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Development of a new Australian Defence Force Fresh Food Provisioning Scale (SUPMAN 4 / NAVSUPMAN 5 Review)

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ABSTRACT

ADF members are fed according to the entitlements stipulated in SUPMAN 4 and NAVSUPMAN 5. The entitlements are aimed at meeting the 'worst case' situation, the nutritional requirements of young, active, males. Because not all ADF members are equally active, and females generally have lower nutritional requirements than males, there is the potential for more food to be made available than is needed. DSTO was requested to devise ration scales that more efficiently satisfy the demonstrated nutritional requirements of ADF members. The results of doubly-labelled water studies to determine the energy expenditures of ADF members were used to devise Military Recommended Dietary Intakes (MRDIs) applicable to four sub-groups of ADF members—adult males, adult females, adolescent males and adolescent females—also taking into account five levels of physical activity. An adaptation of a program used to assess the draft Nutrient Reference Values (NRVs) for Australia and New Zealand was then used to determine food entitlements to meet the MRDIs.

The revised ration scales provide 12.5, 14.5, 16.5, 19.5 and 25 MJ per person per day respectively for five activity categories (denoted Level 1 to 5, respectively). The basic scale meets the energy requirement for troops working at Level 1, and the micronutrient requirements of troops working at Level 1, 2, 3 and 4. Additional food is provided in the form of 1-MJ food modules which can be issued as Morning Tea, Afternoon Tea and / or Supper. The new ration scales will ensure that troops are fed according to their nutritional requirements. This has the potential to reduce wastage and to impact positively on nutritional status of ADF members, including reduced levels of overweight / obesity, together with the flexibility to allow caterers to better meet the nutritional requirements of the group of defence personnel being fed.

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Executive Summary

The intake of adequate energy and nutrients plays a fundamental role in ensuring that ADF personnel are operationally ready. Rationing systems (including freshly cooked food or 'fresh feeding') that promote a high level of nutritional status before, during and after operations or training are essential to ensure that ADF performance is optimal and sustained.

This document reports on the revision and consolidation of The Australian Defence Force Ration Scale (ADFRS) SUPMAN 4, the catering manual used by Army and RAAF, and NAVSUPMAN 5, used by RAN. This revision was conducted under Task VCDF 07 / 082 in response to a request from Joint Logistics Command's Defence Catering Policy Cell.

The request for revision and consolidation of these documents resulted from:

i. The publication in 2006 by the National Health and Medical Research Council (NHMRC) of Nutrient Reference Values (NRVs) for Australia and New Zealand;
ii. Recommendations for Military NRVs (MNRVs) in light of the new NRVs for Australia and New Zealand in a recent DSTO Technical Report titled *Australian Defence Force Nutritional Requirements in the 21st Century (Version 1)*; and
iii. Revision of the Core Food Groups and Australian Guide to Healthy Eating (revisions that are being undertaken as a result of the publication of the NRVs).

DSTO has contributed funding to the NHMRC project to update Australia's Core Food Groups and the Australian Guide to Healthy Eating. Both apply to the general (i.e. civilian) population and need revision following the publication of the NRVs. The contractors involved in this NHMRC project are working as consultants with DSTO to ensure that the ADF Fresh Food Scale (FFS) forms the basis for the provision of a nutritionally adequate food supply for ADF personnel.

A major challenge for this task was to incorporate flexibility within the new FFS to allow the provision of increasing energy and nutrient requirements for five levels of ADF operational activity—*Level 1* ('relatively sedentary') to *Level 5* ('extremely strenuous').

The main features of the draft FFS are:

- It remains close to the existing SUPMAN 4 and NAVSUPMAN 5, but has been updated in light of recent publications detailing the nutritional requirements for the general Australian population, and taking into consideration the specific requirements of military personnel.
- The basic tables of the draft FFS were developed to provide food to meet the energy and macronutrient requirements of ADF personnel working at Level 1 Activity Category and the micronutrient requirements of ADF personnel working

at Level 4 Activity Category. In this way the majority of ADF personnel will be provided adequate micronutrients for all but the highest activity category (Level 5) by the basic catering provided at all sites. As activity category increases, additional energy and macronutrients can be provided without having to allow particularly for the provision of additional micronutrients.

- Modelling conducted by the NHMRC Core Food Group (CGF) contractors established the required amounts of food in each food group per week to ensure a nutritionally adequate base diet providing 12.5 MJ of energy (Level 1).
- As energy requirements increase with activity category levels, the draft FFS provides additional energy in 1-MJ modules for consumption at appropriate times and in forms which promote consumption.
- Definitions are included of what constitutes each feeding opportunity: Breakfast, Lunch / Dinner, and Refreshment Modules.
- The new FFS provides 'extra' foods (e.g. ice-cream), that have traditionally been included in the ADFRS in small amounts in the base Level 1 diet and through the use of modules of additional energy as requirements increase with activity levels.
- The introduction of a weekly scale to replace the previous daily scale allows caterers flexibility to increase the variety of food provided from day-to-day.

Education of caterers will be an important aspect of the introduction of the new FFS. It is strongly recommended that information about the use of the FFS be provided with the tables. As a minimum, definition of what constitutes the various meals, snacks and suppers should accompany the tables. Advice about menu planning using a weekly rather than daily scale is recommended.

Authors

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Angela Malberg has qualifications in Nutrition, Dietetics and Agribusiness Management from Deakin University and Monash University. She has many years experience working in the field of Public Health Nutrition. Major projects have included: managing the development of the Australian Guide to Healthy Eating and associated resources for the Commonwealth Dept of Human Services and Health; researching a product labeling and description system with David McKinna et al for the Meat Research Corporation that informed the development of Meat Standards Australia (MSA); managing three Nutrition Advisory Services for Nutrition Australia Queensland; and managing the regional and rural phase of the TLC Diabetes Research Project for University of Queensland's Centre for Online Health. Following a short-term contract with DSTO to assist in development of a fresh feeding scale for the ADF, Angela now manages nutrition services across three Public Health Units for Southern Regional Services in Queensland Health. Her work focuses on the public health nutrition outcome areas of Food Supply and Supportive Environments for Healthy Eating.

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Chris graduated from the Australian National University with BSc (Hons) in 1972. He has 35 years experience in food science, nutrition and exercise physiology, including extensive research into food acceptability, food intake, energy expenditure and physical performance enhancement of ADF members. For ten years Chris was the Australian National Leader of an international defence technical panel under The Technical Cooperation Program (TTCP). This panel conducted collaborative and cooperative research into performance enhancement for special and conventional military operations. Currently Chris is continuing his research into aids to military performance and nutritional promotion of health and military fitness. From 2006 until 2008 he was Assistant Site Manager of DSTO-Scottsdale. From 2007 until 2009 Chris was the Australian member of a NATO Research Technical Group that developed common nutritional standards for ration packs.

Contents

1. Introduction

Nutritional status is a critical determinant of physical and cognitive performance, and immune status. The intake of adequate energy and nutrients plays a fundamental role in ensuring that ADF personnel are operationally ready. Therefore, rationing systems that provide a nutritionally adequate food supply are essential to ensure that ADF performance is optimal.

Ration packs that will sustain troops during short-term, high-intensity operations (e.g. up to 72 hours) and support long-term, low-intensity operations (lasting many weeks) in the heat, cold, and (perhaps) at altitude are necessary components of ADF rationing systems.

Equally important is the need for ration scales that promote a high level of nutritional status before, during and after operations or training when rationing is with freshly-cooked food ('fresh feeding').

The Defence Catering Policy Cell, within Joint Logistics Command, has requested a significant revision and consolidation of two key policy documents—The Australian Defence Force Ration Scale (ADFRS) SUPMAN 4 and NAVSUPMAN 5—reference documents used by the ADF and Defence-contracted caterers for provision of meals in-barracks, during training and on operational deployments, and also for provision of combat ration packs.

Currently, soldiers' entitlements to freshly cooked food are specified in the *Australian Defence Force Ration Scales and Scales of Issue* (ADFRS) published as SUPMAN 4 (Department of Defence, 2008a). In contrast, RAAF and RAN do not feed according to scales of entitlement. NAVSUPMAN 5 (Department of Defence, 2008b) provides guidance to Navy caterers on appropriate quantities of foods and appropriate menus, but does not stipulate food entitlements. Rather, Navy victualling is accounted for according to financial entitlements. Similarly, RAAF rationing is guided by SUPMAN 4, but accounting for food usage is 'dollar based'. SUPMAN 4 and NAVSUPMAN 5 are reviewed regularly by the Defence Catering Working Group.

SUPMAN 4 states that:

> … in all environments … personnel should be fed to the best possible standard, using fresh rations wherever possible, and tailored to meet the nutritional requirement of the activity being supported.

SUPMAN 4 acknowledges that:

> During operations, the range of items may need considerable amendment depending on availability, transport and other factors which must be recognised when the feeding plan is developed.

Feeding soldiers in barracks involves implementing the full entitlements to food as specified in SUPMAN 4. Accounting for food usage involves determining the quantities of foods that were permitted to be drawn based on the actual level of attendance (as opposed to ration strength, i.e. the number who are entitled to be fed).

SUPMAN 4 also states that:

> In a non-operational environment, Combat Ration Packs (CRP), non-perishables and canned equivalent items may be issued for turnover of stocks. CRP will also be issued for training and exercise purposes, to meet an emergency, or when conditions preclude the use of fresh food or canned equivalents.

2. Background

The request for revision and consolidation of SUPMAN 4 and NAVSUPMAN 5 resulted from:

i. The publication in 2006 by the National Health and Medical Research Council (NHMRC) of Nutrient Reference Values (NRVs) for Australia and New Zealand;
ii. Recommendations for Military NRVs (MNRVs) in light of the new NRVs for Australia and New Zealand in a recent DSTO Technical Report titled *Australian Defence Force Nutritional Requirements in the 21st Century (Version 1*); and
iii. Revision of the Core Food Groups and Australian Guide to Healthy Eating (revisions that are being undertaken as a result of the publication of the NRVs).

Prior to 2006, NHMRC nutritional recommendations addressed only Recommended Dietary Intakes (RDI). This was reflected in the form of Recommended Military Dietary Intakes (RMDI) in an internal (i.e. unpublished) DSTO report by Forbes-Ewan (2002).

However, the NHMRC (2006) NRV include not only RDI, but also Estimated Average Requirements (EAR) and Adequate Intakes (AI) for a wide range of nutrients, an Acceptable Macronutrient Distribution Range (AMDR), and Suggested Dietary Targets (SDT) for a small range of nutrients thought to be particularly relevant to health. Furthermore, many of the 2006 RDI differ substantially from previous recommendations.

Consequently, the report by Forbes-Ewan (2002) was revised to take into account the revised RDI and the development of additional NRV (particularly the EAR, AI, and AMDR). The revised report (Forbes-Ewan, 2009) provides a basis for determining the nutritional adequacy of food provided to ADF personnel in all training and operational situations. The nutritional requirements of four distinct population groups within the ADF are identified: Adult Males; Adult Females; Adolescent Males; and Adolescent Females. Five levels of energy requirement are identified, based on the range of physical workloads of training and operational activities performed by ADF personnel. These range from *Level 1*—applicable to personnel performing relatively sedentary activities—up to *Level 5*, applicable to adult male ADF members attempting the Special Air Service Regiment selection course and other comparable activities. (The highest level of physical activity for the other three population sub-groups is *Level 4*.) The report by Forbes-Ewan (2009) also contains revised RMDI and renames them as Military Recommended Dietary Intakes (MRDI) to distinguish them from the unpublished RMDI. It is anticipated that the MRDI will be officially adopted as the basis for determining nutritional requirements.

Values are also recommended for military–specific EAR (denoted MEAR) for the same group of vitamins and minerals for which there are military-specific MRDI[1].

Forbes-Ewan (2009) provides two tables of recommended nutritional criteria for fresh feeding for a mixed ADF population. One table is based on MRDI and the other on MEAR/AI respectively (Appendix A).

DSTO has contributed funding to the NHMRC project to update Australia's Core Food Groups and the Australian Guide to Healthy Eating, both of which apply to the general (i.e. civilian) population and need revision following the publication of the NRV. The contractors involved in this NHMRC project are working as consultants with DSTO to ensure that the ADF Fresh Food Scale forms the basis for the provision of a nutritionally adequate food supply for ADF personnel. The above-mentioned tables were used to inform the modelling process described below.

As previously discussed, NAVSUPMAN 5 (Navy) and SUPMAN 4 (Army and Air Force) provide the scales of issue, or guidance on food availability for ADF fresh feeding for training and operations in barracks, at sea and on deployment. These documents provide a food scale (or guide) for foods to meet daily nutritional requirements of ADF personnel.

It should be noted that the current basic scale of SUPMAN 4 is intended to be a *maximum* scale, meeting the needs of all ADF members other than Special Forces troops (who are entitled to supplementary food in addition to the food provided by the basic scale). SUPMAN 4 does not take into account the work rates of groups of personnel engaged in specific forms of training or on particular operations, as identified by Forbes-Ewan (2009). By meeting the needs of troops engaged in very vigorous work, the basic scale makes more food available than is needed by those troops who do not have arduous occupations. This has implications in terms of the potential for food wastage and also with respect to overweight/obesity in the ADF.

However, although the basic scale in SUPMAN 4 is intended to be a maximum scale, recent studies (Probert et al. 2005; Forbes-Ewan et al. 2008) have suggested that some training situations may involve energy expenditures at levels marginally greater than those provided for by the current basic scale.

Developing a basis of food provisioning which addresses the specific nutritional needs of each ADF training or operational situation would ensure that all ADF personnel are effectively and efficiently provided with the appropriate nutrition to allow optimal military performance.

NAVSUPMAN 5 and SUPMAN 4 have been used as the basis of issue for ADF catering for many years. Any changes to the structure and content of these scales will require careful change management and education to ensure that ADF personnel receive the nutrients they require to maintain peak health and fitness, thereby maximising their ability to complete their military tasks.

[1] The MRDI for most nutrients is the RDI as published by the NHMRC (2006). If there is no RDI for a particular nutrient, the MRDI is taken to be the AI, with the exceptions of thiamin, riboflavin, niacin, vitamin B6 and sodium. Military-specific MRDI have been devised for these nutrients, as described by Forbes-Ewan (2009).

3. Development of a Draft Fresh Food Scale

A major challenge for this task was to incorporate flexibility within the new Fresh Food Scales to allow the provision of increasing energy and nutrient requirements with the five levels of operational activity.

The tables of the draft Fresh Food Scale were developed so as to provide food to meet the energy and macronutrient requirements of ADF personnel working at a *Level 1* Activity Category and the worst case micronutrient requirements of ADF personnel working at an Activity Category *Level 4*. In this way the majority of ADF personnel will be provided adequate micronutrients for all but the highest activity category (*Level 5*) of requirements in basic catering provision at all sites. As activity category increases, additional energy and macronutrients can be provided with little concern for providing additional micronutrients. However, a note of caution here applies to additional protein and sodium, as discussed in section 5.1 below.

Diet modelling was conducted by the NHMRC Core Food Group (CGF) consultants so that the scale remained as close to the existing SUPMAN 4 and NAVSUPMAN 5 as possible, whilst ensuring that the new scale is consistent with current nutritional science.

