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MATERIALS RESEARCH LABORATORY

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TECHNICAL NOTE

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LABORATORY EVALUATION OF AUSTRALIAN RATION PACKS

K. W. James, M. J. Lichon, P. J. Tattersall,
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CORRIGENDA

p3 5th paragraph, p4 4th paragraph, p5 1st and 6th paragraphs should read "The energy content (Table 3).." not (Table 4).

p4 4th paragraph should read "They were deficient by 300-2000kJ.." not 200-2000kJ.

p5 1st paragraph should read "but they were deficient by 600-1200kJ for a grade 2 activity (NH & MRC, 1984)." not 1400-3000kJ and the following sentence "These revised menus were lower in energy than their predecessors (James et al, 1986) by about 600kJ." should be deleted.

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ABSTRACT

Results of chemical and microbiological analysis of the 1985 packaging program are presented. The contents of moisture, fat, protein, carbohydrate, salt, ascorbic acid, niacin and energy of rations are included. The content of thiamin, riboflavin, sodium, phosphorus, calcium, magnesium, iron, copper, zinc, lead and cadmium in the Individual Meal Combat Ration are also evaluated. Daily available nutrients are estimated and compared to daily requirement. Some rations were found to have an excessive protein and salt content. Combat Ration Ten Man, Patrol Ration One Man and Patrol Ration Papua-New Guinea were found to be energy deficient. Individual Meal Combat Ration was found to be deficient in calcium, magnesium and copper. It was also found that certain components have not been fortified with the vitamins thiamin, riboflavin, niacin or ascorbic acid.

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1. INTRODUCTION

Previous reports (see James, Lichon, Tattersall, Thomson and Hancock, 1986 for last in series) have detailed the results of analysis of ration packs from preceding packaging programs. This report details the results obtained by analysis of complete packs of the 1985 packaging program.

A sample of each ration component was analysed for moisture, fat, protein, ascorbic acid, niacin, and salt. The value for carbohydrate was estimated from the carbon content after adjusting for fat and protein. Energy values in kilojoules (kilocalorie = 4.186 kilojoules) were calculated from the values recommended by Thomas and Corden (1977), Table 1. The Individual Meal Combat Ration (IMCR) was also examined for thiamin (vitamin B1), riboflavin (B2), sodium, phosphorus, calcium, magnesium, iron, copper, zinc, lead, and cadmium. The rations prepared at Materials Research Laboratory — Tasmania (MRL-Tasmania) were examined for microbiological quality.

These evaluations are based on the nutritional requirements stated in the Army Staff Requirement, No. 69.1, Operational Rations (Director of Logistic Development, 1983). These requirements are those of a Reference Man as described by the National Health and Medical Research Council (NH & MRC, 1984). The Reference Man is 70 kg and has the requirements for various grades of activity listed in Table 2.

2. METHODS OF ANALYSIS

The determination of protein, carbohydrate, ascorbic acid, niacin, fat and salt were undertaken according to the same procedures as used in previous reports (James and Forbes-Ewan, 1984a).

Carbohydrate determination in jams followed the classical method of using the difference between 100 and the total percent composition of moisture, fat, ash and protein. Protein and ash determination in jams also followed the classical method as described in *Official Methods of Analysis of the Association of Official Analytical Chemists* (AOAC, 1980). Fat was determined in sweetened condensed milk according to the enzymatic hydrolysis method (Lichon, Tattersall and James, 1987).

Thiamin and riboflavin were determined simultaneously using the HPLC method based on the procedure of Wehling and Wetzel (1984). The mobile phase (30 methanol/ 69 water/ 1 acetic acid/ 0.005M sodium hexane sulphonate) was adjusted to a pH of 4.6 ±0.05 with sodium acetate (3M). Riboflavin was detected first with a Hitachi F-1000 Fluorimeter set at 450 nm excitation and 525 nm emission. Thiamin was detected after post-column derivatization to thiachrome with a Jasco FP-110 Fluorimeter fitted with UV 300 nm cut-off filter on the excitation side and emission was detected at 444 nm.

The elements sodium (Na), phosphorus (P), calcium (Ca), magnesium (Mg), iron (Fe), copper (Cu), zinc (Zn), lead (Pb) and cadmium (Cd) were determined by Labtam 8410 Plasmascan inductively coupled plasma atomic emission spectrometer (ICP-ES) after digestion with sub-boiling distilled nitric acid and 'AristaR' perchloric acid and making to volume with 5% sub-boiling distilled nitric acid. Standard reference materials (USNBS Bovine liver or USNBS Orchard leaves as appropriate) were included with each run of determinations to verify precision and accuracy for each metal reported. In a recent proficiency test by the National Association of Testing Authorities (NATA, 1987) for phosphorus, calcium, sodium, copper, iron and magnesium in food the MRL-Tasmania results were within one standard deviation of the consensus mean.

3. RESULTS

The total nutrients found in each of the rations Combat Ration Ten Man (CR10M), Combat Ration One Man (CR1M), Patrol Ration Papua-New Guinea (PRPNG), Patrol Ration One Man (PR1M) and Individual Meal Combat Ration (IMCR) are summarised in Table 3. Results for individual components are presented in Appendix A. This is the first evaluation of the IMCR and this was the first procurement of the ration.

The percent distributions of energy derived from fat, protein, and carbohydrate for each of the rations CR10M, CR1M, PRPNG, PR1M and IMCR are summarised in Table 4.

The total of the elements sodium (Na), phosphorus (P), calcium (Ca), magnesium (Mg), iron (Fe), copper (Cu) and zinc (Zn) and the vitamins thiamin and riboflavin found in the Individual Meal Combat Ration (IMCR) are summarised in Figures 1 to 6. Results for thiamin and riboflavin in individual components are presented in Appendix A. Results of the elemental analysis for individual components are presented in Appendix B. Copper, zinc and cadmium concentrations were close to detection limits for the equipment (ICP-ES).

4. DISCUSSION

4.1 *Nutritional Evaluation*

4.1.1 *Combat Ration Ten Man (CR10M)*

The detailed results of chemical analysis of CR10M are listed in Appendix A. Tables 3 and 4 summarize the total nutrients available in each menu of the CR10M. The estimated contribution from the supplements, bread, rice and survival biscuits, when supplied according to the ration scale, are listed for moisture, salt, energy, and the nutrients fat, protein and carbohydrate.

There was insufficient energy in the basic packs for the B and C menus, i.e. without any supplement, for a grade 0 (basal) level of activity (NH & MRC, 1984). The CR10M is known to have been issued to significant numbers of users without the cereal supplement (Forbes-Ewan and Waters, 1987). Therefore, all such users would be in serious energy deficit. The energy content of the B and C menus including the various supplements (100,700 — 107,700 kJ) was marginally inadequate for a grade 1 level of activity (11,600 kJ per man day) and was not sufficient for grade 2 activity in any of the menus. If these rations were used for an extended period then there would be a need to increase the supplementary issue for users engaged in grade 2 level of activity. However, it is unlikely that the users of this ration would use them for an extended period at a grade 2 level of activity. Normal usage of these rations is for periods of up to 7 days and generally less than 10 days (Personal communication, MAJ McJames, 1988). If these rations were to be used for the prescribed 42 days in an operational situation, then there will be serious nutritional deficiencies arising in the user group by the 20th to 30th day. It is recommended that the ration scale should provide for a double issue of the cereal supplement for any users receiving the ration whilst undertaking arduous duty. Furthermore, users receiving the ration for an extended period (in excess of 20 days) should also receive a double issue of cereal supplement. Forbes-Ewan and Waters (1987) suggest the provision of a supplementary pack consisting of highly acceptable foods such as cheese, dried fruit, sweet biscuits and confectionery.

Table 4 presents the distribution of the energy content derived from fat, protein and carbohydrate in each version of the ration. The proportion of energy derived from protein was greater than requirements in each of the menus. A desirable level is between 10 and 12% of energy derived from protein (NH & MRC, 1984). The addition of any one of the supplements does improve this aspect but the best achieved (rice with the D ration) only lowers the proportion of energy from protein to 14.5%. The proportion of energy derived from protein (Table 4) has marginally increased, relative to the previous procurement, at the expense of fat and carbohydrate. However, the D and E menus derive more energy from carbohydrate than the other three menus. It would be desirable to reduce the proportion of meat in favour of cereals in some components. Alternatively, the cereal supplement could be increased. Doubling the rice supplement would reduce the proportion of energy derived from protein to 13.3% with the D ration, while doubling the bread supplement would reduce it to 15.2%. This is supported by users of the ration, who would like to receive more cereal suplement (Forbes-Ewan and Waters, 1987). The inclusion of cheese in a supplementary pack as suggested by Forbes-Ewan and Waters (1987) would add to this problem. However, the provision of dried fruit, sweet biscuits and confectionery would also reduce the proportion of energy derived from protein.

