAT) is an important comorbid condition that is associated with increased risk of allograft failure, cardiovascular disease and mortality. The incidence of NODAT after renal transplantation has been reported to be around 15-20% at one year post transplant (34, 35). Immunosuppressive medications can cause a combination of insulin resistance (Prednisolone) and deficient insulin production (Tacrolimus, Ciclosporin). International consensus guidelines (2003) were published with the aim of increasing awareness of NODAT, and diagnostic criteria among the transplant and diabetes communities (36).

Un-modifiable risk factors include:

- Age
- Ethnicity
- Family history of type 2 diabetes
- Hepatitis C

Modifiable risk factors include:

- Overweight and obesity
- Immunosuppressive medication regimen
- Impaired glucose tolerance

Prospective studies have shown diabetes to be strongly associated with an increased body weight post-transplant. However, there are no published studies examining the efficacy of nutritional interventions for the prevention and management of diabetes in adult kidney transplant recipients (26).

Blood glucose levels should be monitored regularly after transplantation and individuals should be referred if necessary to the appropriate diabetes specialist, which should include dietetic support. Early detection and management of NODAT can help prevent complications of diabetes.

Dietary advice should reflect current recommendations to reduce risk of and manage type 2 diabetes in the general population. A healthy weight or appropriate weight reduction towards a healthy BMI of 20-25 kg/m^2 is desirable after transplant.

Due to the increased prevalence of overweight, obesity and NODAT, transplant recipients may be at increased risk of associated comorbidities, which in turn may have an adverse effect on graft function.

8.0 USEFUL WEBSITES

Renal transplant support groups
National Kidney Federation (NKF) – www.kidney.org.uk
National Kidney Patient Association – www.kidney.org.uk/kpa
British Kidney Patient Association – www.britishkidney-pa.co.uk
Renal Association –www.renal.org
Kidney Research UK - www.kidneyresearchuk.org

General information
Guys & St Thomas – everything you need to know about kidneys and healthcare - www.mykidney.org

General Food Safety
National Health Service (NHS) - www.nhs.uk
Food Standards Agency- www.food.gov.uk
Neutropenic diet- www.leukaemialymphomaresearch.org.uk
Patient information: Dietary advice for Haematology patients with Neutropenia. Leukaemia and Lymphoma Research-www.beatingbloodcancers.org.uk

Health eating/lipid lowering/lifestyle:
Consensus Action on Salt and Health -www.actiononsalt.org.uk
British Nutrition Foundation - www.nutrition.org.uk
The Cholesterol charity - www.HeartUK.org.uk
Diabetes UK – www.diabetes.org.uk
British Heart Foundation – www.bhf.org.uk
National Health Service (NHS)- www.nhs.uk

Travelling abroad
National Travel Health Network and Centre (NATHNAC) – www.nathnae.org/travel/MK/travellers-food.htm

Eating Out
Food Standards Agency - Hygiene rating – ratings.food.gov.uk
www.scoresonthedoors.org.uk

Smoking cessation:
www.smokefree.nhs.uk

Alcohol
www.drinkaware.co.uk
www.nhs.uk/Livewell/alcohol

Weight bearing exercises
www.nhs.uk/Livewell/fitness/Pages/physical-activity-guidelines-for-older-adults.aspx

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Appendix 1: Common pathogens associated with foodborne illness (8, 37, 38)

	Additional information	Sources	Symptoms
Campylobacter	Most common cause of food poisoning in the UK Low infective dose; only a small number of bacterium required to cause symptoms	4 in 5 cases associated with contaminated poultry (undercooked chicken or contaminated ready-to-eat products with raw chicken) Undercooked poultry Liver pate Undercooked or raw meat, unpasteurised milk and contaminated water	Usual symptoms include fever, diarrhoea and abdominal pain Causes more than 100 deaths a year
Cryptosporidium	Is a parasite that causes the infection cryptosporidiosis affecting people and farm animals	Can be found in untreated drinking water, lakes, streams, rivers and swimming pools Contamination from infected people or animals Undercooked/raw meat or offal and contaminated food Unpasteurised milk	Can affect anyone, but common in children. Illness can be unpleasant, but for some can be serious Symptoms include diarrhoea, vomiting, abdominal pain and fever Duration can last for a couple of days or up to 3-4 weeks
Clostridium perfringens	Cooking food thoroughly destroys the cells that cause the food poisoning, but not necessarily the spores that grow into new cells Spores can grow at room temperature	Food which is kept warm at room temperature for long periods of time or not refrigerated promptly	Symptoms include diarrhoea and abdominal cramps (not fever or vomiting) Symptoms usually occur for 12-24 hours; though this can be longer in vulnerable groups