The diet modelling conducted by the consultants to the NHMRC Core Food Groups Project is shown in Appendix B. Initial modelling was conducted to provide food group distributions for diets providing 12.5 MJ and 14.5 MJ. The modelling was refined to investigate the viability of providing a base diet with additional food to meet increasing nutrient requirements at higher activity categories. The Core Food Group Consultants provided several models for consideration. Diet A was selected because it provided the distribution of Food Group servings most similar to those provided by SUPMAN 4 and NAVSUPMAN 5. Following a teleconference with the Consultants, this diet model was further revised to reduce protein contribution to energy to below 22.1%, replace two serves of polyunsaturated fats with two serves of nuts/seeds, and revise the dairy serves to include high, medium and lower fat categories.

Diet A, Revision Diet 1 modelling met nearly all of the nutritional criteria recommended by Forbes-Ewan (2009). Notably 100% of 7-day 'real' diets provided greater than the MEARs/AIs, percent energy from protein (21.1%) was slightly higher than the desired 20%, and sodium (2210 mg) was close to the upper recommended level of 2300 mg.

Modelling established the required amounts of food in each food group per week to ensure a nutritionally adequate base diet providing 12.5 MJ of energy (*Level 1*). These foods did not include some 'extras' (e.g. ice-cream) that have traditionally been included in the ADFRS. The decision was made to include two standard serves of 'extra' foods per day in the *Level 1* diet.

This base or *Level 1* diet consisting of Diet A, Revision Diet 1 plus two extras serves was then modelled by the consultants to the NHMRC Core Food Groups Project and forms the basis of *Level 1* catering for the Fresh Food Scale.

The food groups identified in Diet A, Revision Diet 1 Plus were expanded into tables of nutritionally equivalent foods that form the basis of the new *Serials 1-7*.

Quantities outlined in the modelling process related to edible portions of food 'as eaten'. Allowance was made for:

- Shrinkage (loss of weight) during processing where this occurs, e.g. where meat or fish is cooked. Williams et al. (2006) suggested a shrinkage rate of 28.6% when meat is cooked. This percentage was applied also to fish and shellfish in the absence of other references.
- Catering wastage (food produced but not consumed) of 15% across all serials; this consists mainly of servery and plate waste, as recommended by Forbes-Ewan (2009).

In order that the FFS accommodate increasing energy requirements at higher activity levels a system of 1-MJ add-ons was developed and modelled. The Modules were defined so that the addition of extra energy to the base *Level 1* diet is done in such a way that the macronutrient composition of the FFS at each activity level is consistent with the recommendation for macronutrient distribution outlined by Forbes-Ewan (2009).

The report on the modelling process (Appendix B) by the consultants to the NHMRC Core Food Groups Project shows that the recommendations for *Levels 2-5* catering using the *Level 1* diet, plus recommended distribution of addition modules of energy result in diets at all five levels that are consistent with the nutritional criteria recommended by Forbes-Ewan (2009).

An eighth serial was added to the FFS. Foods and culinary adjuncts like tea, coffee and other flavourings used in minimal amounts were assigned to Serial 8 without recommendations on order quantities. These items are valuable adjuncts to food variety, however it is recommended that guidance is provided to caterers regarding the contribution to salt intake that some of these items can make.

The draft FFS tables were produced as worksheets within an MS Excel document from tables developed from the nutritional analysis program FoodWorks (Xyris, Brisbane). The use of such a program allows ready reference to the FFS serial to ensure the nutritionally equivalent amount of food is selected for menu planning.

Appendix C shows the draft Fresh Food Scale.

The draft FFS allows caterers to consistently provide appropriate quantities and types of food for all ADF personnel. At the basic activity category (*Level 1*) the scale will provide adequate micronutrients for personnel working at all but the highest activity category (i.e. up to *Level 4*). As energy requirements increase with activity category levels, extra modules of food can be provided at appropriate times and in forms which promote consumption, and hence increase the likelihood that troops will meet their increased energy and macronutrient needs. For personnel working at activity category *Level 5* modules of food need to be added in recommended quantities to ensure they provide not just extra energy but also meet all the MNRVs. Modelling shows that the extra micronutrient needs at *Level 5* are met by the draft Fresh Food Scale.

The introduction of a weekly scale to replace the previous daily scale allows caterers flexibility to increase the variety of food provided from day-to-day. Recommended definitions of meals and suggested distribution of modules of extra energy between meals and at supper are included.

4. Comparison of Draft Fresh Food Scale with ADFRS

A summary comparison of serial equivalents from the Fresh Food Scale with the ADFRS (SUPMAN 4) is provided in Table 1.

Table 1: Comparison of serial equivalents between Fresh Food Scale and SUPMAN 4

SUPMAN 4 (FFS) Serial Equivalents	**Draft Fresh Food Scale**	**SUPMAN 4**
1. Milk (Milk and Alternatives)	860 mL	750 mL
2. Meat (Meat and Alternatives)	308 g	400 g
3. Egg	1 no.	1 no.
4. Bacon	Nil	30 g
5. Potato (Starchy Vegetable)	345 g	400 g
6. Fruit and Vegetables & 14. Fruit Juice (Fruit) (Vegetables)	 520 g 510 g	 450 g + 90 mL 450 g
7. Bread (Bread and Cereals)	460 g	550 g
8. Butter (Unsaturated Fats, Nuts and Seeds)	50 g	65 g
9. Jam Assorted	FFS includes Serial 7 'extras foods'. Culinary Adjuncts reclassified to include flavourings, herbs, tea, coffee etc only.	32 g
10. Sugar		80 g
13. Beverages		9 g
15. to 26. Culinary Adjuncts		various
(Energy Modules)	1-MJ equivalents include food from various food serials and adjuncts.	Nil

The draft Fresh Food Scale provides slightly more Milk, Dairy and Alternatives, Fruit and Vegetables and slightly less Starchy Vegetables, and Breads and Cereals than SUPMAN 4.

The Butter serial has been replaced with Unsaturated Fats, Nuts and Seeds, and has been slightly reduced in quantity. Serials 9, 10 and 13 have been moved into Serial 7 'extra foods' together with some reclassified foods such as ice-cream and butter.

The Meat and Alternatives (including Bacon) serial has been reduced from 430 g to 308 g. The Eggs serial remains the same. Note that the draft Fresh Food Scale tables show 9 eggs per week, however, the additional two eggs have been added to the Meat and Alternatives group for ease of comparison.

5. Using the Draft Fresh Food Scale

Education of caterers will be an important aspect of the introduction of the new FFS. It is strongly recommended that information about the use of the FFS be provided with the tables. As a minimum, definition of what constitutes the various meals, snacks and suppers should accompany the tables. Advice about menu planning using a weekly rather than daily scale is recommended.

5.1 Use of Draft Fresh Food Scale for Development of Basic (*Level 1*) Menus

A weekly scale allows for flexibility of distribution of quantities of each serial. For example, a caterer has the option to provide one egg per day per person OR two eggs three times per week, and to use the three remaining eggs for cooking custards and desserts OR two eggs three times per week at breakfast, two eggs as main meal dish and one egg for cooking custards or desserts, etc. In another example meat, fish, white meat, legume serves can be provided as one large serve per day OR as one three quarter size serve and one quarter size serve OR as two small serves. How the weekly scale of issue is distributed across a menu is at the Caterer's discretion within some limits.

Currently catering contracts usually require that a six week cyclic menu be provided, with definitions of meals. The definitions and requirements contained in catering contracts need to be reviewed to ensure that they are contributing positively to the provision of nutritionally adequate catering for ADF personnel. The following table outlines recommended definitions of meals.

5.2 Planning menus for higher energy level operations/*Levels 2–5* Catering

Forbes-Ewan (2009) identifies energy requirements increasing from 12.5 MJ (for mixed ADF populations working at *Level 1*) to 25 MJ for male adult ADF members working at *Level 5*. The structure of the draft Fresh Food Scale makes allowance for increased energy requirements of personnel via the addition of modules of energy.

The FFS provides adequate energy, macro and micronutrients for ADF personnel working at level 1 physical activity category. Additional modules of energy are required to meet nutritional requirements as activity levels increase. These modules A, B, C, D and E each provide 1 MJ of energy and are defined in the FFS (Appendix C). Module F corresponds to darker green and other vegetables with minimal energy value. The FFS encourages the use of these foods to increase the variety of food provided at higher catering levels.

Table 1: Recommended Definition of Meals

Breakfast will consist of either:

Hot Breakfast
2 eggs plus half meat serve (~60 g bacon) plus 2 serves (~150 g) cooked vegetables and/or legumes
2 toast, 2 fruit serves (fresh or juice) and 1 dairy (milk or yogurt)

OR

Continental Breakfast
Hot or cold vegetable or fruit muffins, pancakes, crumpets, toast etc.
Large serve hot or cold cereal, porridge, muesli, breakfast flakes
Stewed or fresh fruit, fruit juice, milk or yogurt

Lunch and Dinner will consist of either:

Salad/Sandwich Bar
2 x cereal/pasta/rice salads plus 2 x serves of starchy vegetables as potato salad/baked potato/potato dish
3 x other vegetable/legume salads
Selection of non-dressed salad vegetables including lettuce tomato beetroot cucumber corn etc.
Selection of meats/fish/dips/nuts/cheeses/felafal (or other high quality vegetarian protein source)
Selection of breads/bagels/wraps/pizza-breads/pita-breads etc.

OR

Hot Main Meal
Choice from one grill OR roast, two wet dishes, one vegetarian dish (with high quality vegetarian protein source)
1 x low fat vegetable based pasta or rice dish always available in addition to hot dish
2 x serves starchy vegetable plus 2-3 serves orange, green and other vegetables
Selection of dinner rolls/sliced bread etc

PLUS

Soup, Rice and Pasta Bar
Selection of soup of the day, plain pasta or rice always available with choice of two low fat vegetable sauces

PLUS

Dessert
Selection of fresh fruit or fruit salad, fruit based dessert, milk based dessert, cereal based dessert

The structure of the modules of extra energy needs to be planned carefully because the contribution of protein and sodium to the basic diet are already at the upper level of requirements. Hence modules of additional energy have been allocated to ensure nutrient composition of the diet remains optimal.

The FFS (Appendix C) details the number of modules to be provided in addition to *Level 1* catering to provide sufficient food to meet nutrient requirements at higher activity levels.

It is difficult to meet energy requirements at such high levels within the limitation of three meals per day. Therefore, the FFS provides additional energy in 1-MJ modules. Table 2 of the FFS (Appendix C) recommends the distribution of additional modules of energy with increasing activity levels over Morning Tea (MT) and/or Afternoon Tea (AT) and Supper. In a mess where the opportunities to purchase food away from the barracks is limited or unavailable then it is recommended that the provision of additional food at supper time is mandatory.

Table 2: Recommended Distribution of additional modules of energy with increasing activity levels

Catering Level	**1**	**2**	**3**	**4**		**5**	
Basic FFS Serials 1 to 8	Yes	Yes	Yes	Yes		Yes	
Module A	Nil	1 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper	4 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper + 2 MJ as desired
Module B	Nil	Nil	Nil	2 MJ @ MT and/or Supper	2 MJ @ AT	4 MJ @ MT and AT and Supper	2 MJ @ AT + 2 MJ as desired
Module C	Nil	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper
Module D	Nil	Nil	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper
Module E	Nil	Nil	Nil	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper
Module F[1]	As desired	As desired	As desired	As desired		As desired	
Total MJ Requirement	12.5	14.5	16.5	19.5		25	
Total MJ Available[2]	13.6[2]	15.6[2]	17.6[2]	20.7[2]		26.8[2]	

Note 1: Additional energy provided by this serial is likely to be small.
Note 2: Reference to nutritional profiles modelled by the CFG contractors Oct/Nov 2009

5.2.1 Practical implementation of 1-MJ modules

It is recognised that the implementation of additional food breaks in the form of time allocated to morning tea and afternoon tea may not be practical for many ADF messes. It is envisaged that the extra energy required by personnel will be provided as discrete 'takeaway style' snacks for morning tea and afternoon tea, and possibly for supper. It may suit some messes to provide a second breakfast opportunity rather than morning tea or afternoon tea depending on the training/operations requirements of the barracks. Where there is a larger population of personnel requiring additional energy at supper time, it is envisaged that some sort of takeaway or self-catered area can be provided.

Examples of simple snacks are shown in Table 3. Many can be safely stored without refrigeration and may be suitable for distribution where hot-box feeding is needed.

Table 3: Examples of modules expressed as real food/menu items

1-MJ Morning or Afternoon tea (approximate only)

- 1 piece of fruit and 2-3 sweet biscuits
- 70 g slice fruit cake
- 35 g nuts
- 1 small tub (100 g) dairy dessert and 1 piece of fruit
- 1 chocolate bar
- 1 muesli bar and 250-300 mL tetra pack fruit juice
- 2 commercial jam rollettes
- 60 g fruit and nut trail mix
- 50 g pack of savoury snack biscuits
- 2-3 sweet biscuits and 300 mL cordial drink
- 1 jam or peanut butter sandwich
- small (250 g) can creamed corn
- 1 scone with jam
- 3 puffed rice cakes with eggplant dip

2-MJ Morning Tea, Afternoon Tea or Supper (approximate only)

- 2 x 1-MJ Morning or Afternoon Tea
- 60 g trail mix plus 300 mL commercial regular fat choc milk
- 1 small can (250 g) baked beans and 2 slices toast
- 1 cup fruit salad plus 2-3 scoops icecream
- 35 g nuts and a large cappuccino
- 20 g cheese, 3-4 savoury biscuits and large fruit juice
- 70 g slice fruit cake and large flavoured milk (300 mL)
- 1 salad sandwich with small fruit juice
- 1 wrap sandwich with large cordial drink
- 1 sport supplement drink and large banana
- 1 large serve minestrone/vegetable/legume soup and large bread roll
- 2 slices fruit loaf spread with cream cheese
- 1 slice apple pie with icecream
- baked potato with coleslaw and light sour cream
- 1 half small pizza

3-MJ Higher Energy Supper (approximate only)

- 1 small can (250 g) baked beans and 2 slices toast, a piece of fruit and glass of cordial
- 1 sandwich toasted with cheese and tomato and a piece of fruit
- 2 x 70 g fruit cake plus flavoured milk
- 50 g pack of savoury snack biscuits plus cream cheese dip, julienne vegetables and fruit juice
- banana smoothie made with milk, icecream and banana plus 3-4 sweet biscuits
- 1 large serve soup with toasted cheese and tomato sandwich
- 1 chocolate bar, tub yoghurt and piece of fruit
- 1 peanut butter and banana sandwich plus large chocolate milk
- 1 toasted cheese banana and sultana sandwich with cordial drink

6. Conclusions & Recommendations

The recommendations in the DSTO Report titled *Australian Defence Force Nutritional Requirements in the 21st Century (Version 1*) and the modelling performed on behalf of DSTO by the NHMRC CFG contractors provide the most appropriate nutritional foundation for the draft FFS.

The model used for the draft FFS described above is the most flexible and appropriate for ADF fresh food provision.

Education of caterers will be an important aspect of the introduction of the new FFS. It is strongly recommended that information about the use of the FFS be provided with the tables shown in Appendix C. As a minimum, definition of what constitutes the various meals, snacks and suppers should accompany the tables. Advice about menu planning using a weekly rather than daily scale is recommended.