As is shown in Table 3 there was a substantial surplus of the two vitamins determined for this evaluation. The ascorbic acid concentrations were generally lower than for the last evaluation (James *et al*, 1986). The level of vitamins in the ration can be expected to deteriorate with age, particularly the concentration of ascorbic acid. Thus, the rations will be considerably lower in ascorbic acid when they are consumed.

The salt content, as shown in Table 3, would be considered excessive for all versions of the ration by civilian health authorities. The maximum recommended intake of salt is 5.8 g per adult per day (NH & MRC, 1984; Bullock, 1982; Forbes-Ewan, 1986). The salt content of each of the versions of the ration was four times and approached five times this recommended maximum daily intake. However, there is need for increased salt during acclimatisation to working in a hot environment (Forbes-Ewan, 1986) such as occurs after transfer to northern Australia. To make adequate provision for this circumstance the allowance is raised to 15 g per day per man. Forbes-Ewan (1986) recommends the provision of 14 g of discretionary salt per man (i.e. 140 g per pack) in each of the rations and gradual reduction of salt in various items. Forbes-Ewan and Waters (1987) recommend reduction of salt in all "wet meals" to less than 1%. The salt content was, in general, marginally higher than in the previous evaluation, however, there are no cases of failure with respect to salt specifications.

Table 5 lists 27 items found to contain more than 1% salt, which is considered an adequate level for flavour and acceptability of main meal components (meat and vegetables). The brines are normally discarded when Army cooks prepare the ration for consumption, but untrained unit cooks may use the brines in their cooking. As shown in Table 5, they were relatively insignificant contributors (1.3 - 6.8%) to total salt. Salt in "Vegemite" can not be reduced as this salt is necessary for the safe storage of this item, it is also a relatively insignificant contributor. A significant reduction could be achieved by reformulating the soup powders, leg ham, corned beef, spaghetti and ground meat, beef and tomato puree, beef and vegetable curry, beef and beans and luncheon meat with less salt. There is considerable support among users (49.3%) for less salt generally in the ration (Forbes-Ewan and Waters, 1987). The pork meals were particularly identified as being "too salty". However, there are problems in making large reductions due to the natural salt in components such as milk, and the requirements for acceptable flavour.

4.1.2 Combat Ration One Man (CRIM)

The detailed results of chemical analysis of CRIM are listed in Appendix A. Table 3 summarizes the total nutrients available in each menu of the CRIM.

The energy content (Table 4) of the ration shows little variation compared with the previous evaluation. There was excess energy in all the menus for a grade 2 level of activity. If these rations were used for an extended period then the user is likely to be highly stressed and is likely to be approaching a grade 3 level of activity at times through the demands of combat operations. Therefore, the energy level in these menus is considered acceptable. However, the latest survey of user acceptability of CRIM (Forbes-Ewan and Waters, 1986) shows that 83% of users discard at least one item. The four most commonly discarded items (4-7% of users), Butter Concentrate, Butterscotch, Cereal Block and Biscuits Survival are common to all menus and contribute 960, 840, 1080 and 1640 kJ of energy respectively. In each case discarding one item will still leave of the order of 13,000 kJ, which will meet the demands of a grade 2 level of activity. However, if all these items were discarded there would be a reduction of 4,500 kJ in energy leaving less than 10,000 kJ, insufficient for grade 1 level of activity and barely sufficient for basal needs. The 1987 procurement of CRIM implements most of the recommended changes (Forbes-Ewan and Waters, 1986).

Table 4 presents the distribution of the energy content derived from fat, protein and carbohydrate in each version of the ration. The proportion of energy derived from protein was within the desirable range of 10 to 12% in all cases except menu C. However, three of the four most commonly discarded items Butterscotch, Cereal Block and Biscuits Survival (Forbes-Ewan and Waters, 1986), each contribute between 7 and 14% of the carbohydrate content of the ration. The most commonly discarded item, Butter Concentrate, contributes around 16% of the fat. It can be expected that a user will regularly discard the same items, increasing the chances of nutritional imbalance.

As is shown in Table 3 there was a substantial surplus of the two vitamins determined for this evaluation, suggesting that there is an improvement in this aspect over the previous evaluation of CRIM (James *et al*, 1986). The improvement in this area is largely due to items meeting specification which have failed in previous evaluations, in particular the soup and gravy bases and coffee. The level of unstable vitamins in the ration can be expected to deteriorate with age, particularly the concentration of ascorbic acid. These rations were the last to arrive and ascorbic acid concentrations may have been much higher at procurement.

The beverage base powders (lemon, lime and orange), which have been identified as unacceptable by at least 10% of users (Forbes-Ewan and Waters, 1986), provided about a third of the ascorbic acid in the ration.

This must be regarded with concern as at least 3.5% of users discard these items (Personal communication, Waters, 1986). New beverage base powders were procured in 1987.

The salt content (Table 3) of the ration showed little variation compared with the previous evaluation. The salt content is still considered excessive (greater than 15 g) and should be reduced through reformulation of some components, particularly, the meat items and soups in menus D and E (Table 6). The latest survey of user acceptability (Forbes-Ewan and Waters, 1986) cites four items (Table 6) as being perceived by more than 9% of users as "too salty". These items correspond with items listed (Table 6) as having a high percentage of salt and should be considered priority items for reducing salt in their formulation. The items with the most salt are the soup bases in menus D and E and are described as "too thin" or "weak" by users. Over a third of the formulation is salt which must be regarded as excessive.

4.1.3 Patrol Ration Papua-New Guinea (PRPNG)

The detailed results of chemical analysis of PRPNG are listed in Appendix A. Table 3 summarizes the total nutrients available in each menu of the PRPNG.

The energy content (Table 4) was sufficient in all the menus for a grade 1 level of activity. They were deficient by 200-2000 kJ for a grade 2 level of activity. However, this ration is designed to be supplemented with the products of foraging, which is intended to make up this deficiency. This ration is a modified version of the CRIM and thus acceptability studies of the CRIM would be relevant to the PRPNG, when used by Australian servicemen. The latest survey of user acceptability of CRIM (Forbes-Ewan and Waters, 1986) shows that 83% of Australian users discard at least one item. The most commonly discarded items are Butter Concentrate (B and C PRPNG) and Biscuits Survival (common to all PRPNG) which contribute 827, and 1602 kJ of energy respectively. In each case discarding one item will still leave of the order of 10-11,000 kJ, which will not meet the demands of a grade 1 level of activity. If both of these items were discarded there would be a reduction of 2000 kJ in energy leaving only around 9-10,000 kJ, insufficient for grade 1 level of activity. Replacement of this energy by foraging could divert the user from his main operational objective for too long.

Table 4 presents the distribution of the energy content derived from fat, protein and carbohydrate in each version of the ration. The proportion of energy derived from protein exceeded the desirable maximum of 12% in all cases. However, the products of foraging such as fruits would reduce this proportion to within the normal range. The proportions of energy from fat was less than 30% in most cases, which is in keeping with the recommendation (less than 35%) of the Director-General, Public Health Division (Anon, 1982).

As is shown in Table 3 there was a substantial surplus of ascorbic acid in the rations, but this can be expected to deteriorate with age, particularly if they are stored in tropical conditions. B and C menus have more than double the ascorbic acid of the A and D menus due to the inclusion of fruit candy. This has been shown to have the best storage performance for ascorbic acid (James *et al*, 1986). It is recommended that fruit candy or another ascorbic acid fortified confection be included in the A and D menus.

The niacin content was only just adequate to meet the needs to metabolize the energy present in the ration. The results of foraging would help supplement the vitamins present in the ration.

As shown in Table 3, the salt content was close to the planned 15 g (Forbes-Ewan, 1986). However, most users of this ration should already be acclimatized to a hot environment and this salt content would be considered excessive by many public health authorities. It is recommended that consideration be given to reducing salt in this ration.

4.1.4 Patrol Ration One Man (PRIM)

This was the first procurement of PRIM with the revised menus and reformulated meals. The number of menus has been increased to five and each of them adjusted to correct imbalances noted in previous reports. The detailed results of chemical analysis of PRIM are listed in Appendix A. Table 3 summarizes the total nutrients available in each menu of the PRIM.

There was sufficient energy (Table 4) in the menus for a grade 1 level of activity, but they were deficient by 1400 to 3000 kJ for a grade 2 activity (NH & MRC, 1984). These revised menus were lower in energy than their predecessors (James *et al*, 1986) by about 600 kJ. If these rations were used for an extended period then there would be a need to supplement the ration with emergency ration (chocolate) or with the results of foraging to sustain a grade 2 level of activity. It is recommended that this ration should be supplemented by the inclusion of an additional package of either jam filled biscuits, shortbread biscuits or chocolate to eliminate dependence on foraging while using this ration.