Listeria	Is a bacteria found in soil, water and some animals It can live in food processing plants. It can be destroyed by cooking or pasteurising Unlike other bacteria it can grow in cold temperature such as the refrigerator	Can be present in raw/unpasteurised milk and products made from unpasteurised milk such as soft cheese Undercooked or raw meat or poultry Chilled products such as pate, cooked meats, pre-packed sandwiches, smoked fish/seafood and salad Raw sprouts and soiled/dirty vegetables	Symptoms include fever, stiff neck, confusion, weakness, vomiting and sometimes abdominal pain and diarrhoea A third of cases result in death Causes more deaths each year than E-coli 0157 and Salmonella combined
Escherichia Coli	Many types of E-Coli; many of which are harmless E-Coli 0157 can cause severe illness Bacteria lives in the intestines of humans and animals The cause of a number of large and serious foodborne outbreaks	Contaminated food; particularly undercooked or raw meat Unpasteurised milk and milk products such as soft cheese Unpasteurised juice Soiled/dirty fruit and vegetables (including raw vegetable sprouts) Contaminated water Contamination from infected animals or human faeces	Symptoms include severe diarrhoea (often bloody), abdominal pain and vomiting
Salmonella	A bacteria that lives in the intestines of many types of animals including farm animals, birds, reptiles and amphibians Incidence has declined since 2000; however, still causes many cases	Contaminated meat, poultry, eggs and milk Fruit, vegetables and shellfish can become contaminated through contact with manure, soil or contaminated water Contact with infected person or animal	Symptoms include diarrhoea, abdominal pain and sometimes vomiting and fever

Hepatitis E	Illness of the liver caused by the Hepatitis E virus (HEV)	Undercooked pork and processed pork products including sausages Shellfish In the developing world, transmitted by the consumption of sewage-contaminated food or water. Individuals should be encouraged to boil water in countries with poor water sanitation.	Infection is usually mild and resolves (usually within 4 weeks) in the general population However, in the immunocompromised individual the virus can result in a persistent infection causing liver inflammation. Symptoms include jaundice, pale stools, tiredness, fever, nausea, abdominal pain and loss of appetite
Bacillus Cereus	Bacteria are present in food, multiplying quickly at room temperature	Rice and prepared foods that have been sat at room temperature for long periods of time	Symptoms include diarrhoea or vomiting
Toxoplasma gondii	Transferred via contact with cat faeces Able to enter the food chain	Contact with cat faeces Undercooked or raw meat	Symptoms include flu-like symptoms; however, severe symptoms can occur in vulnerable groups
Norovirus	The most common cause of acute gastroenteritis in the UK 25 different strains Highly contagious; easily spread from person to person or via contaminating food or drink infected individuals prepare for others	Frequently associated with outbreaks of disease linked to raw shellfish (oysters, mussels and clams) Leafy vegetables eaten raw Ready-to-eat products contaminated by infected food workers	Symptoms include diarrhoea, vomiting, nausea and abdominal pain

Appendix 2: Food safety advice for renal transplant patients

High risk - should be avoided	Safer alternative
Unpasteurised milk e.g. milk sold on local farms	Any pasteurised milk, soya milk, Jersey milk or UHT milk
All unpasteurised soft cheese unless cooked until piping hot Homemade cheeses e.g. labneh/paneer Dolcelatte Soft cheeses – mould-ripened (white rind) brie, camembert and certain goats cheese like chevre Blue-veined cheese e.g. Danish Blue, gorgonzola, Roquefort Cheeses on the deli counter	Pasteurised soft cheese (check the label*) e.g. cottage cheese, mozzarella, feta, cream cheese, ricotta, halloumi, hard goats cheese, paneer and labneh. Processed cheeses such as cheese spreads (e.g. Dairylea) All hard cheese (pasteurised and unpasteurised) e.g. Cheddar, red Leicester, edam, gouda, stilton, pecorino and parmesan Mould-ripened cheeses if cooked until piping hot Blue-veined cheeses if cooked until piping hot It is best to buy pre-wrapped cheese
Any form of unpasteurised yoghurt Yoghurt which is described on the label as 'bio' or 'probiotic' (e.g. Onken, Yeo valley, Rachel's, Activia) Probiotic drinking yoghurts e.g. Yakult, Actimel, Supermarket own versions	Any yoghurt that does not describe itself as 'bio' or 'probiotic' e.g. live, plain/natural, sour cream, Greek and fruit yoghurts (e.g. Muller, supermarket own, lassi) Prebiotic yoghurt/product (these contain substances which promote the growth of healthy bacteria. They do not contain any live bacteria themselves)
Ice cream from ice cream vans and soft serve machines e.g. whipped ice cream Homemade ice cream using raw eggs	Shop bought tubs of ice cream stored and consumed according to manufacturer's instructions , individual ice cream portions Homemade ice cream using pasteurised egg or an egg free recipe
Raw or undercooked meat or poultry Rotisserie chickens Meat or poultry from deli counters Cured meats e.g. salami, Parma ham, chorizo and pepperoni	Well cooked meat and poultry Tinned meat Pre-packaged cooked meats and poultry stored and used according to the manufacturer's instructions Cured meats if cooked until piping hot
Meat and vegetable pâtès	Tinned pâtès
Raw or undercooked eggs Sauces, desserts and dressings made with raw eggs e.g. homemade mayonnaise, aioli, Caesar salad dressings, hollandaise and béarnaise sauces, chocolate mousse and egg-nog.	Use lion stamped eggs and cook well Shop bought mayonnaise Products made with pasteurised egg