The FFS needs to be accompanied by information, education materials and resources to support the change management process. To achieve this, it is suggested that the Defence Catering Policy Cell should:

- Include tables for use in Navy and RAAF messing environments;
- Include definitions for the provision of hot-boxed meals;
- Investigate further the most appropriate structure for in-flight catering tables;
- Structure tables in the most suitable form for use by caterers in menu planning;
- Provide supporting information in the form of background research papers to investigate the practical implementation of the draft FFS including issues such as user friendliness, the most appropriate format for presentation of the scale, the impact of Catering Contract requirements and definitions;
- Provide supporting information in the form of education materials for caterers and ADF personnel to support the change management process and implementation of the FFS.

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Professor Lynne Cobiac,
Dr Anthea Magarey.

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Appendix A: Nutrition Criteria for Fresh Food Availability

Table 1: Recommended Nutritional Criteria for Fresh Food Availability – Mixed ADF Populations, based on MRDI/AI (Table 10a of Forbes-Ewan, 2009**)**

	Activity Category			
	1	2	3	4
Energy (MJ)	**12.5**	**14.5**	**16.5**	**19.5**
Protein (g)	**110-147**	**119-162**	**126-174**	**138-195**
Saturated + *trans* fat (g)	≤ 34	≤ 39	≤ 45	≤ 53
Carbohydrate (g)	**391-430**	**471-517**	**557-608**	**682-743**
Dietary Fibre (g)	30	30	30	30
Vitamin A (µg)	900	900	900	900
Vitamin C (mg)	45	45	45	45
Vitamin E (mg)	10	10	10	10
Thiamin (mg	**1.3**	**1.5**	**1.7**	**2.0**
Riboflavin (mg)	**1.9**	**2.2**	**2.5**	**2.9**
Niacin (mg)	**20**	**23**	**26**	**31**
VitaminB6 (mg)	**2.2**	**2.4**	**2.5**	**2.8**
Vitamin B12 (µg)	2.4	2.4	2.4	2.4
Folate (µg)	400	400	400	400
Pantothenic Acid (mg)	6.0	6.0	6.0	6.0
Biotin (mg)	30	30	30	30
Choline (mg)	550	550	550	550
Vitamin D (µg)	5.0	5.0	5.0	5.0
Vitamin K (µg)	70	70	70	70
Calcium (mg)	1300	1300	1300	1300
Chromium (µg)	35	35	35	35
Copper (µg)	1.7	1.7	1.7	1.7
Iodine (µg)	150	150	150	150
Iron (mg)	18	18	18	18
Magnesium (mg)	410	410	410	410
Manganese (µg)	5.5	5.5	5.5	5.5
Molybdenum (µg)	45	45	45	45
Phosphorus (mg)	1250	1250	1250	1250
Potassium (mg)	3800	3800	3800	3800
Selenium (µg)	70	70	70	70
Sodium (mg)	920–2300	920–2500	920–2750	920–3000
Zinc (mg)	14	14	14	14

The MRDI or AI shown in this table is the one that applies to the 'worst case' ADF population for each nutrient. As examples, the criterion for energy is the MRDI for adolescent males, while the criterion for iron is the MRDI for adult females. For protein and carbohydrate the estimated requirements are expressed as acceptable ranges. For each micronutrient the NHMRC (2006) RDI (or AI if there is no RDI) applies, with the exceptions of thiamin, riboflavin, niacin, vitamin B6 and sodium, for which the MRDI apply. For Saturated + trans fat the criterion is <10% of total energy, in accordance with the recommendation of the NHMRC (2006).

Note: This table does not include an allowance for unavoidable food discards. An appropriate allowance for this is considered to be 15% when the efficiency of the mess is not known.

Table 2: Recommended Nutritional Criteria for Fresh Food Availability – Mixed ADF Populations, based on EAR/MEAR/AI (Table 10b of Forbes-Ewan, 2009)

	Activity Category				
	1	2	3	4	5
Energy (MJ)	**12.5**	**14.5**	**16.5**	**19.5**	**25**
Protein (g)	**110-147**	**119-162**	**126-174**	**138-195**	**162-235**
Saturated + *trans* fat (g)	≤ 34	≤ 39	≤ 45	≤ 53	≤ 68
Carbohydrate (g)	**391-430**	**471-517**	**557-608**	**682-743**	**906-984**
Dietary Fibre (g)	30	30	30	30	30
Vitamin A (µg)	630	630	630	630	630
Vitamin C (mg)	30	30	30	30	30
Vitamin E (mg)	10	10	10	10	10
Thiamin (mg	**0.9**	**1.1**	**1.2**	**1.4**	**1.8**
Riboflavin (mg)	**1.3**	**1.5**	**1.8**	**2.0**	**2.7**
Niacin (mg)	**14**	**16**	**18**	**22**	**28**
VitaminB6 (mg)	**1.5**	**1.7**	**1.8**	**2.0**	**2.2**
Vitamin B12 (µg)	2	2	2	2	2
Folate (µg)	330	330	330	330	330
Pantothenic Acid (mg)	6	6	6	6	6
Biotin (mg)	30	30	30	30	30
Choline (mg)	550	550	550	550	550
Vitamin D (µg)	5	5	5	5	5
Vitamin K (µg)	70	70	70	70	70
Calcium (mg)	1050	1050	1050	1050	1050
Chromium (µg)	35	35	35	35	35
Copper (µg)	1.7	1.7	1.7	1.7	1.7
Iodine (µg)	100	100	100	100	100
Iron (mg)	8	8	8	8	8
Magnesium (mg)	340	340	340	340	340
Manganese (µg)	5.5	5.5	5.5	5.5	5.5
Molybdenum (µg)	34	34	34	34	34
Phosphorus (mg)	1055	1055	1055	1055	1055
Potassium (mg)	3800	3800	3800	3800	3800
Selenium (µg)	60	60	60	60	60
Sodium (mg)	920–2300	920–2500	920–2750	920–3000	920–3200
Zinc (mg)	12	12	12	12	12

The estimated requirement shown in this table is the one that applies to the 'worst case' ADF population for each nutrient. As examples, the criterion for energy is the average estimated energy requirement for adolescent male ADF members, while the criterion for iron is the EAR for adult females. For protein and carbohydrate the estimated requirements are expressed as acceptable ranges. For each micronutrient the NHMRC (2006) EAR (or AI if there is no EAR) applies, with the exceptions of thiamin, riboflavin, niacin, vitamin B6 and sodium for which the MEAR applies. For Saturated + trans *fat the criterion is <10% of total energy, in accordance with the recommendatios of the NHMRC (2006).*

Note*: This table does not include an allowance for unavoidable food discards. An appropriate allowance for this is considered to be 15% when the efficiency of the mess is not known.*

Appendix B: Final Report to DSTO on diets conforming to Military Nutrient Standards at energy levels ranging from 12.5 to 25 MJ

Katrine Baghurst and Peter Baghurst
on behalf of the
Consultants* to the NHMRC Core Food Group project

*** The NHMRC Core Food Groups Project was managed by the Dietitians Association of Australia with consultants, Professor Katrine Baghurst, Associate Professor Peter Baghurst, Professor Lynne Cobiac and Dr Anthea Magarey**

November 2009

PART 1 Initial analyses

Introduction

As part of the revision of the NHMRC Core Food Groups (CFG) and Australian Guide to Healthy Eating (AGHE) recommendations, DSTO provided funding to extend the analysis to include the higher energy requirements of Military Personnel and the new Military EAR/RDI/AIs (MEARs, MRDIs, MAIs) for mixed ADF populations (Tables 1 and 2). These included both upper and lower limits for protein and carbohydrate at each energy level as well as an upper limit for saturated plus trans fat. The B Vitamin MEARs/RDIs also increase with energy levels.

This report outlines the analyses undertaken in discussion with DSTO.

Method

Diets were designed using a similar process as that outlined for the CFG/AGHE update in the First Draft Report to NHMRC provided to DSTO except that as the lowest energy level required by DSTO was 12.5 MJ, this energy level, rather than 'minimal energy', formed the base or Foundation diet for this group of people.

After discussions with DSTO, two energy levels 12.5 MJ and 14.5 MJ were modelled and then a series of potential 1 MJ add-ons were developed to increase energy levels up to 25 MJ whilst remaining within protein and carbohydrate limits for each energy level. Again, after discussions with DSTO the B vitamin MEAR/MRDIs for the 25-MJ diet were used when designing diets for all energy levels, so the add-on approach could be used efficiently.

The diets were initially designed using composite foods representing each food group and then the resulting pattern was tested using simulated 7 day diets with real foods to ensure that these food patterns still attained the MEARs and AIs when tested with a variety of 'real' foods whilst remaining within the protein, carbohydrate and saturated fat limits. Aiming the initial modelling with composites at the MRDI level is necessary to ensure compliance with MEAR as foods can vary widely in their nutrient profiles even within food categories.

There were some limitations on which nutrients could be assessed as the Australian food data base used for the CFG/AGHE project (AUSNUT07) is limited in the nutrients it contains. Some additional data from the UK/USA was included for Vitamin B6 and Vitamin B12 but we could not assess adequacy of pantothenic acid, biotin, choline, chromium, copper, molybdenum or manganese.

In the initial analyses for 12.5 and 14.5 MJ, after discussions with DSTO, no allowance was made for what are commonly called 'extra' foods such as alcohol, confectionary, cakes, biscuits etc. The full energy requirement was modelled with the basic food groups: cereals, fruits, vegetables, meat and alternatives, milks and alternatives and fats and oils. Subsequently, some allowance was made for these and some additional 'extras' options were also included within the suggested 1 MJ add-ons for attaining the higher energy levels.

Serve sizes

The dietary patterns are expressed in terms of serves of food groups or subgroups per week. The size of the serves for the different food types within food groups are shown in Table 3.

Generally speaking, the food serve sizes used for both the CFG/AGHE and this analysis which are similar to those in the current AGHE but the serve size of cereals was reduced to a 40 g bread equivalent rather than 60 g. The AGHE used 60 g because breads at that time were approximately 30 g a slice and they decided to use two slices of bread as the serve. This has received some criticism from end users, so the serve size equivalence was changed to approximately one thick bread slice which currently is closer to 38–40 g than the 30 g of some years ago. Thus, a recommendation for eight serves of cereal/day in the AGHE if eaten as bread would equate to 480 g of bread, which equates to 12 'serves'/day with the smaller new serve size of 40 g (or 84 'serves' a week). Amounts for other cereals were adjusted accordingly.

The meat serve in the AGHE was given as a range of 65–100 g cooked weight. In this analysis we used a single point serve size of 80 g cooked weight. Milks (250 mL), fruits (about 150 g) and vegetable (75 g) serve sizes remain similar to those used for the AGHE.

The modelling both with the composites and the 7-day 'real' foods is done on the basis of the current food patterns in the community so the analysis involves using a factor which assumes about the same proportional use of foods from within food groups as currently occurs in the community (i.e. a certain level of breads versus breakfast cereal versus rice, pasta etc, or a certain ratio of fish to poultry, to eggs etc).

The proportions used in modelling based on the National Nutrition Survey of 1995 for young men and young women for the various food groups are shown in Table 6. Initial analyses were done with these proportions. (Subsequent discussions with DSTO led to us developing a special mix of cereals for the final analyses that was more closely aligned with that normally used in this population).

Please note that the nutrient database uses nutrient figures for foods 'as eaten' i.e. cooked, peeled, reconstituted with water, as relevant. Thus the values for meats are weights for lean or semi-trimmed meats after cooking, not raw weights; weights for fruits and vegetables are without peel, cores, stalks etc; values for cereals such as rice and pasta are cooked weight not dried.

For catering purposes these weights will need adjustment.

Initial analysis results

Tables 4 and 5 show the initial analyses of dietary patterns to achieve the MEARs within protein/ carbohydrate and saturated fat levels for energy levels of 12.5 and 14.5 MJ.

In Tables 4 and 5 the headings have the following meanings:

Daily intake – the average content of the 100 7-day diets for that nutrient
Minimum – the lowest mean level of that nutrient from any of the simulated 7-day Diets (i.e. none of the 7-day diet averaged less than this level)

Maximum – the highest mean level of that nutrient in any of the 7 day diets
Met MEAR/MAI – the number of 7-day diets out of 100 that met the MEAR/MAI
Met MRDI/MAI – the number of 7-day diets out of 100 that met the MRDI/MAI

The three rows below the nutrient list show the average percentage energy from fat, protein and carbohydrate from all 7-day diets.

The Food lists at the base of the page show the weekly number of serves of the various food groups (i.e. for Dark Green Vegetables, an N servings of '7' means seven serves per week or one/day at 75 g/serve).

Diets were analysed on a weekly basis to give flexibility. It is not generally necessary to have exactly the same pattern of intake each day (e.g. there may be more green vegetables one day and somewhat less or none the next day).

With the high energy and carbohydrate requirements, for the 12.5-MJ diet the recommended serves of cereal foods (16/day, half wholemeal—equivalent to about 10 or 11 AGHE serves) and starchy vegetables (5/day, about two large potatoes)—were quite high. The diets also included, on average, one 75-g serve per day of green leafy vegetables, one of orange vegetables, one of legumes/beans and one other vegetable.

The diet also included three serves of fruit/day (can include fruit juice as one serve); a handful of nuts three times a week and some polyunsaturated margarine.

The recommended red meat serve (beef/lamb/veal) was three serves per week at 80 g cooked weight with other meat group alternatives (pork, fish poultry, eggs, legumes/nuts) once a day (some of this, about two or three serves, could be additional red meat).

Dairy serves included just under three serves a day with half the serves being lower fat milks and yoghurts and the rest cheeses or full fat milks, yoghurts, custards.

For the 14.5-MJ diet, as the MEARs had been met, the only change was to include additional cereal serves which increased the energy whilst keeping the protein and carbohydrate levels within range.

For the 1-MJ add-ons proposed at this stage, foods were needed that are generally high in carbohydrate and not too high in protein and saturated fat. Foods which fall in this category found on the database include some cereal foods including popcorn and muesli bars, starchy vegetables, fruits, sweetened dairy products such as yoghurts, custards and ice-creams, sweet biscuits and sweetened soft drinks and sugar-based confectionary (see Table 7).

Most of these foods had, on average, less than 10–12 g protein/MJ and 30–60 g of carbohydrate/MJ, whilst being low in saturated fat.

For the 16.5-MJ diet a combination of two of these add-ons were needed on top of the 14.5-MJ pattern; for the 19.5-MJ diet an additional 5-MJ of add-ons; and for 25-MJ diet an additional 10.5-MJ of add-ons.

As the 14.5-MJ diet was towards the upper end of the range for protein (average 156 g with the recommended range being 119–162 g), the choice for add-ons for the 16.5-MJ diet should be from the lower protein add-ons to keep below 174 g protein. The carbohydrate of the 14.5-MJ diet averaged 501 g (range 471–517 g). The 16.5-MJ diet range for carbohydrate was 557–608 g, so an additional 70–90 g carbohydrate across the two 1-MJ add-ons would raise the carbohydrate to between 570 and 590 g on average.

Some of the 7-day diets did have protein or carbohydrate means just outside the ranges set, but this was probably inevitable as the ranges are fairly narrow given the diversity of foods in the food supply. Generally though, both the 12.5- and 14.5-MJ diets conformed quite well to the DSTO ranges for protein and carbohydrate.