The proportion of energy derived from protein (Table 4) has been dramatically reduced in these revised menus. There is an imbalance between menus C (18.9% from protein) and D (13.2% from protein). It is planned to swap the Beef & Noodles in PRIM C with Veal Italienne in the PRIM D. The energy from protein was still excessive but the new formulations are a considerable improvement over the old formulations. They were much more consistent with the proportion of energy from protein in the other combat rations. There will be a lower demand for water to process the surplus protein in these revised menus. The proportion of energy derived from fat was also well below 30% in most rations. There would be some opportunity for increasing the energy content by increasing the proportion of fat in the main meal items. This is in accord with the recommendation (less than 35% of energy from fat) of the Director-General, Public Health Division (Anon, 1982). Inclusion of an additional package of either jam filled biscuits, shortbread biscuits or chocolate would help correct the imbalance in the proportions of energy from protein, fat and carbohydrate.

The level of ascorbic acid and niacin has been reduced. The reduction in ascorbic acid is due to the fortified items being generally lower than in the last evaluation, which has been offset in some menus by the main meal item containing significant ascorbic acid. The reduction in niacin is partly due to the lower net weight of main meal items and partly due to reformulation of the meals. None of the fortified tiems in the PRIM have been found to fail their vitamin specifications. There was a substantial surplus of the two items determined. The level of vitamins in the ration can be expected to deteriorate with age, particularly the concentration of ascorbic acid.

The salt content (Table 3) of the ration showed a small reduction over previous years which is considered to be due to reformulation of individual components. The salt content was close to the planned level of 12 to 15 g and no further reduction is required through reformulation of some components. However, one item (Tuna & Rice) failed specification with respect to salt.

4.1.5 Individual Meal Combat Ration (IMCR)

The IMCR has been designed as a substitute meal when fresh rations are not available. They are expected to be used only in conjunction with fresh food from base kitchens, canned equivalents, or the CR1OM ration. They have not been designed for use as a sole source of food for an extended period. Therefore, evaluation of the nutritional quality must be in terms of these perceived requirements. The results of chemical analysis of the individual components are listed in Appendices A and B. Table 3 and Figures 1 to 6 summarize the total nutrients in each menu of the ration.

The energy content (Table 4) was of the order of one third of daily needs and would be an adequate replacement for any of the fresh meals. The proportion of energy derived from protein (Table 4), varied from 9.1 to 16.3%, which is in keeping with the broad usage envisioned. The broad range of protein content was due to the wide range of protein concentration in the main meal items (6.7-13.2%, Appendix A). It is recommended that consideration be given to reformulating the main meal items to narrow the range of protein concentration. The proportion of energy derived from fat was 30% or less, which is in keeping with the recommendation (less than 35%) of the Director-General, Public Health Division (Anon, 1982).

The vitamin content was less than planned due to the failure to fortify the main meal items to specification. However, many of the main meal items had substantial vitamin concentrations naturally present. A trial is being undertaken to evaluate the storage stability of vitamins in these components.

Ascorbic acid content (Figure 1) was between 150 and 200% of daily requirement. However, it may not be enough to cover storage up to two years. The trial to evaluate the storage stability of vitamins will provide a better assessment. The total ascorbic acid in the rations followed the same pattern as the total sodium in the rations as shown in Figure 1.

Niacin content (Figure 2) exceeded the requirement to metabolize the food for energy. As niacin is considered stable and some may be derived from tryptophan in the protein (NG & MRC, 1984); there is probably no need to fortify main meals with niacin. Therefore, it is recommended that niacin fortification of these meals be deleted from specifications. The total niacin in the rations followed the same pattern as the total iron in the rations as shown in Figure 2.

Riboflavin content (Figure 3) was around twice the expected requirement to metabolize food for energy. As riboflavin is generally stable to heat and is well protected from ultra-violet light by the can, there is probably no need to fortify the main meals with riboflavin. Therefore, it is recommended that riboflavin fortification of these meals be deleted from specifications.

Thiamin content (Figure 4) ranged from 0.46 mg (below the requirement) to 3.7 mg (five times the requirement to metabolize food to energy). However, thiamin is known to be heat labile (Forbes-Ewan, 1981) and there is likely to be a serious decline in concentration of thiamin during storage. Thus, the ration is likely to be deficient in thiamin after 2 years storage. The trial to evaluate the storage stability of vitamins will provide a better assessment. Total thiamin followed the same pattern as total magnesium and total copper in the rations (Figure 4). Both copper and thiamin are involved in energy metabolism.

The salt content (Table 3, Figure 1) exceeded one third of total daily needs but would be an acceptable compromise with the requirements of manufacturing technology and the wide variety of operational requirements. It is consistent with up to 15 g salt being available for acclimatization needs (Forbes-Ewan, 1986). However, there is no provision for salt to be taken at the discretion of the user.

The sodium content was higher than that indicated by the salt content (Table 3, based on chloride) by 8 to 16% (Figure 1). This ration is expected to be used to replace a main meal which can be expected to be richer in sodium than snack meals or breakfast. Thus, the user could offset this sodium intake with lower intakes at the other meals. It further emphasises the consequences of the inability of the user to control salt intake with this ration, through the use of discretionary salt as is possible with other rations.

Total phosphorus (Figure 5) was in excess of minimum requirements (based on ⅓ RDI). Phosphorus (present as phosphates) is known to interfere in the absorption of copper, zinc and influence calcium absorption (Whitney and Hamilton, 1984). Thus, this excess of phosphates could exacerbate the deficiencies in copper, zinc and calcium. Total phosphorus should follow total calcium, preferably in 1:1 ratio (Whitney and Hamilton, 1984). Figure 5 shows that the pattern for phosphorus does not follow that for calcium. Menu A has a calcium to phosphorus ratio of 1:5, which is outside the maximum recommended range of 1:3 (Whitney and Hamilton, 1984). Only menu E has a ratio close to 1:1.

Total calcium (Figure 5) was substantially less than the recommended intake (⅓ RDI) in all menus except menu E. The only dairy product present in the ration is sweetened condensed milk, which contributes 41-46% of calcium in menus A, B, C and D. T .e additional calcium in menu E was found in Lamb & Vegetables with Rosemary. It is recommended that consideration be given to ensuring that other food sources used with the IMCR will supplement the calcium intake.

Total magnesium (Figure 4) was at least 20% below the recommended intake (⅓ RDI). Magnesium was also found to be deficient in the CRIM, particularly after discards were taken into account (James, Hancock and Tattersall, 1985). The deficiency in magnesium is probably due to failure to use major sources such as nuts, legumes and green leafy vegetables (Whitney and Hamilton, 1984). It is recommended that consideration be given to ensuring that other food sources used with the IMCR will supplement the magnesium intake.

Total iron (Figure 2) was close to the recommended intake (⅓ RDI). Only menu D was slightly deficient, but this should not be of concern as the iron present should be in an easily absorbed form. Menu C had a total iron approaching toxic level, but this should be offset by lower intake from other food sources.

Total copper (Figure 4) was close to recommended intake (⅓ RDI). Menus B and D are deficient, while menu C had a surplus. These differences would be expected to balance out over an extended period of use, particularly as the ration is designed to be used with other food sources. However, James *et al* (1985) found that there was a deficieny of copper in the CRIM, which could be used at another stage of operations requiring the use of IMCR. Thus, in sustained operations, there may be a serious copper deficiency through the use of IMCR and CRIM at differenct stages. It is recommended that consideration be given to ensuring that other food sources used with the IMCR will supplement the copper intake.

Total zinc (Figure 6) was generally close to recommended intake. Menus D and E were deficient, while menu A has a substantial surplus. These differences would be expected to balance out over an extended period of use. Zinc is mobilised and lost by persons using diets with excessive protein. Menu A had high levels of protein, and zinc (Figure 6). However, menus C, D and E have high levels of protein, and low levels of zinc and on this basis appear to be deficient in total zinc. (Figure 6).

Total lead and cadmium (Appendix B) were much less than the limit set by the NH & MRC (1983) and give no cause for concern.

4.2 Compliance with Australian Defence Force Food Specifications (ADFFS).

Table 7 summarises the items from each ration which fail at least one specification (DPI, 1979). In many cases the failure was in respect of the only specification measurable by chemical means.

These results should not be used to legally enforce compliance as the methods used and the number of items tested are often not those specified by the ADFFS sampling plan (DPI, 1979). Most results relate to only one sample rather than the five required by ADFFS. The results obtained are considered reliable, but are derived for the purpose of nutritional assessment rather than testing for compliance with specifications. However, the method for niacin closely corresponds with the ADFFS method (DPI, 1979). The method for fat can be expected to give higher than normal results. The method for ascorbic acid has been found to be more reliable than the ADFFS procedure (James and Forbes-Ewan, 1984b). The method for thiamin and riboflavin is considered more reliable than the ADFFS procedure. In particular, it has separated thiamin from interfering substances in coffee, which was of concern in the previous report (James *et al*, 1986). The method for moisture, in general, will give a result close to the ADFFS procedure.

A feature of the results with respect to specification is that most of the items noted as failures in the last report (James *et al*, 1986) have not repeated in this report. Only seven (7) items, which were noted in the previous report for failing the specification, also feature in this report.