Raw/undercooked fish and shellfish e.g. sushami, oysters and caviar Sushi made with raw fish/shellfish Fish and shellfish from open counters Cold smoked fish e.g. smoked salmon and trout, ready to eat fish and shellfish unless consumed within 24 hours	Fish and shellfish if cooked until piping hot Tinned fish Sushi made with cooked seafood or vegetables Pre-packaged fish and shellfish stored and used according to the manufacturer's instructions Consume cold smoked fish/ready to eat fish including smoked salmon within 24 hours of opening the packet
Unwashed fruits, vegetables and salad Unpasteurised fruit juice and smoothies Raw sprouted seeds	Wash all fruit, vegetables and salad Pasteurised fruit juice and smoothies Thoroughly cook sprouted seeds
Ready to eat sandwiches that contain high risk foods e.g. cured meat or smoked salmon	All other pre-packaged sandwiches which have been stored and consumed according to manufacturer's instructions
Reheated cooked rice and rice dishes	Freshly cooked rice served immediately

Appendix 3: The 4Cs of good food hygiene (8)

Cleaning

Wash hands with soap and hot water and dry thoroughly before preparing food, handling raw food and before eating. It is advisable to do the same after going to the toilet, gardening, touching bins, rubbish, dirty washing and after handling pets or pet litter or blowing your nose.

Keep worktops, chopping boards and utensils clean at all times, cleaning with hot soapy water, and especially after contact with raw food.

Wash and change dish cloths and tea towels regularly and launder at 60°C. Use a separate hand towel or kitchen paper to dry your hands.

Never handle food you have diarrhea, vomiting or open cuts or sores, which should be protected with a waterproof plaster or dressing.

Cooking

Thorough cooking kills harmful bacteria in food, therefore it is extremely important to make sure that food is cooked properly. When cooking or reheating food, always check that it is steaming hot throughout.

- Take extra care to ensure poultry, pork, rolled joints and products made from minced meat (e.g. burgers and sausages), fish, shellfish and eggs are cooked thoroughly
- Eat cooked foods within an hour of making
- Keep leftovers in the fridge stored in sealed containers and eat within two days
- If reheating foods make sure they are served piping hot; do not reheat more than once
- Always follow the cooking or reheating instructions on the food label
- Do not eat food that is past its ‘use-by’ date and discard food that has expired

UNDERSTANDING USE-BY DATES

‘Use by’ dates appear on fresh foods that expire quickly.

It can be dangerous to eat foods beyond this date.

‘Best before’ dates show how long food will remain at its desired quality.

It is advisable to consume the product within a few days of this to reduce the risk of foodborne illness.

Chilling

Chilling food properly helps to stop harmful bacteria from growing. Some foods need to be kept chilled to keep them safe, for example foods with a ‘use by’ date, cooked dishes and other ready-to-eat foods such as prepared salads and desserts. It is very important not to leave these types of foods at room temperature.

- Keep refrigerators at the correct temperature (between 0-5°C)

- Check chilled food on delivery to make sure it is cold enough and put food that needs to be kept chilled in the fridge straight away. Cool bags are useful to keep foods cool during transportation
- Avoid buying foods from refrigerators or freezers that are overstocked as these foods may not be cold enough. Avoid overloading home refrigerators or freezers
- Cool cooked food as quickly as possible (within 1-2 hours) and then store in the refrigerator or freezer. Store leftovers in multiple shallow containers as this helps to speed up the cooling process
- Keep chilled food out of the fridge for the shortest time possible during preparation
- Defrost food in the fridge overnight, or in the microwave if you intend to cook and eat straightaway. Eat leftovers within 24 hours of defrosting and do not refreeze. The only exception is if you are defrosting raw food, such as meat or poultry, once it's cooked it can be refrozen

Table 7: Fridge and freezer temperatures

Fridge and freezer temperatures:	**Fridge**	**Freezer**
	0°C - 5°C	-18°C or lower

Avoiding cross contamination

Cross-contamination is when bacteria spreads between food, surfaces or equipment. It is most likely to happen when raw food touches (or drips onto) ready-to-eat food, equipment or surfaces. Cross-contamination is one of the most common causes of food poisoning.

To reduce the risk:

- Clean and disinfect work surfaces, chopping boards and equipment thoroughly before, in between and after preparing foods, especially raw foods
- Wash hands before preparing food and thoroughly after touching raw food
- Always cover raw meat/fish/poultry and store at the bottom of the refrigerator so it is not in contact with ready-to-eat foods or allow their juices to drip down onto them. Storing in a sealed container may be helpful
- Use different chopping boards and utensils for raw meat/poultry and ready-to-eat foods. Use coloured boards to identify boards used for raw meat/fish/poultry
- Keep raw and ready-to-eat food separate during storage and preparation. It is especially important to keep raw meat, poultry, fish, shellfish and eggs away from read-to-eat foods such as bread and salads
- Do not wash raw meat or poultry before cooking as any harmful bacteria will be destroyed in cooking. Washing could splash, potentially harmful germs, onto work surfaces

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