The Upper Levels of nutrients did not seem to be an issue with these diets with the potential exception of folic acid that is to be added to breads and foods made with bread flour. 120 µg folic acid (200 µg dietary folate equivalents) was mandatorily added to each 100 g of bread from September 2009. The UL for folic acid (not folate per se) is 1000 µg for adults, so breads or foods made with bread flour (e.g. some crumpets, muffins etc) need to be limited to about 800 g or less per day if there is no other source of folic acid in the diet. This probably is not too much of an issue as this level of intake equates to about 20 slices of bread or other breads-flour equivalents a day.

At this stage, although running diets aimed at MEARs instead of MRDIs in the initial modelling had been discussed, we did not do this as, on reflection, when using only the basic food groups (i.e. no 'empty' kilojoules) the amounts and types of foods needed to reach the DSTO energy, protein and carbohydrate ranges automatically lead to higher than MEAR levels for most nutrients and indeed higher than MRDI for most.

When DSTO had assessed these initial findings, further discussions led to some changes in approach and further refinement of what constituted the various food groups used in modelling.

Table 1: Recommended Nutritional Criteria for Fresh Food Availability – Mixed ADF Populations (based on MEAR/AI)

	Activity Category				
	1	2	3	4	5
Energy (MJ)	**12.5**	**14.5**	**16.5**	**19.5**	**25**
Protein (g)	**110-147**	**119-162**	**126-174**	**138-195**	**162-235**
Saturated + *trans* fat (g)	≤ 34	≤ 39	≤ 45	≤ 53	≤ 68
Carbohydrate (g)	**390-430**	**471-517**	**557-608**	**682-743**	**906-984**
Dietary Fibre (g)	30	30	30	30	30
Vitamin A (µg)	630	630	630	630	630
Vitamin C (mg)	30	30	30	30	30
Vitamin E (mg)	10	10	10	10	10
Thiamin (mg	**0.9**	**1.1**	**1.2**	**1.4**	**1.8**
Riboflavin (mg)	**1.3**	**1.5**	**1.8**	**2.0**	**2.7**
Niacin (mg)	**14**	**16**	**18**	**22**	**28**
VitaminB6 (mg)	**1.5**	**1.7**	**1.8**	**2.0**	**2.2**
Vitamin B12 (µg)	2	2	2	2	2
Folate (µg)	330	330	330	330	330
Pantothenic Acid (mg)	6	6	6	6	6
Biotin (mg)	30	30	30	30	30
Choline (mg)	550	550	550	550	550
Vitamin D (µg)	5	5	5	5	5
Vitamin K (µg)	70	70	70	70	70
Calcium (mg)	1050	1050	1050	1050	1050
Chromium (µg)	35	35	35	35	35
Copper (µg)	1.7	1.7	1.7	1.7	1.7
Iodine (µg)	100	100	100	100	100
Iron (mg)	8	8	8	8	8
Magnesium (mg)	340	340	340	340	340
Manganese (µg)	5.5	5.5	5.5	5.5	5.5
Molybdenum (µg)	34	34	34	34	34
Phosphorus (mg)	1055	1055	1055	1055	1055
Potassium (mg)	3800	3800	3800	3800	3800
Selenium (µg)	60	60	60	60	60
Sodium (mg)	2300–4600	2300–4600	2300–4600	2300–4600	2300–4600
Zinc (mg)	12	12	12	12	12

The estimated requirement shown in this table is the one that applies to the 'worst case' ADF population for each nutrient. As examples, the criterion for energy is the RMDI for adolescent males, while the criterion for iron is the MEAR for adult females. For protein and carbohydrate the estimated requirements are expressed as acceptable ranges (see Table 4). For each micronutrient the NHMRC (2006) EAR (or AI if there is no EAR) applies, with the exceptions of thiamin, riboflavin, niacin, vitamin B6 and sodium (see section 6.2.1.3). For Saturated + trans *fat the criterion is <10% of total energy.*

Note: *This table does not include an allowance for unavoidable food discards. An appropriate allowance for this is considered to be 15% when the efficiency of the mess is not known (see section 6.2.1.1). Therefore, when using these tables to set entitlements to fresh feeding, the above nutrient values should all be multiplied by the appropriate factor (if the approximate efficiency of the mess is known), or by 1.15 if the efficiency is unknown.*

Table 2: Recommended Nutritional Criteria for Fresh Food Availability – Mixed ADF Populations (based on MRDI/AI)

	Activity Category				
	1	2	3	4	5
Energy (MJ)	**12.5**	**14.5**	**16.5**	**19.5**	**25**
Protein (g)	**110-147**	**119-162**	**126-174**	**138-195**	**162-235**
Saturated + *trans* fat (g)	≤ 34	≤ 39	≤ 45	≤ 53	≤ 68
Carbohydrate (g)	**390-430**	**471-517**	**557-608**	**682-743**	**906-984**
Dietary Fibre (g)	30	30	30	30	30
Vitamin A (µg)	900	900	900	900	900
Vitamin C (mg)	45	45	45	45	45
Vitamin E (mg)	10	10	10	10	10
Thiamin (mg	**1.3**	**1.5**	**1.7**	**2.0**	**2.5**
Riboflavin (mg)	**1.9**	**2.2**	**2.5**	**2.9**	**3.8**
Niacin (mg)	**20**	**23**	**26**	**31**	**40**
VitaminB6 (mg)	**2.2**	**2.4**	**2.5**	**2.8**	**3.2**
Vitamin B12 (µg)	2.4	2.4	2.4	2.4	2.4
Folate (µg)	400	400	400	400	400
Pantothenic Acid (mg)	6.0	6.0	6.0	6.0	6.0
Biotin (mg)	30	30	30	30	30
Choline (mg)	550	550	550	550	550
Vitamin D (µg)	5	5	5	5	5
Vitamin K (µg)	70	70	70	70	70
Calcium (mg)	1300	1300	1300	1300	1300
Chromium (µg)	35	35	35	35	35
Copper (µg)	1.7	1.7	1.7	1.7	1.7
Iodine (µg)	150	150	150	150	150
Iron (mg)	18	18	18	18	18
Magnesium (mg)	410	410	410	410	410
Manganese (µg)	5.5	5.5	5.5	5.5	5.5
Molybdenum (µg)	45	45	45	45	45
Phosphorus (mg)	1250	1250	1250	1250	1250
Potassium (mg)	3800	3800	3800	3800	3800
Selenium (µg)	70	70	70	70	70
Sodium (mg)	2300–4600	2300–4600	2300–4600	2300–4600	2300–4600
Zinc (mg)	14	14	14	14	14

The estimated requirement shown in this table is the one that applies to the 'worst case' ADF population for each nutrient. As examples, the criterion for energy is the MRDI for adolescent males, while the criterion for iron is the MRDI for adult females. For protein and carbohydrate the estimated requirements are expressed as acceptable ranges (see Table 4). For each micronutrient the NHMRC (2006) RDI (or AI if there is no RDI) applies, with the exceptions of thiamin, riboflavin, niacin, vitamin B6 and sodium (see section 6.2.1.3). For Saturated + trans *fat the criterion is <10% of total energy.*

Note: *This table does not include an allowance for unavoidable food discards. An appropriate allowance for this is considered to be 15% when the efficiency of the mess is not known (see section 6.2.1.1). Therefore, when using these tables to set entitlements to fresh feeding, the above nutrient values should all be multiplied by the appropriate factor (if the approximate efficiency of the mess is known), or by 1.15 if the efficiency is unknown.*

Table 3: Equivalences within groups for serve sizes (as eaten)

A. Meats and alternatives equivalences	**Serve size (g/ml)**
Legumes as meat alt	200
Nuts/seeds as meat alt	30
Eggs	90
Beef, veal lean	80
Mince low fat	80
Lamb	80
Pork	80
Other meats (rabbit, kangaroo etc)	80
Poultry	80
Hi-LComega fish	80
Medium LComega fish	120
Lower LComega fish	120
Shellfish	150
B. Milk, yoghurt and cheese equivalences	
Cheeses	40
Condensed milks	60
Milks and fortified soy milks	250
Evaporated milk	120
Yoghurts	200
C. Refined cereals equivalences	
Breads/rolls	40
Cracker biscuits	25
Crumpet/muffin white	40
Breakfast cereals processed	30
Scones	40
White rice	120
Noodles	120
Pasta refined	120
Wholegrain cereals	
Breads/rolls	40
Wholegrain crackers	25
Fruit breads	40
Crumpet/muffin wg	40
Breakfast cereals wg	30
Muesli wholegrain	30
Oats/porridge	180
Brans/germ	30
Other grains lower starch	120
Other grains higher starch	120
Brown Rice	120
Pasta wholemeal	120

D. Fruit and vegetables equivalences	**Serve size (g/mL)**
Dried semi-dried fruit	30
Pome fruit small apple/pear	150
Stone; medium peach, 2 plums	150
Banana one small	100
Berries 10 large straw or raspberries	180
Tropical; 1 slice pineapp, 1 cup mango, ¾ fruit	150
Grapes 30 seedless	120
Oranges and mandarins 1 large	180
Melons	
¼ cantaloupe; 1/20 watermelon	200
Other fruit	150
Fruit juice orange/apple	200
Other fruit juice	200
All vegetables	75

Table 4: 12.5-MJ diet—100 simulated 7-day diets

	Daily intake	minimum	maximum	met MEAR/AI	met MRDI/AI
Energy	12265.0	11947.8	12779.1	100	100
Protein	144.9	134.3	153.4	100	100
Fat	71.1	63.5	77.0	100	100
SatFat.total	22.6	20.3	25.1	100	100
MUFA.total	23.8	20.3	29.4	100	100
PUFA.total	18.6	15.2	25.0	100	100
Cholesterol	304.1	172.6	464.0	100	100
Carbohydrate	392.5	370.1	421.7	100	100
Sugars.total	117.3	105.2	128.9	100	100
Starch	273.2	253.4	291.9	100	100
Dietary fibre	65.2	59.9	71.1	100	100*
Thiamin	3.1	2.6	3.4	100	100
Riboflavin	3.1	2.8	3.6	100	0
Niacin	80.3	74.1	88.7	100	100
Vitamin B6	3.1	2.4	4.1	100	31
Vitamin B12	6.4	4.2	25.9	100	100
Folate	1220.6	1065.8	1382.4	100	100
Biotin	69.1	58.3	83.7	100	100
Vitamin A	1410.6	1123.3	1831.1	100	100
Vitamin C	218.3	157.4	342.3	100	100
Vitamin D	5.2	4.5	7.1	74	74*
Vitamin E	10.9	8.2	15.7	68	68*
Calcium	1378.4	1266.1	1477.1	100	98
Phosphorus	2586.9	2495.3	2684.0	100	100
Zinc	19.7	18.5	21.2	100	100
Iron	23.9	21.7	26.3	100	100
Magnesium	683.3	643.9	740.8	100	100
Iodine	199.5	168.6	227.2	100	100
Selenium	136.4	113.2	159.6	100	100
Sodium	2696.4	2377.9	3183.7	100	100*
Potassium	6490.1	6228.8	6811.5	100	100*

Percent energy from fat	21.4
Percent energy from protein	20.1
Percent energy from carbohydrate	51.2

FoodGroups	**Number of servings/week**
"DarkGreenVeg"	"7"
"OrangeVeg"	"7"
"StarchyVeg"	"35"
"OtherVeg"	"7"
"Legumes"	"14"
"NutsSeeds"	"4"
"TotalFruit"	"21"
"RedMeats"	"4"
"AllOtherMeatsEggsLegs"	"10"
"LoFatDairy"	"10"
"MidFatDairy"	"5"
"HiFatDairy"	"5"
"PolyUnsatFat"	"7"
"WholegrainCereals"	"49"
"RefinedCereals"	"28"

Table 5: 14.5-MJ diet—100 7-day diets

	Daily intake	minimum	maximum	met MEAR/AI	met MRDI/AI
Energy	14385.4	13868.7	14817.9	100	100
Protein	156.0	146.6	162.9	100	100
Fat	71.5	63.1	78.5	100	100
SatFat.total	22.3	20.4	24.3	100	100
MUFA.total	23.9	20.4	27.6	100	100
PUFA.total	19.3	16.1	23.1	100	100
Cholesterol	250.7	141.3	449.5	100	100
Carbohydrate	501.6	470.6	523.7	100	100
Sugars.total	122.4	112.2	133.9	100	100
Starch	377.2	348.2	404.4	100	100
Dietary fibre	72.9	68.8	78.0	100	100*
Thiamin	3.7	3.2	4.1	100	100
Riboflavin	3.3	2.9	3.9	100	1
Niacin	89.9	82.5	95.8	100	100
Vitamin B6	3.4	2.7	5.0	100	57
Vitamin B12	7.7	4.4	26.5	100	100
Folate	1552.5	1374.3	1734.6	100	100
Vitamin A	1420.0	1140.5	1783.2	100	100
Vitamin C	216.7	158.6	319.8	100	100
Vitamin D	5.1	4.4	6.3	57	57*
Vitamin E	10.7	7.9	13.5	68	68*
Calcium	1489.1	1392.9	1586.3	100	100
Phosphorus	2789.3	2676.9	2908.9	100	100
Zinc	21.1	19.6	22.3	100	100
Iron	27.3	25.1	29.7	100	100
Magnesium	755.1	718.7	799.9	100	100
Iodine	234.0	211.1	267.4	100	100
Selenium	151.4	134.3	170.5	100	100
Sodium	3325.3	2923.4	3745.4	100	100*
Potassium	6689.0	6283.6	7035.6	100	100*

Percent energy from fat 18.4 * AI thus DI should approx AI only
Percent energy from protein 18.4
Percent energy from carbohydrate 55.8

FoodGroups	**Number of servings/week**
"DarkGreenVeg"	"7"
"OrangeVeg"	"7"
"StarchyVeg"	"35"
"OtherVeg"	"7"
"Legumes"	"14"
"NutsSeeds"	"4"
"TotalFruit"	"21"
"RedMeats"	"3"
"AllOtherMeatsEggsLegs"	"8"
"LoFatDairy"	"10"
"MidFatDairy"	"5"
"HiFatDairy"	"5"
"PolyUnsatFat"	"7"
"WholegrainCereals"	"56"
"RefinedCereals"	"56"

Table 6: Proportions of key foods within groups for men and women 19–30 yrs used in modelling

Fresh Fruit	**% of total for gender group**
Women	
Orange/mandarin	12
Lemon, grapefruit	<1
Apple/pear	35
Berries	2
Apricot	1
Nectarine	4
Peach	5
Plum	1
Banana	21
Pineapple	3
Mango	1
Pawpaw	<1
Grape	5
Kiwifruit	1
Passionfruit	1
Rockmelon/cantaloupe	2
Honeydew melon	1
Watermelon	7
Men	
Orange	16
Lemon, grapefruit	<1
Apple/pear	34
Berries	1
Apricot	1
Nectarine	2
Peach	4
Plum	1
Banana	20
Pineapple	3
Mango	3
Pawpaw	<1
Grape	5
Honeydew melon	1
Kiwifruit	1
Passionfruit	<1
Rockmelon/cantaloupe	3
Watermelon	6
Starchy vegetables	
Women	
Potato	91
Parsnip	<1
Corn	9
Men	
Potato	93
Parsnip	<1
Corn	6