Four items (muesli bars, chewing gum, lifesavers, and butterscotch) have been procured without a specification. It was therefore, not possible to evaluate compliance with specifications for these items. Butterscotch has in the past been evaluated with the barley sugar specification but has never passed this specification for moisture. Action is in progress to approve a specification for muesli bars.

Table 8 lists the incidence of failures with respect to particular parameters. It is notable that moisture and ascorbic acid were the most common parameters to fail specifications.

4.2.1 Combat Ration Ten Man (CR10M)

Tomato Sauce was examined during procurement and passed the ascorbic acid specification (Personal communication, AGAL Report 8521587, 8521591). The result obtained during the nutritional assessment was half that obtained by Australian Government Analytical Laboratories (AGAL). Therefore, this product has lost ascorbic acid rapidly and warrants further investigation of its storage stability.

Beef & Dumplings also failed the fat specification in the previous report (Table 7). The method used for nutritional analysis is well known for producing a higher result than that to be expected from the ADFFS specified method. Therefore, fat was also determined by the ADFFS method (Soxhlet Method) with a result of 10.15% which also marginally exceeds the specification (10%). It was not tested during procurement.

Beef and Vegetables has failed the moisture specification for the past three years (Table 7). It was also determined by the ADFFS method with a result of 75.56%, which also fails the specification. It has not been examined during procurement.

Chicken & Vegetables and **Lamb with Rosemary** are new items for a new menu (CR10M).

Chicken and Vegetables fails the specification for moisture and vitamins.

Whole Tomatoes has failed consistently with respect to the ascorbic acid specification (Table 7). The analysis shows that most of the ascorbic acid is present in the brine solution and about one seventh present in the fruit. It may be that the ascorbic acid has been added to the brine during filling in the expectation that it will migrate into the fruit during storage. At procurement this item met specification (Personal communication, AGAL Report 851183941), therefore, these results reflect the effect of storage after procurement. The average ascorbic acid content of the tomatoes and the brine is 3.65 mg/100 g (ie 36.5 mg/kg) about 17% of that found at procurement. This suggests that further investigation of the storage stability of ascorbic acid in canned tomatoes is warranted.

4.2.2. *Combat Ration One Man (CR1M)*

Butter Concentrate is also used in PRPNG, both samples fail the moisture specification (Table 7). No samples were taken at procurement, but it is unlikely that there would be any difference from the MRL-Tasmania result. Butter concentrate was noted in the previous report for failing the moisture specification. This product is packaged in tubes, while in the CR10M it is packaged in tins and always meets the specification. Therefore, there may be a problem with respect to either the packaging process or with respect to moisture permeation through the tube packaging material.

Shortbread Biscuits is also used in PR1M. The PR1M sample passed the moisture specification. It was also determined by the ADFFS method with a result of 4.14%, which also fails the specification. It would be necessary to draw more samples in order to gauge the extent of failure according to the specification. This item has not been recently analysed during procurement.

Survival Biscuits have also consistently failed their moisture specification by a substantial margin over several years (Table 7). It was determined by the ADFFS method with a result of 4.45%, which also fails the specification. It is possible that this is a problem brought about by the packaging, but again there are no data on moisture at procurement to assess this aspect. Some evaluation of this problem was undertaken in the last report (James *et al*, 1986) with the conclusion that there may be an increase in moisture content brought about by the permeation of moisture through the packaging material. If this were verified on investigation then consideration should be given to improving the packaging material.

Cheese was also examined according to the ADFFS method with a result of 44.5% for moisture, which meets the specification (Table 7). Therefore, this should not be regarded as a failure to meet the specification. However, it does illustrate that there can be a substantial difference between the result obtained for a nutritional assessment and that obtained for quality control purposes. It was also examined by AGAL (Personal communication, AGAL Report 8506911) with a result close to that obtained using the ADFFS Method.

Luncheon Meat Type II has consistently failed the fat specification during nutritional assessment, when structural or bound fat is included. The ADFFS method will give a lower result as it does not include the amount of bound fat. The product was not sampled during procurement. However, the result obtained by the ADFFS method was 10.85%, which still exceeds the specification.

Sausages & Vegetables was also noted as failing specification for fat in AFFSE Report 1/82, when the result was 9.6% with a limit of 5%.

4.2.3 *Patrol Ration Papua-New Guinea (PRPNG)*

Survival Biscuits: This is the first time that survival biscuits have been low rather than high in the moisture specification. It serves to prove that it is feasible to meet the specification on moisture.

Rice: This is the first occasion when this type of rice has failed to meet the moisture specification. It was also determined by the ADFFS method with a result of 11.6%, which also fails the specification.

Butter Concentrate is also used in the CR1M, where it has also consistently failed to meet the moisture specification (Table 7).

Beef & Vegetables has failed the moisture specification for the past three years in other rations (Table 7). It has not been examined during procurement but this is unlikely to be affected by storage.

Luncheon Meat Type II is also used in CRIM, where it has a history of failing the specification for fat (Table 7). The result by the ADFFS method was 12.7% and still fails the specification.

4.2.4 Patrol Ration One Man (PRIM)

All the freeze-dried components were tested after production for microbiological quality. Two batches of **Beef & Green Beans** failed the Standard Plate Count due to undercooking of the beans. Five batches of **Tuna & Rice** failed the Standard Plate Count due to the high levels from matured cheese. Two batches of **Veal Italienne** failed the Standard Plate Count due to inexperience with the preparation of this meal. None of the batches failing with respect to Standard Plate Count had pathogenic organisms present and were therefore accepted for use. All other freeze-dried meals conformed to specification (DPI, 1979).

Tuna & Rice is a new item for a new menu. The high salt result may reflect the amount of salt incorporated in the canned tuna and therefore, there may be need to review this specification.

Sweetened Condensed Milk replaces milk powder, which showed poor storage performance. It is the same item as is used in PRPNG, IMCR and CRIM. In every case (Table 7) it has failed the fat specification. During procurement it was found to just meet the specification (Personal communication, AGAL Report 8510561). The MRL-Tasmania results are based on a new method specifically developed to overcome problems identified with the ADFFS method, which tends to give a low result, while the old MRL-Tasmania method tended to give high results. It is, therefore, our opinion that this item is consistently failing the specification and that the specified method for fat should be altered to the enzymatic MRL-Tasmania method.

Chocolate is also used in CRIM and PRPNG. The specification states a minimum weight of 55 g. Ration menu sheets specify the weight to be 50 g and the procurement contract specified 50 g. The mean weight of 11 bars was 51.79 g with a standard deviation of 1.33 g. Therefore, this cannot be regarded as a failure of the specification. It is recommended that the chocolate specification be revised to show a weight of 50 g minimum.

4.2.5 Individual Meal Combat Ration (IMCR)

This was the first procurement of the components for the IMCR. The main meal items are new additions to the specifications, which were only available in draft form. In addition, the manufacturer was unable to comply with the vitamin specification for main meal items due to a shortage of vitamin concentrates for fortification.

Chicken & Vegetables, Beef Meatballs with Bacon & Vegetables and **Lamb & Vegetables with Rosemary** fail the moisture specification as well.

Shortbread Biscuits, Sweetened Condensed Milk and **Lime Beverage Base Powder** are the same items as are used for PRPNG, CRIM and the revised PRIM. The lime beverage base powder was noted as failing specification at procurement (Personal communication, AGAL Report 856121, 856128) for ascorbic acid.

Coffee is the same item as that used in PRIM, CRIM, PRPNG and CR1OM. This is the only case in which it fails the moisture specification. This can be attributed to the normal variation of moisture between packets of coffee.

5. CONCLUSION

The nutritional quality, on the available results, appears to have improved on the previous procurement. This packaging program is notable in that the first procurement was undertaken of the IMCR, the new CR1OM E and the revised menus for the PRIM.

The revised menus of the PRIM are a dramatic improvement over the old menus, particularly with respect to protein content.

The energy contents of the CR10M and PRIM menus are inadequate for their intended operational use. The rations CR10M and PRIM are deficient in energy for a grade 2 level of activity. It is recommended that the energy requirement of users of these rations be reviewed. The CRIM menus have an adequate energy content for operational use.

The protein content of CR10M is excessive. The options for reduction of protein in CR10M are currently under investigation.

The salt content of the rations is of some concern. There appears to have been a small reduction in salt in all the rations. The options are being investigated for reducing salt content by reformulation of selected ration components.

The high standard of microbiological quality of items produced at the MRL-Tasmania has been maintained in the 1985 program.

There has been a marked improvement in the proportion of ration items meeting ADFFS specifications. It is probably brought about by a greater level of quality control during procurement. Most of the items found to fail specifications are new formulations and are, in a sense, first production scale trials. Failures must be expected as manufacturers adjust their technology to prepare the revised formulations. This improvement may not be passed on to the user due to loss of quality during storage. The storage properties of vitamins in a range of items is under investigation and will provide a better assessement of levels remaining at consumption. It is also planned to obtain rations currently being issued for determination of the residual vitamin concentration at consumption to verify storage trial data.