Darker green vegetables	% of total for gender group
Women	
Broccoli	21
Brussels sproutg	3
Cabbage	9
Silverbeet	<1
Spinach	4
Pea	21
Alfalfa sprout	1
Asparagus	3
Snowpea	3
Capsicum	11
Lettuce	25
Leek	1
Men	
Broccoli	21
Brussels sproutg	3
Cabbage	9
Silverbeet	<1
Spinach	4
Pea	21
Alfalfa sprout	1
Asparagus	3
Snowpea	3
Capsicum	11
Lettuce	25
Leek	1
Orange vegetables	
Women	
Carrot	64
Pumpkin	35
Sweet potato	1
Men	
Carrot	64
Pumpkin	34
Sweet potato	2
Other vegetables	
Women	
Swede	<1
Turnip	<1
Bean sprout	1
Celery	2
Beetroot	3
Cauliflower	8
Tomato	42
Squash	2

	% of total for gender group
Zucchini	6
Avocado	4
Cucumber	8
Eggplant	<1
Mushroom	7
Onion	9
Bean, green	7
Men	
Swede	<1
Turnip	<1
Bean sprout	<1
Celery	3
Beetroot	3
Cauliflower	5
Tomato	46
Squash	1
Zucchini	5
Avocado	3
Cucumber	4
Eggplant	1
Mushroom	6
Onion	13
Bean, green	9
Meats and alternatives	
Women	
beef/veal	31.9
lamb	7
pork	4.2
chicken, turkey, duck	32.1
eggs	7.6
hi omega fish	2.4
mid omega fish	2.4
lo omega fish	4.9
seafood	3.5
Legumes	2.3
Total seeds & nuts	1.7
Men	
beef/veal	32.2
lamb	8.5
pork	4.6
chicken, turkey, duck	26.9
egg	7.8
hi omega fish	3.7
med omega fish	3.7
lo omega fish	7.5
seafood	2.5
Legumes	1.2
Total seeds & nuts	1.2

	% of total for gender group
Low fat dairy	
Women	
Milk reduced fat	76
Milk skim	9
Yoghurt reduced fat	8
Soymilk reduced fat	<1
Sweetened condensed skim milk	0
Custard reduced fat	6
Men	
Lo fat/serve	
Reduced fat milk	85
Milk skim	8
Yoghurt reduced fat	5
Soymilk reduced fat	<1
Sweetened condensed skim milk	<1
Custard reduced fat	2
Mid fat dairy	
Women	
Milk full fat	94.0
Yoghurt plain regular fat	3.4
Reduced fat hard	0.4
Soymilk full fat	1.4
Evaporated milk	0.1
Men	
Milk full fat	93.8
Yoghurt plain regular fat	4.0
Reduced fat hard	0.2
Soymilk full fat	1.8
Evaporated milk	0.1
High fat dairy	
Women	
Cheese total hard	95
Soft brie/camembert	5
Men	
Cheese total hard	100
Soft brie/camembert	0
Wholegrain cereals	
Women	
Mixed grain bread/roll	13.0
Wholemeal bread/roll	27.0
Bran cereal	4.0
Wholewheat biscuit	12.0
Cereal flakes	12.0
Muesli	7.0
Oats	22.0
Pasta wholemeal	1.0
Brown rice	2.0

	% of total for gender group
Men	
Mixed grain bread/roll	15.0
Wholegrain bread/roll	23.0
Bran cereal	1.5
Wholewheat biscuit	9.0
Cereal flakes	24.0
Muesli	6.1
Oats	10.9
Pasta wholemeal	1.5
Brown rice	9.0
Refined cereals	
Women	
Bread/roll	37.0
Muffin	1.0
Crumpet white	2.5
Corn flakes	6.0
Puffed rice	2.5
Pasta	24.0
Rice	24.0
Noodle	3.0
Men	
Bread/roll	38.1
Muffin	1.0
crumpet white	0.5
Corn flakes	1.2
Puffed rice	0.5
Pasta	28.0
Rice	27.0
Noodle	4.0

Table 7: Some examples of possible 1-MJ add-ons from the AUSNUT07 database showing protein, carbohydrate and saturated fat content per megajoule

	Nutrient per MJ (rounded)			Amount per MJ (g/mL)
	Protein	Saturated Fat	Carbohydrate	
Wholegrain cereal	8	3	45	100
Wholegrain Bread	12	0.3	39	110
Wholegrain Breakfast cereal	4	1.2	58	60
Brown rice	6	3	63	160
Oats	6	0.6	38	360
Refined cereal serve	7	3	42	120
White bread	10	3	45	100
Sweetened breakfast cereal	10	0.2	40	60
Rice	4	0	52	200
Instant noodles	5	6	27	130
Pasta	8	0.2	55	170
Starchy vegetable	9	1	44	300
Muffin - fruit	10	0.4	50	100
Fruit (esp banana)	4	0.1	50	400
Reduced fat custard	12	2	46	100
Frozen yoghurt (150g)	7	5	39	150
Fruit yoghurt regular fat	12	6	27	250
Ice cream regular	5	10	26	120
Sweetened condensed skim milk	10	0.2	60	100
Muesli bar	8	1.2	36	70
Popcorn	5	7	25	50
Soft drink /cordials/sugar confectionery/fruit leather/jams	0	0	62	750
Sweet biscuits	3	6	32	60

Part 2 Final analyses after discussions with DSTO

With the initial analyses to hand, the following suggestions were made by DSTO to further refine the analyses and more closely align it with current practice.

1. Suggestions from DSTO re food patterns to be modelled for the 12.5-MJ diet

Model the 12.5-MJ diet with the 19.5-MJ RMDIs and MEARs.

- SUPMAN 4 currently provides at least four serves of meat and alternatives a day. DSTO requested the inclusion of 2-4 serves of meat/alternatives per day (including two eggs 3-4 times per week). The DSTO analysis modelled legumes as vegetables and suggested two serves per day. Because the meat/alternatives group has little in the way of legumes then this should be also be retained.
- Include at least three dairy serves.
- Include at least 4-5 starchy vegetable serves.
- Include at least six other vegetables (two each of Dark Green Vegetables, Orange Vegetables and Other Vegetables).
- Include at least three fruit.
- Include at least 10 bread/rice/pasta, (including two serves of rice every day and two serves of pasta every day) (subsequently called DSTO cereals group).
- Include 1-3 extras from the high carbohydrate (high sugar) and high carbohydrate /high fat groups ('high carbohydrate' extras include foods such as jams, jellies as well as sugar-based confectionary, soft drinks, cordial etc; 'high carbohydrate /fat' extras includes items such as cakes, biscuits, buns, sweet muffins, pastries, chocolate and chocolate bars). The nutrient profile for these groups was compiled by combining the nutrient profiles of all relevant items from the food data base.
- Include nuts and seeds/unsaturated oils etc as required.

Process followed

A number of diets were again modelled. Three of the key models produced at this stage are shown below and were further discussed with DSTO.

Diet A. Initial model

In line with DSTO suggestions, the initial model tested had:

10 bread/rice/pasta serves with two serves per day as rice,two serves as pasta, one serve as breakfast cereal and five serves as bread
3 dairy serves a day, one as cheese and two as low/reduced fat milks/yoghurts
3 fruit serves
3 meats/alternatives per day with at least four serves per week as eggs (serve is two eggs), two/week fish and the rest as meats

4 starchy vegetables
6 additional vegetables as two dark green vegetables, 2 orange vegetables, and 2 'other' vegetables
2 serves legumes a day
30 g/day polyunsaturated margarine (10 serves a week at 20 g/serve)
3 extras serves, two as high carbohydrate (soft drink, sugar confectionary etc) and one as high carbohydrate/fat extras (cakes/biscuits etc).

However, this resulted in a diet totalling about 14.5 MJ and somewhat high protein than recommended by DSTO, so the above diet was rerun without the 3 x 600 kJ extras (about 1800 kJ total) and one legume serve/week instead of two.

This diet had 12.47 MJ and was called **Diet A**; its nutrient profile is shown below.

Diet A attained all the 19.5-MJ MEARs and the mean for those nutrients with AIs approximated the AI. Carbohydrate was within bounds for a 12.5-MJ diet, averaging 406 g (range 390–430 g); saturated fat was below 34 g (about 24 g) but protein was substantially higher than the DSTO range for the 12.5-MJ diet, averaging 162 g (DSTO range for 12.5-MJ diet was 110–147 g).

Weights per serve are 'as cooked' or 'as eaten' weights; all meats are as semi-trimmed and cooked using non-fat techniques such as grilling or dry-baking rather than frying. Analysis for sodium allowed for salt in foods only (not discretionary use) and for canned/tinned processed foods includes lower salt/lower sugar varieties (e.g. do not use fish, vegetables, canned in brine or fruit canned in heavy syrups etc). Basic foods e.g. breads were, however, standard types not specifically salt-reduced.

Diet B. Adjusted model with reduced protein (two serves of meat a day instead of three) but with one high carbohydrate/high fat extra per day added; rest of the diet as per Diet A.

To reduce the protein level and allow for some flexibility with respect to inclusion of 'extras', the meat and alternatives were reduced to two serves per day by reducing meats to a total of 10 serves per week, eggs to three serves per week and fish to one serve per week. (Note, for flexibility, the extras used in the program were 300-kJ equivalents compared to the AGHE's 600-kJ equivalents. However, when referring to 'extras' in the text, we are referring to AGHE 600-kJ equivalent 'extra' serves).

Reducing other sources of protein through reduction of one serve of cereals/day or one serve of dairy foods/day resulted either in an insufficient reduction in protein (for cereals) or calcium falling below MEAR in 14% of the 7-day diets for dairy reduction.

Reducing the meat serves to two per day and adding one high carbohydrate/fat extra (cakes/biscuits etc) gave a diet averaging 12.5 MJ with all nutrients reaching the 19.5-MJ MEARs and approximating the MAIs.

Protein and carbohydrate were, on average, within the DSTO ranges for 12.5 MJ, but were at the higher end of the range for both (carbohydrate average 426 g/day; range 390–430 g; protein average 142 g/day, range 110–147g). Saturated fat averaged just under 24 g/day (DSTO limit of 34 g for saturated fat plus trans).

Diet C. Diet with an additional extra serve (total 2/day) replacing a cereal serve.

To allow for even more flexibility re 'extras', Diet C was devised. This was as per Diet B except the cereals were reduced by one serve to nine serves/day and an additional high carbohydrate/high fat 'extra' was added/day (note: at this stage, we did not use a high carbohydrate extra to replace the cereal serve as the carbohydrate was already at the upper end of the DSTO range).

Diet C provided 12.5 MJ, attained the 19.5-MJ MEARs/MAI standards, and had protein of 141 g/day on average (only slightly lower than Diet B, presumably milk/cereal protein in cakes/biscuits almost equated protein from bread/rice/pasta at relative contributions set by DSTO). Carbohydrate 419 g (about 7 g less than Diet B) and saturated fat 27.5 g about 3–4 g higher than Diet B but still within the limits set by DSTO.

This diet with nine serves of cereals and two high fat/carbohydrate extras per day would therefore be an alternative way to achieve MEAR/MAIs and protein, carbohydrate, saturated fat standards.

Final agreed 12.5-MJ diet

In discussions with DSTO, it was decided that Diet A was the preferred option of those modelled thus far but some further refinements were trialled (see Revisions to Diet A) to finalise the recommendations with Diet A1 being the DSTO preferred option. This had slightly reduced protein compared to the original Diet A obtained by reducing legume serves from seven to three per week; polyunsaturated margarine was reduced from 10 to eight serves and replaced by two serves of nuts and seeds per week. Dairy serves were changed to seven per week from each of the high-, medium- and low-fat categories rather than 7 high-fat and 14 low-fat.

It was agreed that a 13.5-MJ base diet could then be devised with the addition of one high carbohydrate extra and one high fat/high carbohydrate extra to Diet 1A to which further 1-MJ modules of various composition could be added to increase energy up to 25 MJ.

Five modules were constructed which could be used in different amounts and combinations to increase the energy content of the diet whilst keeping the balance of protein, fats and carbohydrates within limits and these were called Modules A, B C, D, E.

Module A was composed of equal amounts of the high carbohydrate extras and the high carbohydrate (sugar) /high fat extras
Module B was all high carbohydrate (sugar) extras
Module C was a 1:1:1 combination of the composite vegetables, fruit and cereals groups
Module D was a 1:1:1 combination of the low-fat dairy, legumes and the combined 'extras' groups
Module E was a 1:1:1:1 combination of high-fat dairy, medium-fat dairy, eggs and nuts/seeds groups

Diet A. A 12.5-MJ diet attaining 19.5-MJ MEARs with 10 cereals, 3 meats but no extras (note: protein higher than DSTO range)

Food Groups	N servings per week
"DarkGreenVeg"	"14"
"OrangeVeg"	"14"
"StarchyVeg"	"28"
"OtherVeg"	"14"
"Legumes"	"7"
"TotalFruit"	"21"
"RedMeats"	"7"
"Pork/Chicken"	"8"
"Eggs"	"4"
"Fish"	"2"
"LoFatDairy"	"14"
"HiFatDairy"	"7"
"PolyUnsatFat"	"10"
"Cereals"	"70"

	Daily intake	minimum	maximum	met MEAR/AI	met MRDI/AI	
Energy	12467.0	12004.2	12915.7			
Protein	161.9	156.1	166.8	100	100	
Fat	65.1	59.3	70.7			
SatFat.total	23.8	21.5	25.7			
MUFA.total	20.2	18.1	23.2			
PUFA.total	15.0	14.1	16.2			
Cholesterol	488.3	456.1	539.9			
Carbohydrate	406.1	384.4	427.7			
Sugars.total	108.5	98.2	120.5			
Starch	295.6	274.8	320.0			
Dietary fibre	50.8	47.3	55.8			*AI
Thiamin	2.1	1.8	2.5	100	66	
Riboflavin	2.4	2.3	2.6	100	0	
Niacin	75.6	70.9	80.3	100	100	
Vitamin B6	2.9	2.3	3.8	100	62	
Vitamin B12	6.8	6.0	7.7	100	100	
Folate	991.5	832.1	1114.0	100	100	
Vitamin A	2342.4	1825.6	2757.3	100	100	
Vitamin C	259.9	175.0	364.2	100	100	
Vitamin D	6.6	5.7	7.7			* AI
Vitamin E	9.8	8.4	11.4			* AI
Calcium	1336.7	1258.1	1473.0	100	84	
Phosphorus	2356.3	2246.8	2445.7	100	100	
Zinc	19.1	17.8	20.6	100	100	
Iron	16.9	15.5	18.2	100	1	
Magnesium	490.3	460.5	517.3	100	100	
Iodine	200.5	186.5	222.3	100	100	
Selenium	164.0	140.1	182.2	100	100	
Sodium	2401.5	2095.2	2748.5			*AI
Potassium	6088.7	5799.0	6356.8			*AI

Percent energy from fat	19.3
Percent energy from protein	22.1
Percent energy from carbohydrate	52.1

Diet B – same as Diet A except – 2 meats instead of 3 – and one 600-kJ high fat/high carbohydrate extra added (protein and carbohydrate within limits but on the high side).