6. RECOMMENDATIONS

1 That a double issue of cereal supplement or a supplementary pack of dried fruit, sweet biscuits and confectionery be provided for all CR10M users undertaking arduous duty and all users of the ration in excess of 20 days.

2 That salt concentration should be reduced in CR10M soup powders, leg ham, corned beef, spaghetti and ground meat, beef and tomato puree, beef and vegetable curry, beef and beans and luncheon meat.

3 That fruit candy or another ascorbic acid fortified confection be included in the A and D menus of the PRPNG.

4 That consideration be given to reducing salt in PRPNG and CRIM items.

5 That an additional package of either jam filled biscuits, shortbread biscuits or chocolate be included in each menu of PRIM ration.

6 That consideration be given to reducing the range of protein concentration in IMCR main meal items.

7 That niacin and riboflavin fortification of IMCR main meals be deleted from their specifications.

8 That consideration be given to ensuring that other food sources used with the IMCR supplement calcium, magnesium and copper intake.

9 That the stability of ascorbic acid fortification of whole tomatoes and tomato sauce be investigated.

10 That the tube used to package butter concentrate be investigated for moisture permeability.

11 That the packaging used for survival biscuits be investigated for moisture permeability.

12 That the specification for tuna and rice be reviewed, with respect to standard plate count and salt.

13 That the specification for chocolate be revised to a mass of 50 g.

14 That the energy requirement of users of ration packs be reviewed.

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TABLE 1: Energy per Gram of Nutrient

NUTRIENT	kJ/g
Protein	17
Fat	37
Carbohydrate	16

Source: Thomas and Corden, 1977

TABLE 2: Nutrient Requirements of Reference 70 kg Man per Day

NUTRIENT	REQUIREMENT			
	GRADE 0	GRADE 1	GRADE 2	GRADE 3
Energy kJ	8,800	11,600	13,000	14,400
Protein g (minimum)	70	70	70	70
Protein 12% energy g	—	81	94	111
Ascorbic acid mg	30	30	30	30
Niacin mg	14	19	21	23
Thiamin mg	1.1	1.2	1.3	1.4
Riboflavin mg	1.0	1.4	1.7	1.9
Sodium mg	920-2300	920-2300	920-2300	920-2300
Magnesium mg (1)	320	320	320	320
Phosphorus mg (3)	800	800	800	800
Calcium mg (2)	800	800	800	800
Iron mg	10	10	10	10
Zinc mg	12-16	12-16	12-16	12-16
Copper mg (3)	2-3	2-3	2-3	2-3
Description of Activity	Basal Maintenance	Normal 8 hrs light physical work/day e.g. Clerical	Moderate e.g. Infantry	Strenuous e.g. Labouring

Sources: NH & MRC, 1984, 1 — Dreosti, 1986, 2 — Nordin, 1986, 3 — Whitney and Hamilton, 1984.

TABLE 3: Combat Ration Results — Total Contribution by each Ration

	Net weight g	Water g	Protein g	Fat g	Carbo-hydrate g	Energy Calculated kJ	Salt g	Ascorbic Acid mg	Niacin mg
Combat Ration Ten Man									
Bread Supplement (est.)	2500	975	195	38	1260	25400	32		
Biscuit Supplement (est.)	1300	80	140	192	860	23200	18		
Rice Supplement (est.)	1700	196	111	10	1380	25400	not significant		
Common Items	3600	1770	131	309	1250	33600	98	599	287
Menu A Total	12500	7460	1019	893	2730	94000	201	1480	468
Menu B Total	12600	8220	898	755	2440	82200	220	1860	506
Menu C Total	11900	7770	868	741	2200	77500	215	1370	437
Menu D Total	12400	7370	921	836	3050	95400	208	1880	490
Menu E Total	13200	8050	1075	734	2920	93200	184	2070	706
Combat Ration One Man									
Common Items	594	56	43	103	360	10400	13	43	15
Menu A Total	1180	440	87	127	490	14100	17	91	21
Menu B Total	1180	449	86	113	500	13700	17	165	21
Menu C Total	1220	485	112	127	460	14000	18	167	24
Menu D Total	1200	447	91	147	470	14500	22	96	25
Menu E. Total	1190	421	109	148	470	14800	23	104	25
Patrol Ration Papua-New Guinea									
Common Items	507	35	30	30	380	7800	9	54	11
Menu A Total	949	278	92	82	460	12000	16	58	19
Menu B Total	903	285	78	65	450	11000	14	125	21
Menu C Total	1015	336	112	104	430	12700	16	124	19
Menu D Total	969	297	99	63	470	11600	14	57	23
Patrol Ration One Man									
Common Items	424	26	32	45	300	7000	10	41	16
Menu A Total	713	31	115	94	440	12400	15	85	30
Menu B Total	703	33	111	81	440	11900	14	80	29
Menu C Total	709	31	138	97	410	12400	14	72	35
Menu D Total	703	33	91	75	470	11800	15	91	33
Menu E Total	707	30	105	77	460	11900	15	100	28
Individual Meal Combat Ration									
Common Items	85	8	4	2	70	1300	0.17	17	5
Menu A Total	410	166	38	38	160	4600	3	58	9
Menu B Total	406	177	22	28	170	4200	4	72	14
Menu C Total	409	184	38	23	160	4000	3	43	22
Menu D Total	411	185	30	35	150	4300	4	57	8
Menu E Total	409	182	32	32	160	4200	3	44	19
Recommended Daily Dietary Intake (RDI) per 70 kg Male at									
Grade 2 activity			70-93.8			13,000		30	21
Grade 1 activity			70-81.2			11,600		30	19
Grade 0 activity			70			8,800		30	14

TABLE 4: Combat Ration Results — Percent Energy Distribution

	Protein %	Fat %	Carbo-hydrate %
Combat Ration Ten Man			
Bread Supplement (est.)	13	5	79
Biscuit Supplement (est.)	10	31	59
Rice Supplement (est.)	7	1.5	87
Common Items	7	34	59
Menu A Total (a)	19	35	46
Menu B Total (a)	19	34	47
Menu C Total (a)	19	35	46
Menu D Total (a)	16	33	51
Menu E Total (a)	20	30	50
Combat Ration One Man			
Common Items	7	37	56
Menu A Total	10	34	56
Menu B Total	11	31	59
Menu C Total	14	34	53
Menu D Total	11	37	52
Menu E Total	12	37	51
Patrol Ration Papua-New Guinea			
Common Items	7	14	79
Menu A Total	13	25	62
Menu B Total	12	22	66
Menu C Total	15	30	55
Menu D Total	15	20	65
Patrol Ration One Man			
Common Items	8	24	68
Menu A Total	16	28	56
Menu B Total	16	25	59
Menu C Total	19	29	52
Menu D Total	13	24	63
Menu E Total	15	24	61
Individual Meal Combat Ration			
Common Items	5	7	88
Menu A Total	14	30	56
Menu B Total	9	25	66
Menu C Total	16	21	63
Menu D Total	12	30	58
Menu E Total	13	28	59

(a) Does not include the cereal supplement.

TABLE 5: CR10M Items with Salt Content greater than 1%

MENU	ITEM NAME	Salt %	Salt g	% Salt of Ration Total
A	Beef Noodle Soup Powder	15.5	17	8.7
	Beef and Gravy	1.0	19	9.3
	Pork and Cereal	1.2	17	8.3
	Spaghetti and Ground Meat	1.9	35	17.3
	TOTAL		88	43.6
B	Beef Steak and Kidneys	1.5	28	12.7
	Beef and Beans	1.7	31	14.3
	Luncheon Meat Type 1	2.2	30	13.5
	TOTAL		89	40.5
C	Beef and Vegetable Curry	1.7	26	12.2
	Beef and Tomato Puree	1.8	33	15.3
	Chicken Noodle Soup Powder	14.6	16	7.4
	Corned Beef	1.9	27	12.5
	TOTAL		102	47.4
D	Beef and Dumplings	1.1	20	9.8
	Beef and Vegetables	1.3	23	10.9
	Ham Type II	2.4	33	15.8
	Baked Bean Sauce	1.3	5	2.4
	Pea and Ham Soup Powder	9.4	14	6.9
	TOTAL		95	45.8
E	Salmon Brine	1.3	6	3.5
	Salmon	1.1	15	8.2
	TOTAL		21	11.7
BE	Tomato Soup Powder	11.4	21	10.5
CD	Green Beans Brine	1.1	3	1.3
	Green Beans	1.2	6	2.9
	TOTAL		9	4.2
com	Potato Brine	3.6	14	6.8
	Whole Potatoes	1.2	13	6.6
	Curry Powder	3.8	1	0.5
	Vegemite	10.4	10	4.9
	Tomato Sauce	3.0	7	3.4
	Butter Concentrate	2.6	8	3.7
	TOTAL		53	25.8

% OF TOTAL for common items based on mean salt for 5 menus.