Food Groups	N servings/week
"DarkGreenVeg"	"14"
"OrangeVeg"	"14"
"StarchyVeg"	"28"
"OtherVeg"	"14"
"Legumes"	"7"
"TotalFruit"	"21"
"RedMeats"	"5"
"Pork/chicken)"	"5"
"Eggs"	"3"
"Fish"	"1"
"LoFatDairy"	"14"
"HiFatDairy"	"7"
"PolyUnsatFat"	"10"
"Cereals"	"70"
"HiFatHi Extras"	"14" (equiv to 1/day of AGHE 600kj extras)

	Daily intake	minimum	maximum	met MEAR/AI	met MRDI/AI	
Energy	12475.1	12065.4	12996.9			
Protein	141.9	137.5	147.2	100	100	
Fat	65.4	61.3	73.3			
SatFat.total	24.6	22.8	26.9			
MUFA.total	20.0	18.0	24.1			
PUFA.total	15.0	13.7	16.5			
Cholesterol	376.7	347.5	411.2			
Carbohydrate	426.2	395.2	450.4			
Sugars.total	118.3	107.3	127.2			
Starch	305.8	281.6	330.7			
Dietary fibre	51.6	46.5	57.9			*AI
Thiamin	2.1	1.8	2.4	100	64	
Riboflavin	2.4	2.2	2.7	100	0	
Niacin	66.9	60.7	72.6	100	100	
Vitamin B6	2.8	2.2	3.9	100	47	
Vitamin B12	5.7	4.8	6.4	100	100	
Folate	988.2	824.0	1173.0	100	100	
Vitamin A	2386.6	1967.5	2753.0	100	100	
Vitamin C	256.3	163.8	370.5	100	100	
Vitamin D	6.2	5.5	6.9			*AI
Vitamin E	9.4	7.7	11.			*AI
Calcium	1346.9	1200.4	1432.6	100	89	
Phosphorus	2195.6	2100.6	2292.8	100	100	
Zinc	17.0	15.9	18.1	100	100	
Iron	16.2	15.1	17.7	100	0	
Magnesium	478.6	450.9	512.8	100	100	
Iodine	198.1	179.3	215.7	100	100	
Selenium	143.4	126.6	159.7	100	100	
Sodium	2385.8	2101.4	2698.1			*AI
Potassium	5902.7	5605.0	6226.4			*AI

Percent energy from fat	19.4
Percent energy from protein	19.3
Percent energy from carbohydrate	54.7

DIET C Same as Diet B but with 9 cereals and 2 high fat/high carbohydrate extras (within protein, carbohydrate and fat ranges as well as MEAR/MAI standards)

Food Groups	N servings/week	
"DarkGreenVeg"	"14"	
"OrangeVeg"	"14"	
"StarchyVeg"	"28"	
"OtherVeg"	"14"	
"Legumes"	"7"	
"TotalFruit"	"21"	
"RedMeats"	"5"	
"Pork/Chicken"	"5"	
"Eggs"	"3"	
"Fish"	"1"	
"LoFatDairy"	"14"	
"HiFatDairy"	"7"	
"PolyUnsatFat"	"10"	
"RefinedCereals"	"63"	
"HiFatHiSugarExtras"	"28"	(equiv to 2/day AGHE extras)

	Daily intake	minimum	maximum	met MEAR/AI	met MRDI/AI	
Energy	12536.8	12066.6	12988.4			
Protein	141.0	135.1	146.8	100	100	
Fat	71.2	64.6	77.9			
SatFat.total	27.5	24.7	30.5			
MUFA.total	21.9	19.6	25.0			
PUFA.total	15.5	14.4	16.9			
Cholesterol	392.3	364.9	425.7			
Carbohydrate	419.2	396.6	447.3			
Sugars.total	127.4	117.7	137.7			
Starch	289.7	267.8	319.3			
Dietary fibre	50.6	47.2	55.7			*AI
Thiamin	2.0	1.8	2.3	100	64	
Riboflavin	2.4	2.3	2.7	100	0	
Niacin	65.5	61.8	69.5	100	100	
Vitamin B6	2.8	2.2	3.9	100	53	
Vitamin B12	5.7	4.8	6.3	100	100	
Folate	934.1	798.0	1084.4	100	100	
Vitamin A	2412.6	2030.5	2803.0	100	100	
Vitamin C	254.4	183.4	417.5	100	100	
Vitamin D	6.3	5.7	7.1			*AI
Vitamin E	9.9	8.2	11.5			*AI
Calcium	1371.4	1273.5	1451.8	100	95	
Phosphorus	2203.8	2111.4	2304.7	100	100	
Zinc	16.8	15.5	17.7	100	100	
Iron	16.0	14.9	17.4	100	0	
Magnesium	475.6	448.2	514.1	100	100	
Iodine	196.7	175.5	212.3	100	100	
Selenium	139.6	118.5	161.0	100	100	
Sodium	2350.3	2062.6	2899.8			*AI
Potassium	5936.5	5594.1	6290.7			*AI

Percent energy from fat	21.0
Percent energy from protein	19.1
Percent energy from carbohydrate	53.5

REVISIONS TO DIET A.

REVISION DIET 1. To reduce protein, legumes were reduced from seven to three serves per week (tried five, not much effect) and pork/chicken from eight to seven serves/week. Polyunsaturated margarine was reduced from 10 to eight serves and replaced by two serves of nuts/seeds per week (30 g/serve). Dairy serves were changed to seven per week from each of the high, medium and lower fat categories from seven high-fat and 14 low-fat.

Outcomes: protein was reduced about 6 g from about 162 g to approx 156 g/day

AllFoodGroups	Nservings
"DarkGreenVeg"	"14"
"OrangeVeg"	"14"
"StarchyVeg"	"28"
"OtherVeg"	"14"
"Legumes"	"3"
"NutsSeeds"	"2"
"TotalFruit"	"21"
"RedMeats"	"7"
"Pork/chicken"	"7"
"Eggs"	"4"
"Fish"	"2"
"LoFatDairy"	"7"
"MidFatDairy"	"7"
"HiFatDairy"	"7"
"PolyUnsatFat"	"8"
"DSTO Cereals"	"70"

	Daily intake	minimum	maximum	met MEAR/AI	met MRDI/AI
Energy	12534.8	12241.9	12839.2		
Protein	155.9	148.0	161.7	100	100
Fat	70.4	66.2	75.0		
SatFat.total	26.8	25.0	28.6		
MUFA.total	22.4	19.9	24.9		
PUFA.total	14.7	13.2	17.1		
Cholesterol	496.9	459.7	536.5		
Carbohydrate	405.9	389.3	424.0		
Sugars.total	108.7	98.8	123.1		
Starch	295.3	279.8	319.4		
Dietary fibre	48.6	45.3	55.4		
Thiamin	2.0	1.6	2.4	100	47
Riboflavin	2.5	2.2	2.7	100	0
Niacin	74.2	69.1	79.8	100	100
Vitamin B6	2.9	2.2	3.8	100	59
Vitamin B12	7.8	6.7	8.9	100	100
Folate	953.3	800.6	1129.2	100	100
Vitamin A	2432.0	1967.8	2950.6	100	100
Vitamin C	248.9	174.5	332.3	100	100
Vitamin D	6.7	5.7	8.0		
Vitamin E	10.0	8.2	12.		
Calcium	1256.8	1149.5	1386.5	100	9
Phosphorus	2293.7	2191.3	2388.7	100	100
Zinc	18.8	17.2	20.2	100	100
Iron	16.4	15.2	17.7	100	0
Magnesium	484.8	460.7	516.4	100	100
Iodine	211.6	192.7	231.0	100	100
Selenium	161.0	140.4	180.7	100	100
Sodium	2209.8	1937.2	2506.7		
Potassium	5945.2	5665.0	6206.7		

Percent energy from protein, fat and carbohydrate = 21.1, 20.8 and 51.8 respectively

REVISION DIET 2. As above, but to further reduce protein, high fat dairy serves were reduced from seven per week to five per week; to compensate for energy loss, one serve of polyunsaturated margarine was restored from the original Diet A to a total of nine per week (if add more nuts/seeds increase protein again).
Outcome: Protein further reduced by about 2.5 g.

AllFoodGroups	N servings
"DarkGreenVeg"	"14"
"OrangeVeg"	"14"
"StarchyVeg"	"28"
"OtherVeg"	"14"
"Legumes"	"3"
"NutsSeeds"	"2"
"TotalFruit"	"21"
"RedMeats"	"7"
"Pork/chicken"	"7"
"Eggs"	"4"
"Fish"	"2"
"LoFatDairy"	"7"
"MidFatDairy"	"7"
"HiFatDairy"	"5"
"PolyUnsatFat"	"9"
"DSTO Cereals"	"70"

	Daily intake	minimum	maximum	met MEAR/AI	met MRDI/AI
Energy	12421.0	11877.4	12779.8		
Protein	153.5	147.6	158.3	100	100
Fat	69.4	65.0	74.9		
SatFat.total	25.1	22.8	26.8		
MUFA.total	22.4	19.7	25.9		
PUFA.total	15.5	13.8	18.1		
Cholesterol	488.1	450.6	535.6		
Carbohydrate	403.9	378.6	422.8		
Sugars.total	107.7	97.9	117.5		
Starch	294.1	273.2	313.6		
Dietary fibre	48.5	44.6	54.0		
Thiamin	2.0	1.8	2.3	100	49
Riboflavin	2.4	2.2	2.6	100	0
Niacin	73.5	68.9	77.7	100	100
Vitamin B6	2.9	2.1	3.9	100	60
Vitamin B12	7.5	6.5	8.6	100	100
Folate	950.2	807.3	1086.8	100	100
Vitamin A	2408.8	1940.7	2868.5	100	100
Vitamin C	248.0	168.9	365.5	100	100
Vitamin D	6.6	5.7	7.6		
Vitamin E	10.0	7.8	12.		
Calcium	1188.6	1110.2	1300.2	100	1
Phosphorus	2248.1	2164.5	2342.2	100	100
Zinc	18.6	17.3	19.8	100	100
Iron	16.4	15.3	18.0	100	1
Magnesium	482.1	447.8	513.3	100	100
Iodine	208.5	186.9	224.3	100	100
Selenium	159.7	141.9	181.2	100	100
Sodium	2144.2	1915.7	2451.0		
Potassium	5928.4	5589.4	6228.8		

Percent energy from fat	20.7
Percent energy from protein	21.0
Percent energy from carbohydrate	52.0

REVISION DIET 3. As above for Revision 2 but reduced pork/chicken one more serve to 6 serves/week; restored polyunsaturated margarine to original 10 serves/week. Protein reduced to 150 g but protein % not changed much as again slightly lower energy. "Meats and alts" at three per day (21/week) if we count 3x75 g legumes as a one serve meat alts and two nuts/seeds as one serve meat alts
Outcome: protein down to 150 g/day.

AllFoodGroups	Nservings
"DarkGreenVeg"	"14"
"OrangeVeg"	"14"
"StarchyVeg"	"28"
"OtherVeg"	"14"
"Legumes"	"3"
"NutsSeeds"	"2"
"TotalFruit"	"21"
"RedMeats"	"7"
"Pork/chicken"	"6"
"Eggs"	"4"
"Fish"	"2"
"LoFatDairy"	"7"
"MidFatDairy"	"7"
"HiFatDairy"	"5"
"PolyUnsatFat"	"10"
"WholegrainCereals"	"0"
"DSTO Cereals"	"70"

	Daily intake	minimum	maximum	met MEAR/AI	met MRDI/AI
Energy	12410.6	11970.1	12884.0		
Protein	150.3	144.4	155.6	100	100
Fat	70.2	65.8	75.1		
SatFat.total	25.2	23.4	27.1		
MUFA.total	22.5	19.5	25.4		
PUFA.total	16.1	14.5	18.7		
Cholesterol	471.6	433.1	507.0		
Carbohydrate	404.7	377.5	428.3		
Sugars.total	107.9	99.5	122.4		
Starch	294.8	269.5	314.7		
Dietary fibre	48.7	43.8	53.4		
Thiamin	2.0	1.6	2.3	100	43
Riboflavin	2.4	2.1	2.6	100	0
Niacin	72.0	66.7	77.9	100	100
Vitamin B6	2.9	2.3	4.0	100	56
Vitamin B12	7.5	6.6	8.4	100	100
Folate	952.6	780.1	1144.6	100	100
Vitamin A	2407.9	2078.3	2820.6	100	100
Vitamin C	257.8	188.7	353.1	100	100
Vitamin D	6.9	6.0	8.1		
Vitamin E	10.1	8.5	13.		
Calcium	1188.6	1092.8	1285.4	100	0
Phosphorus	2218.9	2149.4	2310.9	100	100
Zinc	18.4	16.9	19.6	100	100
Iron	16.3	15.3	17.6	100	0
Magnesium	479.8	451.4	509.9	100	100
Iodine	208.5	191.3	233.6	100	100
Selenium	157.6	133.5	174.4	100	100
Sodium	2148.4	1860.9	2451.5		Potassium 5889.6
5518.5	6180.0	100	100		

Percent energy from fat 20.7
Percent energy from protein 20.6
Percent energy from carbohydrate 52.2

REVISION – 14,500 kJ. As per revision 3 but with four extras/day of 500-600 kJ (note as diet 3 was a bit lower than 12.5 MJ, three extras gave a mean just under 14.2 MJ – could add some other basic 300-kJ food component if you want to use just three extras/day)

AllFoodGroups	N servings /week
"DarkGreenVeg"	"14"
"OrangeVeg"	"14"
"StarchyVeg"	"28"
"OtherVeg"	"14"
"Legumes"	"3"
"NutsSeeds"	"2"
"TotalFruit"	"21"
"RedMeats"	"7"
"Pork/chicken"	"6"
"Eggs"	"4"
"Fish"	"2"
"LoFatDairy"	"7"
"MidFatDairy"	"7"
"HiFatDairy"	"5"
"PolyUnsatFat"	"10"
"DSTO Cereals"	"70"
"HiSugarExtras"	"28"
"HiFatHiSugarExtras"	"28"

	Daily intake	minimum	maximum	met MEAR/AI	met MRDI/AI
Energy	14627.3	14244.3	15099.4		
Protein	155.7	150.6	161.3	100	100
Fat	82.4	77.5	87.6		
SatFat.total	31.1	28.6	34.0		
MUFA.total	26.6	23.7	29.7		
PUFA.total	17.5	15.8	19.8		
Cholesterol	505.0	466.7	546.6		
Carbohydrate	506.5	479.9	530.1		
Sugars.total	192.9	182.6	205.4		
Starch	311.7	291.5	334.1		
Dietary fibre	49.8	45.8	55.7		
Thiamin	2.1	1.8	2.4	100	83
Riboflavin	2.6	2.4	2.8	100	0
Niacin	74.0	69.3	77.9	100	100
Vitamin B6	3.2	2.4	4.1	100	86
Vitamin B12	7.4	6.4	8.2	100	100
Folate	957.2	816.6	1145.4	100	100
Vitamin A	2502.8	2063.9	2871.1	100	100
Vitamin C	248.5	180.4	340.7	100	100
Vitamin D	7.2	6.2	8.5		
Vitamin E	10.6	8.7	14.0		
Calcium	1268.6	1180.1	1379.7	100	21
Phosphorus	2311.6	2219.5	2410.6	100	100
Zinc	18.6	16.7	19.7	100	100
Iron	17.0	16.0	18.4	100	9
Magnesium	503.8	475.1	538.6	100	100
Iodine	232.9	209.9	250.4	100	100
Selenium	166.1	146.9	188.6	100	100
Sodium	2397.6	2095.1	2679.3	72	72
Potassium	6043.0	5725.0	6460.1	100	100

Percent energy from fat	20.9
Percent energy from protein	18.1
Percent energy from carbohydrate	55.4

Appendix C: Draft Fresh Food Scale

The FFS provides a system for fresh food availability in the Defence setting in messing, operations and deployment situations. The aim is to ensure that Defence personnel have enough food made available to them in order to select and consume a diet that provides adequate nutrition and hydration.