TABLE 6: CRIM Items with Salt Content greater than 1%

MENU	ITEM NAME	Salt %	Salt g	% Salt of Ration Total	% Users* responding "too salty"
A	Beef and Vegetables	1.2	2.7	15.5	
	Ham and Egg	1.5	1.7	10.0	
	TOTAL		4.4	25.5	
B	Pork and Beans	1.4	1.5	8.8	9
	Corned Beef Hash	1.3	2.9	16.6	11
	TOTAL		4.4	25.4	
C	Luncheon Meat Type II	1.9	2.2	12.6	
D	Sausages and Veg	1.2	1.4	6.2	
	Luncheon Meat Type I	2.1	4.7	21.2	9
	Beef Soup and Gravy Base	50.6	3.4	15.2	
	TOTAL		9.5	42.6	
E	Corned Beef Type E	2.6	5.7	25.4	15
	Beef and Egg	1.1	1.2	5.3	
	Chicken Soup and Gravy Base	39.3	2.8	12.4	
	TOTAL		9.7	43.1	
com	Butter Concentrate	2.4	0.7	3.4	
	Shortbread Biscuits	1.1	1.0	5.0	
	Survival Biscuits	1.5	1.4	7.0	
	Cheese	2.5	1.3	6.6	
	TOTAL		4.4	22.0	

% OF TOTAL for common items based on mean salt for 5 menus.
* Source: Forbes-Ewan and Waters, 1986.

TABLE 7: Items failing to meet ADFFS

Ration	Item	Specification Failed	Value of Specification	Result 1985	Result 1983/84	Result 1982/83
CR10M com	Tomato Sauce	Ascorbic	> 66mg/100g	39.0		
CR10M D	Beef and Dumplings	Fat	< 10%	10.3	12.0	
CR10M D	Beef and Vegetables	Moisture	< 73%	74.5	74.6	81.8
CR10M E	Chicken and Vegetables	Moisture	< 73%	77.3		
		Ascorbic	> 30mg/100g	6.3		
	Lamb with Rosemary	Ascorbic	> 30mg/100g	1.5		
	Whole Tomatoes	Ascorbic	> 17.9mg/100g	1.9	9.0	11.7
	Whole Tomato Brine	Ascorbic		12.9		
PRPNG	Survival Biscuits	Moisture	2.5 — 4%	2.4		
	Rice	Moisture	< 10%	11.8		
	Butter Concentrate	Moisture	< 0.3%	0.84		
	Beef and Vegetables	Moisture	< 73%	77.1		
PRPNG D	Luncheon Meat Type II	Fat	< 10%	13.2		
CRIM ABC	Butter Concentrate	Moisture	< 0.3%	0.48	0.53	
CRIM ABC	Shortbread Biscuits	Moisture	2.5 — 4%	4.3		
	Survival Biscuits	Moisture	2.5 — 4%	4.7	4.1	6.2
	Chocolate	Net Weight	> 55g	51.7		
CRIM AB	F.D.Rice	Net Weight	> 55g	54.0		
CRIM A	Beef and Vegetables	Moisture	< 73%	75.0		
CRIM ABC	Cheese	Moisture	< 45%	46.1		
CRIM C	Luncheon Meat Type II	Fat	< 10%	10.4	15.0	11.7
CRIM D	Sausages and Vegetables	Fat	< 7%	8.0		
PRIM	Tuna and Rice	Salt	< 2.54%	3.4		
	Sweetened Condensed Milk	Fat	> 9%	8.7		
PRIM com	Chocolate	Net Weight	> 55g	50.5		
IMCR A	Beef Minced with Tortellini	Ascorbic	> 30mg/100g	0.87		
		Niacin	> 7mg/100g	1.8		
		Riboflavin	> 0.5mg/100g	0.14		
IMCR B	Beef Meat Balls and Sweet & Sour Sauce	Ascorbic	> 30mg/100g	0.00		
		Niacin	> 7mg/100g	0.91		
		Riboflavin	> 0.5mg/100g	0.30		
IMCR C	Chicken and Vegetables	Moisture	< 73%	77.7		
		Ascorbic	> 30mg/100g	0.52		
		Niacin	> 7mg/100g	6.1		
		Riboflavin	> 0.5mg/100g	0.44		
IMCR D	Beef Meat Balls with Bacon & Vegetable	Moisture	< 73%	76.1		
		Ascorbic	> 30mg/100g	0.00		
		Niacin	> 7mg/100g	1.2		
		Riboflavin	> 0.5mg/100g	0.11		
IMCR E	Lamb and Vegetable with Rosemary	Moisture	< 73%	76.6		
		Ascorbic	> 30mg/100g	0.93		
		Niacin	> 7mg/100g	3.0		
		Riboflavin	> 0.5mg/100g	0.35		
IMCR ACE	Shortbread Biscuits	Moisture	2.5 — 4%	4.2		
	Sweetened Condensed Milk	Fat	> 9%	8.7		
	Coffee	Moisture	< 4%	4.2		
		Ascorbic	> 420mg/100g	408		
IMCR CE	Lime Beverage Powder	Ascorbic	> 200mg/100g	161		

TABLE 8: Incidence of Failures to particular Specification Parameters

Parameter	Number of Items Failing
Moisture	16
Fat	6
Ascorbic acid	12
Niacin	5
Riboflavin	5