The quantities of food identified provide an indication of the amount of food from each group/serial that needs to be procured per person on a weekly basis. This amount accounts for catering discard, preparation shrinkage and wastage factors as appropriate to the form in which the food is purchased. Actual size of catered serves (CS) may be made up as appropriate to the dish.

Numbers of serves indicated in this table are from Diet A, Revision Diet 1 Plus. The serve sizes correspond to Australian Guide to Healthy Eating serves sizes (ref AGHE etc)

Serial 1a
Low fat dairy serial
7 serves per week

Serial 1b
Mid fat dairy serial
7 serves per week

Serial 1c
High fat dairy serial
7 serves per week

Serial 2a
Red Meat serial
7 serves per week

Serial 2b
Pork/Chicken/Poultry serial
7 serves per week

Serial 2c
Egg serial
4 serves per week

Serial 2d
Fish serial
2 serves per week

Serial 2e
Legumes serial
3 serves per week

Serial 3a
Starchy vegetables serial
28 serves per week

Serial 3b
Orange vegetables serial
14 serves per week

Serial 3c
Darker Green vegetables serial
14 serves per week

Serial 3d
Other vegetables serial
14 serves per weekSerial 4
Fruit serial
21 serves per week

Serial 5
Bread cereal rice pasta noodles serial
70 serves per week

Serial 6a
Polyunsaturated spreads and oils serial
8 serves per week

Serial 6b
Nuts and seeds serial
2 serves per week

Serial 7
Extra Foods Serial
(Note not NRS/nutritionally necessary at *Level 1*)
All other foods included with mix of nutrient profiles
hence 17a, 17b, 17c & 17d
14 serves per week

Serial 8
Culinary Adjuncts –Herbs, Spices, Sauces, Spreads, Cooking Aids - Amount not set but requires guidance re better choices

Use of Fresh Food Scale for Development of Basic (*Level 1*) Menus

Weekly Scale allows for flexibility of distribution of quantities of each serial. For example: Caterer has option to provide one egg per day per person OR 2 eggs, three times per week plus use 2-3 remaining eggs for cooking custards and desserts OR 2 eggs three times per week at breakfast, two eggs as main meal dish and one egg for cooking custards or desserts, etc.

Meat, fish, white meat, legume serves can be provided as one large serve per day OR as one three quarter size serve and one quarter size serve OR as two small serves. How the weekly scale of issue is distributed across a menu is at the Caterer's discretion within some limits.

Currently catering contracts usually require that a six week cyclic menu is provided, with definitions of meals. The definitions and requirements contained in catering contracts need to be reviewed to ensure that they are contributing positively to the provision of nutritionally adequate catering for ADF personnel. The following definitions of meals are recommended.

Table 1: Recommended Definition of Meals

Breakfast will consist of one of:

Hot Breakfast
2 eggs plus half meat serve (~60 g bacon) plus 2 serves (~150 g) cooked vegetables and/or legumes
2 toast 2 fruit serves (fresh or juice) and 1 dairy (milk or yogurt)

OR

Continental Breakfast
Hot or cold vegetable or fruit muffins, pancakes, crumpets, toast etc.
Large serve hot or cold cereal, porridge, muesli, breakfast flakes
Stewed or fresh fruit, fruit juice, milk or yogurt

Lunch and Dinner will consist of one of:

Salad/Sandwich Bar
2 x cereal/pasta/rice salads plus 2 x serves of starchy vegetables as potato salad/baked potato/potato dish
3 x other vegetable/legume salads
Selection of non-dressed salad vegetables including lettuce tomato beetroot cucumber corn etc.
Selection of meats/fish/dips/nuts/cheeses/felafal (or other high quality vegetarian protein source)
Selection of breads/bagels/wraps/pizza-breads/pita-breads etc.

OR

Hot Main Meal
Choice from one grill OR roast, two wet dishes, one vegetarian dish (with high quality vegetarian protein source)
1 x low fat vegetable based pasta or rice dish always available in addition to hot dish
2 x serves starchy vegetable plus 2-3 serves orange, green and other vegetables
Selection of dinner rolls/sliced bread etc

PLUS

Soup, Rice and Pasta Bar
Selection of soup of the day, plain pasta or rice always available with choice of two low fat vegetable sauces

PLUS

Dessert
Selection of fresh fruit or fruit salad, fruit based dessert, milk based dessert, cereal based dessert

Levesl 2–5 **Catering**

The FFS provides adequate energy, macro and micronutrients for ADF personnel working at *Level 1* physical activity category. Additional modules of Energy are required to meet nutritional requirements as activity levels increase. These modules each provide 1 MJ of energy and are defined below.

Module A
Sufficient number of serves from serial 7a and/or 7b (Extras general and Extras high carbohydrate) to provide 1 MJ

Module B
Sufficient number of serves from serial 7b (Extras high carbohydrate) to provide 1 MJ

Module C
Sufficient number of serves from serials 3a, 3b, 4 and 5 (Starchy & Orange Vegetables, Fruit, Bread, Cereals Rice Pasta Noodles) to provide 1 MJ

Module D
Sufficient number of serves from serials 1a, 2e and 7c (Low Fat Dairy, Legumes, Extras Milks and supplements) to provide 1 MJ

Module E
Sufficient number of serves from serials 1b, 1c, 2c and 6b (Mid & High Fat Dairy, Eggs and Nuts) to provide 1 MJ

Module F
Corresponds to Serials 3c and 3d (darker green and other vegetables)
Use as desired to increase the variety of food provided at higher catering levels.
There are NO LIMITS on the amount of food that may be provided from Serial 3c and 3d. Use should be encouraged.

Level 2
Level 1 Catering plus 1 x Module A and 1 x Module C and Module F foods included as desired.
Distributed as 1-MJ unit at MT and 1-MJ unit at Supper.

Level 3
Level 1 Catering plus 2 x Module A and 1 x Module C and 1 x Module D and Module F foods included as desired.
Distributed as 2-MJ unit at MT and a 2-MJ unit at Supper.

Level 4
Level 1 Catering plus 2 x Module A and 2 x Module B and 1 x Module C and 1 x Module D and 1x Module E and Module F foods included as desired.
Distributed as 2-MJ unit at MT, 2-MJ at AT and a 3-MJ unit at Supper.
Or distributed as 4-MJ unit at MT and 3-MJ unit at supper

Level 5
Level 1 Catering plus 4 x Module A and 4 x Module B and 2 x Module C and 2 x Module D and 1x Module E and Module F foods included as desired.
Distributed as 4-MJ unit at MT, 2-MJ at AT and a 3-MJ unit at Supper plus 4 MJ (possibly mixture of Module B and Module D drinks) distributed as desired.

Table 2: Recommended Distribution of additional modules of energy with increasing activity levels

Catering Level	**1**	**2**	**3**	**4**		**5**	
Basic FFS Serials 1 to 8	Yes	Yes	Yes	Yes		Yes	
Module A	Nil	1 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper	4 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper + 2 MJ as desired
Module B	Nil	Nil	Nil	2 MJ @ MT and/or Supper	2 MJ @ AT	4 MJ @ MT and AT and Supper	2 MJ @ AT + 2 MJ as desired
Module C	Nil	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper
Module D	Nil	Nil	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper	2 MJ @ MT and/or Supper
Module E	Nil	Nil	Nil	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper	1 MJ @ MT and/or Supper
Module F[1]	As desired	As desired	As desired	As desired		As desired	
Total MJ Requirement	12.5	14.5	16.5	19.5		25	
Total MJ Available[2]	13.6[2]	15.6[2]	17.6[2]	20.7[2]		26.8[2]	

Note 1: Additional energy provided by this serial is likely to be small.
Note 2: Reference to nutritional profiles modelled by the CFG contractors Oct/Nov 2009

Definitions of Serials and Modules

Definitions and serve sizes for items in Serials 1-8 below coincide with the Core Food Group (CFG) definitions of the National Health and Medical Research Council. The composition of the modules wasdetermined so that the addition of extra energy to the base *Level 1* diet is done in such a way that the macronutrient composition of the FFS at each activity level is consistent with the recommendation for macronutrient distribution outlined by Forbes-Ewan (2009). Modelled amounts are for food as eaten. For FFS, wastage/catering discard factors have been added to ensure food provision will result in the consumption of "food-as-eaten" quantities. Nutrient profiles are based on "food-as-eaten" serve sizes. These definitions are approximations only of nutrient composition.

Serial 1a
Low-fat dairy serial
Serve size equivalence is 250 mL low-fat milk; 200 g low-fat yoghurt; 120 g low-fat evaporated milk; 30 g low-fat milk powder.
Approximate Average Nutrient Composition per serve: 330 mg calcium; 533 kJ; 9.8 g protein; 1.8 g fat; 1.1 g saturated fat; 17.9 g carbohydrate

Serial 1b
Mid-fat dairy serial
Serial includes regular fat milks and yoghurts, regular fat soft cheeses and reduced fat hard cheeses.
Serve size equivalence is 250 mL regular fat milk; 200 g regular-fat yoghurt; 120 g regular-fat evaporated milk; 120 g soft curd cheeses; 60 g semi-soft low-fat cheeses; 40 g reduced-fat hard cheeses; 30 g full-fat milk powder;
Approximate Average Nutrient Composition per serve: 301 mg calcium; 780 kJ; 10.8 g protein; 10.3 g fat; 6.4 g saturated fat; 13.6 g (0.04 g to55.6 g) carbohydrate

Serial 1c
High-fat dairy serial
Serial includes regular fat semi-soft cheeses and regular-fat hard cheeses.
Serve size equivalence is 60 g semi-soft cheese; 40 g fat hard cheeses;
Approximate Average Nutrient Composition per serve: 297 mg calcium; 695 kJ; 10.9 g protein; 13.7 g fat; 8.3 g saturated fat; 0.14 g carbohydrate

Serial 2a
Red Meat serial
Serial includes beef, lamb and veal, corned red meat and offal. Given offal not generally eaten frequently, it is not included in profile. Corned meat may contribute to high sodium intake so also excluded from profile. Both these foods are included in equivalence lists.
Serve size equivalence is 80 g red meat "as eaten".
Approximate Average Nutrient Composition per serve: 2.7 mg iron; 638 kJ; 22.6 g protein; 6.7g fat; 3.1g saturated fat; 0.25g carbohydrate

Serial 2b
Pork/Chicken/Poultry serial
Serial includes pork, chicken, poultry, bacon, ham and other processed meats like salami. Given offal not eaten frequently, it is not included in profile. Bacon, ham and other processed meats may contribute to high sodium intake but consumed on regular basis so included in this nutrient profile. Salami is very high fat and eaten less frequently so excluded. All these foods are included in equivalence lists.
Serve size equivalence is 80 g pork/chicken/poultry "as eaten".
Approximate Average Nutrient Composition per serve: 1 mg iron; 611 kJ; 19.9 g protein; 7.1 g fat; 2.5 g saturated fat; 0.57 g carbohydrate

Serial 2c
Egg serial
Serial includes whole egg and equivalent frozen whole egg.
Serve size equivalence is 90 g whole egg "as eaten" i.e. no shell.
Approximate Average Nutrient Composition per serve: 1.4 mg iron; 536 kJ; 11.5 g protein; 9.1 g fat; 2.8 g saturated fat; 0.28 g carbohydrate

Serial 2d
Fish serial
Serial includes fish and shellfish (tripe was included because profile closer to fish but removed).
Serve size equivalence is 120 g fish, 150 g shellfish "as eaten".
Approximate Average Nutrient Composition per serve: 1.55 mg iron; 606 kJ; 28.4 g protein; 3.2 g fat; 0.96 g saturated fat; 0.16 g carbohydrate

Serial 2e
Legumes serial
Serial includes legumes and legume products including vegetarian meat substitutes and soy based products.
Serve size equivalence is 75 g "as eaten".
Approximate Average Nutrient Composition per serve: 1.35 mg iron; 407 kJ; 8.3 g protein; 3.1 g fat; 0.52 g saturated fat; 7.7 g carbohydrate; 3.5 g fibre

Serial 3a
Starchy vegetables serial
Serial includes fresh, frozen, canned, and dried potato, white sweet potato, parsnip, corn and cornmeal. Note that dry potato powder and canned starchy vegetables add to sodium.
Serve size equivalence is 75 g fresh, frozen, canned or 15 dry potato or raw cornmeal.
Approximate Average Nutrient Composition per serve: 9.8 mg vitamin C; 235 kJ; 1.5g protein; 0.23 g fat; 11.2 g carbohydrate; 1.6 g fibre

Serial 3b
Orange vegetables serial
Serial includes fresh, frozen, canned, and juiced carrots, orange sweet potato, pumpkin and red capsicum. Note that canned carrots vegetables add to sodium.
Serve size equivalence is 75 g fresh, frozen or canned orange vegetables or 75 mL juice.
Approximate Average Nutrient Composition per serve: 9.8 mg vitamin C; 148 kJ; 1.1 g protein; 0.1 g fat; 6.7 g carbohydrate; 1.5 g fibre

Serial 3c
Darker Green vegetables serial
Serial includes fresh, frozen and canned darker green vegetables.
Serve size equivalence is 75 g fresh, frozen or canned darker green vegetable.
Approximate Average Nutrient Composition per serve: 24.3 mg vitamin C; 118 kJ; 2.2 g protein; 0.5 g fat; 2.6 g carbohydrate; 2.4 g fibre

Serial 3d
Other vegetables serial
Serial includes diversity of fresh, frozen, juiced and canned vegetables including avocado.
Serve size equivalence is 75 g fresh, frozen, juiced or canned vegetable.
Approximate Average Nutrient Composition per serve: 10.1 mg vitamin C; 89 kJ; 1.3 g protein; 0.24 g fat; 2.8 g carbohydrate; 1.6 g fibre

Serial 4
Fruit serial
Serial includes diversity of fresh, frozen, juiced, dried and canned fruit.
Serve size equivalence: 30 g dried fruit, 100 g banana, 120 g grapes, 150 g pome/stone/tropical/other fruit, 180 g berries/citrus, 200 g melon, 200 mL juices.
Approximate Average Nutrient Composition per serve: 33.9 mg vitamin C; 319 kJ; 1.3 g protein; 0.2 g fat; 15.6 g carbohydrate; 3.1 g fibre

Serial 5
Bread cereal rice pasta noodles serial
Serial includes diversity of bread, cooked and raw cereal, crackers/low fat savoury biscuits, breakfast cereals, pastas, noodles and rice.
Serve size equivalence: 25 g cracker biscuits; 30 g breakfast and other dry cereals; 40 g bread/scones/crumpets/ English muffins and dry pasta/noodles; 120 g cooked cereals/pasta/noodles; 180 g cooked porridge/congee.
Approximate Average Nutrient Composition per serve: 488 kJ; 3.3 g protein; 1.4 g fat; 21.5 g carbohydrate; 2 g fibre

Serial 6a
Polyunsaturated spreads and oils serial
Serve size equivalence is 30 g/mL
Approximate Average Nutrient Composition per serve: 893 kJ; 0.07 g protein; 24 g fat; 3.9 g saturated fat; 0.1 g carbohydrate;

Serial 6b
Nuts and seeds serial
Serial includes nuts and nut spreads, seeds and seed spreads.
Serve size equivalence is 30 g/mL
Approximate Average Nutrient Composition per serve: 1.2 mg iron; 792 kJ; 5.8 g protein; 17.4 g fat; 2.1 g saturated fat; 1.8 g carbohydrate; 2.8 g fibre

Serial 7
Culinary Adjuncts/SRA –Extras
Serial includes extra foods as described by CFG and in current AGHE as equivalent to serve size that provides 600 kJ. Includes mixture of all other food not included in serials above like other fats and oils, cake, biscuits, icecream, sports drinks, cordials, nutritional supplement drinks, junk food etc.
Serve size equivalence is amount that provides approximately 500 to 600 kJ
No of serves per week is from whole of Serial 7 not each subgroup, i.e. 1200 kJ per day maximum.