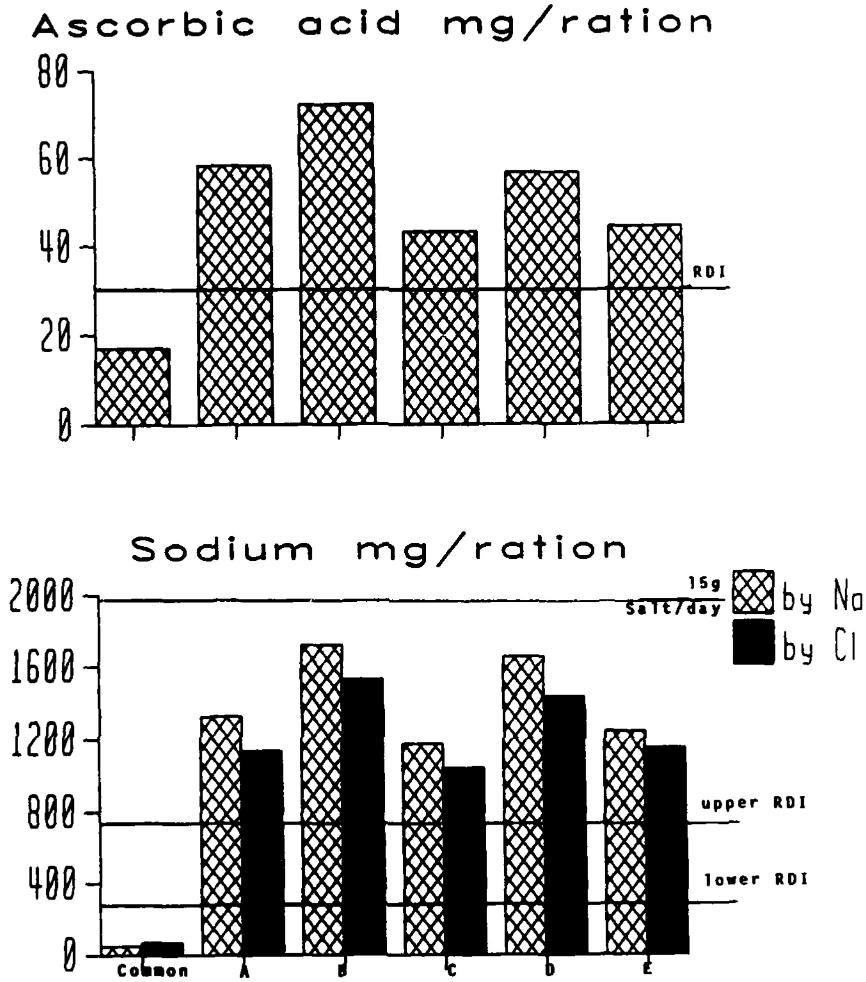

Figure 1: IMCR Ration
Ascorbic acid & Sodium

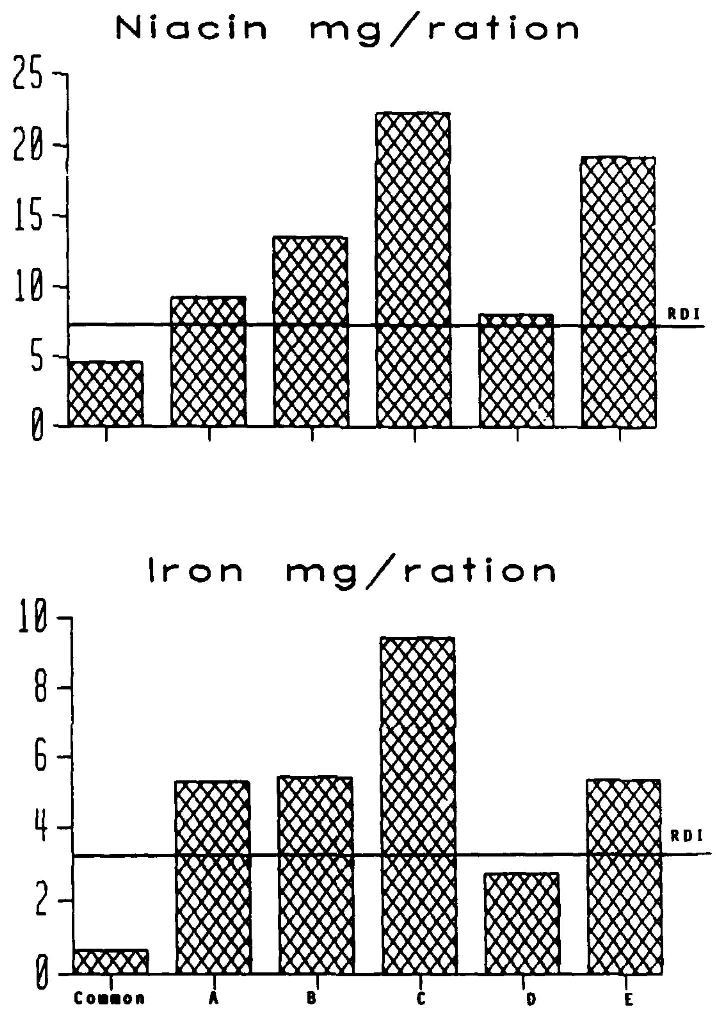

Figure 2: IMCR Ration
Niacin and Iron

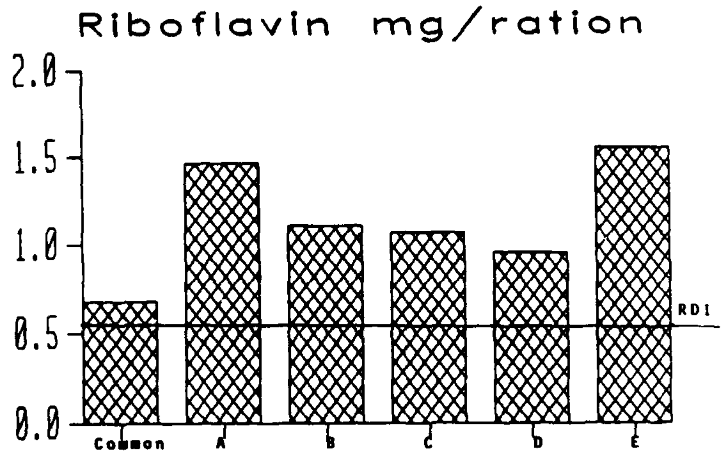

Figure 3: IMCR Ration
Riboflavin

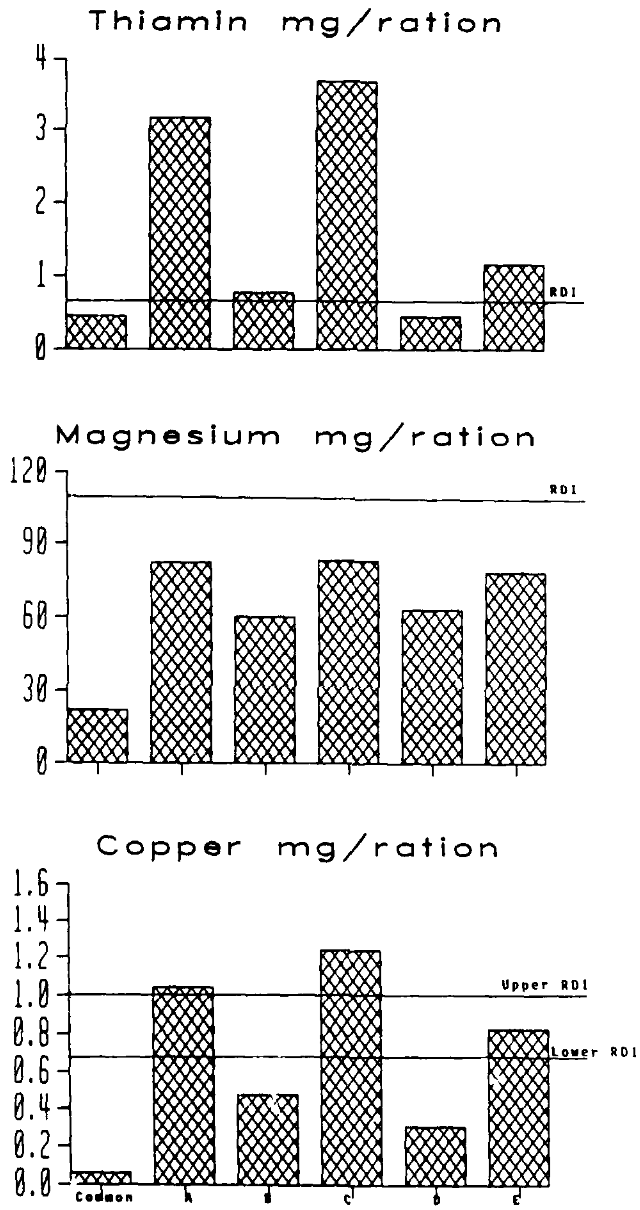

Figure 4: IMCR Ration
Thiamin, Mg and Cu

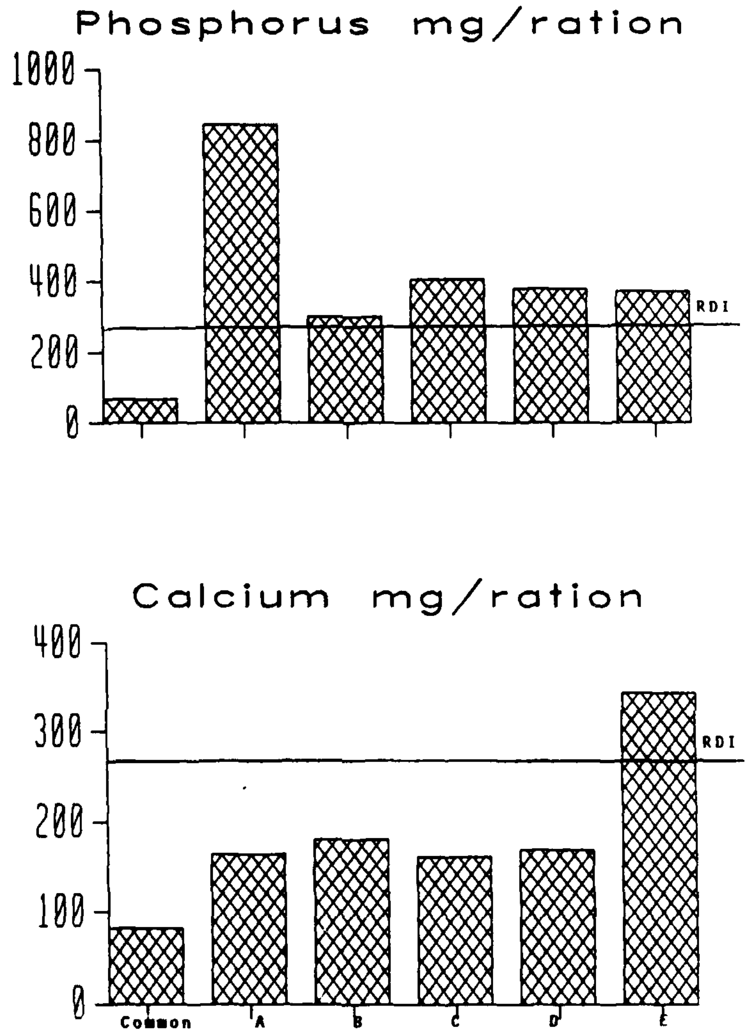

Figure 5: IMCR Ration
Phosphorus & Calcium

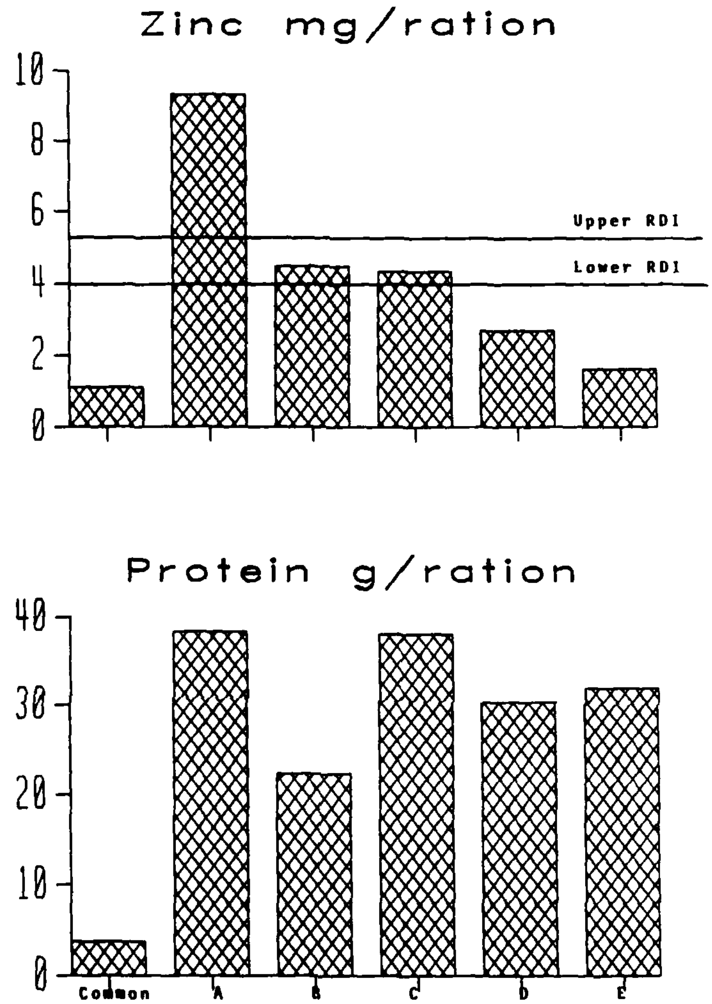

Figure 6: IMCR Ration
Zinc and Protein

APPENDIX A
COMBAT RATION RESULTS 1985 PROCUREMENT
COMBAT RATION TEN MAN (CR10M)

Menu	Item	Specification	Net Mass g	Moisture %	Fat %	Carbohydrate %	Protein %	Energy Calc. kJ/100g	Ash %	Salt %	Ascorbic Acid mg/100g	Niacin mg/100g	Riboflavin mg/100g
A	Beef Noodle Soup Powder	7-4-3	112	3.8	3.0	69.8	12.1	1440	ND	15.5	150	18.0	5.44
	Beef and Gravy	5-1-1	1773	71.7	5.4	2.5	19.3	570	ND	1.05	2.5	3.09	ND
	Pork and Cereal	5-3-22	1363	65.6	12.7	2.5	16.7	790	ND	1.22	0.0	3.04	ND
	Spaghetti and Ground Meat	5-3-21	1797	73.8	6.5	6.0	10.8	520	ND	1.93	1.6	2.2	ND
	Whole Tomato Brine	7-1-20	111	93.1	0.11	ND	ND	4	ND	0.61	12.9	1.15	ND
	Whole Tomatoes	7-1-20	583	92.4	0.06	5.4	1.1	110	1.12	0.83	1.9	0.64	ND
AB	Apricot Jam	4-5-1	27?	32.8	0.01	66.7	0.21	1070	0.29	0.004	76	0.22	ND
B	Beef Steak and Kidneys	5-1-8	1823	73.2	6.2	4.2	16.4	570	ND	1.53	1.3	3.33	ND
	Beef and Beans	5-3-9	1838	69.3	4.9	11.4	13.0	580	ND	1.71	1.8	2.47	ND
	Fruit Salad	4-1-6	1120	84.7	0.14	14.8	0.35	250	0.19	0.006	1.6	0.25	ND
	Fruit Salad Juice	4-1-6	282	87.4	0.02	12.6	ND	200	ND	0.008	1.9	0.26	ND
	Luncheon Meat Type 1	5-1-6	1360	66.3	17.0	2.1	13.0	890	ND	2.18	0.0	2.0	ND
BE	Tomato Soup Powder	7-4-3	185	2.79	2.7	69.0	6.8	1320	ND	11.4	344	35.5	6.05
C	Beef and Tomato Puree	5-3-23	1790	73.6	5.8	4.2	13.5	510	ND	1.84	1.4	2.38	ND
	Beef and Vegetable Curry	5-3-26	1533	73.0	5.7	7.5	11.5	520	ND	1.72	0.0	2.70	ND
	Carrots	7-1-7	544	91.4	0.15	6.7	0.58	120	ND	0.96	0.0	0.15	ND
	Carrot Brine	7-1-7	211	95.7	0.23	ND	ND	9	ND	0.79	0.0	0.18	ND
	Chicken Noodle Soup Powder	7-4-3	109	3.65	4.0	70.7	12.0	1490	ND	14.6	140	21.1	5.15
	Corned Beef	5-1-3	1392	59.9	16.7	0.00	21.0	980	2.29	1.93	0.0	2.4	ND
	Sliced Peach Juice	4-1-7	309	82.6	0.02	17.4	ND	280	ND	0.004	4.4	0.31	ND
	Sliced Peaches	4-1-7	1141	79.6	0.12	19.8	0.39	330	0.22	0.005	2.8	0.52	ND