In order to simplify Module descriptions Serial 7 is divided into sub-groups:

Serial 7a Extras General
Serve Average ~ 600 kJ; 2.2 g protein; 6 g fat; 3.3 g saturated fat; 19 g carbohydrate

Serial 7b Extras High carbohydrate
Serve Average ~ 600 kJ; 0.4 g protein; 0.2 g fat; 0.1 g saturated fat; 37 g carbohydrate

Serial 7c Extras Milks and supplements
Serve Average ~ 600 kJ; 8 g protein; 2.8 g fat; 1.8 g saturated fat; 22 g carbohydrate

Serial 7d Extras fats and Oils
Serve Average ~ 600 kJ; 0.2 g protein; 17 g fat; 8.6 g saturated fat; 0.3 g carbohydrate

Serial 8
Culinary Adjuncts-Herbs, Spices, Sauces, Spreads, Cooking Aids
Serial includes condiments and cooking aids many being important for adding variety to meals and beverages. Tea and coffee for instance are included in this serial. They are provided as a list with no limits on ordering except for budgetary constraints. Some products may contain high levels of sodium and should be limited to very small amounts.

Modules of extra energy definitions

Module A
Sufficient number of serves from serial 7a and/or 7b (Extras general and Extras high carbohydrate) to provide 1 MJ
1 MJ average 7a + 7b ~ 2.2 g protein, 5.2 g fat, 47 g carbohydrate

Module B
Sufficient number of serves from serial 7b (Extras high carbohydrate) to provide 1 MJ
1 MJ 7b ~ 0.7 g protein, 0.3 g fat, 62 g carbohydrate

Module C
Sufficient number of serves from serials 3a, 3b, 4 and 5 (Starchy & Orange Vegetables, Fruit, Bread, Cereals Rice Pasta Noodles) to provide 1MJ
1 MJ average S3a + S3b + S4 + S5 ~ 6.2g protein, 1.4 g fat, 46 g carbohydrate

Module D
Sufficient number of serves from serials 1a, 2e and 7c (Low Fat Dairy, Legumes, Extras Milks and supplements) to provide 1 MJ
1 MJ average S1a + S2e + S7c ~ 13 g protein, 4.7 g fat, 37 g carbohydrate

Module E
Sufficient number of serves from serials 1b, 1c, 2c and 6b (Mid & High Fat Dairy, Eggs and Nuts) to provide 1 MJ
1 MJ average S1b + S1c + S2c + S6b ~ 16 g protein, 18 g fat, 4.3 g carbohydrate

Module F
Corresponds to Serials 3c and 3d (darker green and other vegetables)
Use as desired to increase the variety of food provided at higher catering levels.
NO LIMITS because want to encourage use.
1 MJ average S3c + S3d = large volume of vegetables 1 MJ ~ 16 g protein, 3.5 g fat, 26 g carbohydrate, 19 g fibre

Fresh Food Scale

Serial	basic and alternative items	Weekly Scale mL/g
1	milk and milk products and alternatives	
1a	low fat dairy	
	Fluid Milk or Ca Fortified Soy Beverage - Reduced Fat/Skim/Nonfat	2000
	Milk Powder Dry - Non Fat/Skim	240
	Yoghurt, Fruit or Plain or Cultured Buttermilk- Reduced Fat/Skim/Low Fat	1600
	Milk, Evaporated, Undiluted – Reduced Fat/Skim/NonFat	1000
	Custard, made on reduced or non fat milk/reduced fat commercial	2000
1b	mid fat dairy	
	Fluid Milk or Ca Fortified Soy Beverage – Whole/Full Fat (4%)	2000
	Milk Powder Dry - Whole/Full Fat	240
	Yoghurt, Fruit or Plain – Whole/Full Fat	1600
	Milk, Evaporated, Undiluted – Whole/Full Fat	1000
	Custard, made on whole or full fat milk/full fat commercial	2000
	Cheese Hard or Processed– 25% Fat Reduced –e.g. cheddar, gouda, tasty, mozzarella	320
	Cheese Soft/White–e.g. neufchatel, bocconcini,	800
	Cheese Curd–e.g. ricotta	1000
1c	high fat dairy	
	Cheese Very Hard – e.g. parmesan, romano	240
	Cheese Hard – e.g. cheddar, gouda, tasty, mozzarella, smoked	320
	Cheese Soft –e.g. havarti, brie, camembert, bluevein	480
	Cheese Soy	480
	Cheese Feta – Low Salt	640

Serial	basic and alternative items	Weekly Scale mL/g
2	Meat and alternatives	
2a	Red Meat Beef, Lamb, Veal, Kangaroo, Liver, Kidney - Boneless - Lean – Fat trimmed Raw Weight	830
2b	Pork/Chicken/White Meat Pork, Chicken, Turkey, Rabbit, Ham, Bacon - Boneless - Lean – Fat trimmed Raw Weight	830
2c	Eggs	each
	egg – whole	9 x 55 g egg
2d	Fish	
	Prawn, Oyster, Crab – Without shell Raw Weight	440
	Salmon, Tuna, Sardine - Canned In Water, No Added Salt, Drained	280
	Whiting, Shark, Snapper, Cod, Fish type not specified – Fillets – Boneless – Skinless	360
2e	Legumes	
	Bean, Soy - Curd, Tofu, Tempeh	260
	Bean - Soy, Borlotti, Cannellini, Kidney, Broad, Haricot, Split Pea, Dry Weight	40
	Bean, Soy, Borlotti, Cannellini, Kidney, Broad, Haricot, Split Pea, Cooked or Canned Weight Drained	260
	Beans,Refried, Canned	260
	Baked Beans,Canned In Tomato Sauce,Salt Reduced	260
	Vegetarian Nutmeat/Loaf Meat Substitute-Based, Soy Bean-Based	260

Serial	basic and alternative items	Weekly Scale mL/g
3	Vegetables	
3a	starchy vegetables	
	Potato, Sweet Potato, Parsnip - Without Skin, Ready to use, Raw/Frozen	2400
	Potato, White Sweet Potato, Parsnip - Clean Unpeeled prior to prep	3000
	Potato, Canned, Drained	2400
	Corn off the cob Raw/Frozen Canned, Drained	2400
	Corn, Cream Style, Canned	2400
	Cornmeal, Cooked With Water	2400
	Potato, Instant Mashed, Dry Powder	480
	Cornmeal, Raw	480
3b	orange vegetables	
	Carrot, Pumpkin, Orange Sweet Potato, Red Capsicum - Raw/Frozen, Canned Drained, Without Skin, Ready to use	1200
	Carrot, Pumpkin, Orange Sweet Potato, Red Capsicum - Clean Unpeeled prior to prep	1500
	Carrot Juice,	1200
3c	darker green vegetables	
	Broccoli, Brussels Sprout, Chinese Cabbage, Red Cabbage, Green Cabbage, Silverbeet, Spinach, Green Peas, Sprouts, Asparagus, Snowpea, Green Capsicum, Lettuce, Leek – Raw, Cooked, Frozen, Canned & Drained, Ready to use	1200
3d	other vegetables	
	Swede, Turnip Bean Sprout Celery Beetroot Cauliflower Cucumber Eggplant Green Bean, Butter bean, Mushroom Onion, Shallot, Spring Onion, Squash Zucchini – Raw, Cooked, Frozen, Canned & Drained, Ready to use	1200
	Juice, Celery, Beetroot, Mixed vegetable, Tomato	1200
	Avocado, Raw	1200
	Tomato,Sun Dried	240
	Onion,Dehydrated	240
	Tomato Paste,No Added Salt	400

Serial	basic and alternative items	Weekly Scale mL/g
4	Fruit	
	Fruit, Dried, Raw	725
	Fruit, Canned, Drained	3600
	Fruit, Stone, Pomme, Tropical e.g. mango, paw paw, pineapple, Raw, Peeled ready to eat	3600
	Fruit juice	3600
	Banana, Common, Raw, Peeled, Ready to eat	2400
	Berry ,Raw, Frozen, Canned & Drained	4350
	Passionfruit, Pulp, Raw Canned	2400
	Grape, Black Green, Raw – Ready to eat	2900
	Fruit Citrus Raw, Canned & Drained, Peeled and ready to eat	4350
	Fruit, Melon, Raw Peeled ready to eat	4800

Serial	basic and alternative items	Weekly Scale mL/g
5	Bread cereal rice pasta noodles	
	Bread, White, Wholemeal, Fruit, Mixed Grain, Naan, Pizza Base, Pumpernickel, Rye, Sour Dough, Souvlaki, Crumpet, English Muffin, Bagel, Scone, - Roll, Slice, Flat etc	3200
	Breakfast Cereal, Whole Wheat, Bran, Corn, Rice Biscuit, Flake, Puffed, Untoasted Muesli,	2400
	Oats, Semolina, Polenta, Raw or Instant, Uncooked, Dry	2400
	Porridge Semolina, Cooked,	9700
	Rice, White, Brown, Raw	4000
	Rice, White Brown, Cooked, No Added Salt	9700
	Pasta, Noodle, Regular, Wholemeal, White, Gluten free, Egg, Asian, Dry	4000
	Pasta, Noodle, Regular, Wholemeal, White, Gluten free, Egg, Asian, Cooked & Drained, No Added Salt	9700
	Rice Cake,Puffed	25
	Biscuit, Cracker Savoury, Crispbread, Wholemeal, Rice Commercial	25
	Flour, Wheat, White, Wholemeal, Arrowroot, Cornflour, Rice, Plain Self-Raising, Dry Scone Mix	30
	Grains, Barley, Millet, Couscous Dry Raw	50
	Grains, Barley, Millet, Couscous Cooked, No added salt	120
6	Polyunsaturated Fats and Nuts	
6a	Polyunsaturated fats and oils	
	Oil,Polyunsaturated,Blended	280
	Margarine,Polyunsaturated,Reduced Salt	280
6b	Nuts and seeds	
	Brazil Nut Cashew Almond Macadamia Hazelnut Peanut Walnut Unsalted, Raw, Dry Roasted, Shelled ready to eat	70
	Tahini, Sesame Butter	70
	Peanut Butter, , No Added Sugar	70
	Seed, Pumpkin, Sesame Sunflower Kernel, Raw Unsalted	70

Serial	basic and alternative items (needs more work)	Weekly Scale mL/g
7	Extra Foods Weekly Scale applies to group as total	
7a	Extras – general	
	Ice Cream and ice confections	1400
	Biscuit,Plain,Sweet,	420
	Chocolate,Milk,Dark,With/Without Nut/Fruit/Fillings,Chocolate bars	385
	Biscuit,Fancy Sweet	385
	Biscuit,Savoury,	385
	Cake,Iced,	490
	Cake,Fruit,Rich	490
7b	Extras - High carbohydrate	OR
	Sports Drink,Ready-To-Drink,All Flavours	3500
	Cordial base,citrus fruit juice high(>40%),regular	1050
	Boiled Lolly, Confectionery sugar/nougat/jelly	700
	Topping,Chocolate	700
	Jam,Fruit spreads	840
	Honey,All Types	700
	Sugar,Brown, Raw, White	560
	Jelly Crystals,All Flavours	560
	Sports Drink Base,All Flavours	560
7c	Extras - Milks and supplements	OR
	Ready to Drink RTD [Oral Supplement]	1540
	Beverage Flavour Mix,Unfort,W/Milk Solids&Sugar,Choc	560
	Sports Supplement Powder,High Ptn&Energy,Chocolate	560
	Milk, Flavours,Commercial	2450
	Milk,Sweetened Condensed,Skim Undiluted	700
7d	Extras - Fats and Oils	OR
	Cream,Pure(Fat>35%)	490
	Butter,Reduced/No Salt	280
	Oil,other or Mayonnaise	280

Serial	basic and alternative items	Provided as list or SRA sheet with no particular limits on ordering except for budget constraints
8	Culinary Adjuncts - Herbs, Spices, Sauces Spreads, Cooking aids	
	Baking Powder	
	Yeast,Compressed	
	Pepper,Black/White	
	Curry Powder/ other spices	
	Vinegar	
	Custard Powder,Dry	
	Sauce,Tomato,Barbeque, Chili, Bottled,No Added Salt	
	Gravy Powder,Salt Reduced,Dry Mix	
	Garlic,Raw/ other herbs	
	Gelatine,Dry	
	Pickle,Mustard,Sweet,	
	Chutney,Fruit	
	Flour,Arrowroot	
	Junket,All Flavours,From Tablet,With Added Milk	
	Vegemite [Yeast extract]	
	Tea,black,brewed from leaf/teabags,regular	
	Coffee,instant,regular,dry powder	
	Cocoa, powdered	

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Military rations, nutrition, nutritional requirements, food

19. ABSTRACT

ADF members are fed according to the entitlements stipulated in SUPMAN 4 and NAVSUPMAN 5. The entitlements are aimed at meeting the 'worst case' situation, the nutritional requirements of young, active, males. Because not all ADF members are equally active, and females generally have lower nutritional requirements than males, there is the potential for more food to be made available than is needed. DSTO was requested to devise ration scales that more efficiently satisfy the demonstrated nutritional requirements of ADF members. The results of doubly-labelled water studies to determine the energy expenditures of ADF members were used to devise Military Recommended Dietary Intakes (MRDIs) applicable to four sub-groups of ADF members-adult males, adult females, adolescent males and adolescent females-also taking into account five levels of physical activity. An adaptation of a program used to assess the draft Nutrient Reference Values (NRVs) for Australia and New Zealand was then used to determine food entitlements to meet the MRDIs.

The revised ration scales provide 12.5, 14.5, 16.5, 19.5 and 25 MJ per person per day respectively for five activity categories (denoted Level 1 to 5, respectively). The basic scale meets the energy requirement for troops working at Level 1, and the micronutrient requirements of troops working at Level 1, 2, 3 and 4. Additional food is provided in the form of 1-MJ food modules which can be issued as Morning Tea, Afternoon Tea and / or Supper. The new ration scales will ensure that troops are fed according to their nutritional requirements. This has the potential to reduce wastage and to impact positively on nutritional status of ADF members, including reduced levels of overweight / obesity, together with the flexibility to allow caterers to better meet the nutritional requirements of the group of defence personnel being fed.