	Strawberry Jam	4-5-1	507	32.6	0.02	67.0	0.21	1080	0.14	0.008	104	0.14	ND
CD	Green Beans	7-1-10	495	89.9	0.13	7.1	1.2	140	ND	1.22	3.4	0.21	ND
	Green Beans Brine	7-1-10	253	99.6	0.01	ND	ND	0	ND	1.10	3.1	ND	ND
D	Baked Bean Sauce	7-1-2	400	84.8	0.09	12.8	1.6	240	1.83	1.27	0.0	0.30	ND
	Baked Beans	7-1-2	484	70.9	0.59	21.8	6.1	470	ND	0.51	0.0	0.25	ND
	Beef and Dumplings	5-3-25	1812	67.5	10.3	12.1	13.0	800	ND	1.13	2.0	ND	ND
	Beef and Vegetables	5-3-12	1811	74.5	4.1	9.7	10.3	480	ND	1.25	0.0	3.43	ND
	Ham Type II	5-2-11	1354	75.5	4.2	0.00	15.9	430	ND	2.42	29.4	3.74	ND
	Pea and Ham Soup Powder	7-4-3	153	4.1	8.6	53.8	19.8	1520	12.02	9.43	116	51.6	5.22

APPENDIX A
COMBAT RATION RESULTS 1985 PROCUREMENT
COMBAT RATION TEN MAN (CR10M)

Menu	Item	Specification	net Mass g	Moisture %	Fat %	Carbo hydrate %	Protein %	Energy Calc. kJ/100g	Ash %	Salt %	Ascorbic Acid mg/100g	Niacin mg/100g	Riboflavin mg/100g
E	Chicken and Vegetables	5-3-29	1818	77.3	0.94	7.4	13.3	380	ND	0.72	6.3	10.5	ND
	Lamb with Rosemary	5-3-31	1786	72.6	6.6	5.3	13.9	570	ND	0.81	1.5	3.6	ND
	Salmon	3-1-2	1392	68.8	8.2	0.00	23.3	700	ND	1.09	0.0	5.22	ND
	Salmon Brine	3-1-2	490	89.2	0.57	ND	ND	20	ND	1.32	0.0	0.52	ND
EB	Whole Corn Kernels	7-1-24	560	77.1	0.56	18.7	2.2	360	ND	0.71	0.0	0.5	ND
	Whole Corn Kernels Brine	7-1-24	208	91.4	0.03	ND	ND	1	ND	0.82	0.0	0.40	ND
ABE	Peas	7-1-11	602	86.6	0.61	13.03	3.9	300	ND	0.65	1.0	0.87	ND
	Peas Brine	7-1-11	454	90.2	0.00	ND	ND	0	ND	0.62	8.0	1.44	ND
ADE	Raspberry Jam	4-5-1	275	33.3	0.01	66.0	0.52	1070	0.15	0.006	101	0.24	ND
AED	Fruit Pudding	4-7-2	1526	28.7	12.5	50.5	5.2	1360	1.10	0.24	5.3	0.46	ND
BDE	Blackberry Jam	4-5-1	274	33.6	0.01	66.0	0.28	1060	0.13	0.011	106	0.22	ND
com	Butter Concentrate	2-1-1	295	0.28	92.6	2.5	1.8	3500	2.82	2.56	0.0	0.05	ND
	Coffee	8-1-7	79	2.8	0.19	75.8	18.9	1540	ND	0.09	448	165	ND
	Curry Powder	8-3-3	28	6.3	15.5	56.2	15.5	1740	ND	3.88	1.0	3.92	ND
	Potato Brine	7-1-14	388	95.4	0.00	ND	ND	0	ND	3.60	0.0	0.39	ND
	Salt	8-3-17	43	0.16	0.00	ND	0.00	0	ND	99.8	0.0	ND	ND
	Sugar	8-3-19	809	0.02	0.00	100	0.00	1600	ND	0.002	0.0	ND	ND
	Tea	8-3-26	116	6.5	0.16	75	23.9	1610	ND	0.12	6.8	6.45	ND
	Tomato Sauce	8-3-21	229	69.6	0.14	25.3	1.3	430	3.69	3.03	39.0	1.17	ND
	Unsweetened Condensed Milk	2-5-3	395	72.3	7.53	11.5	6.9	580	1.80	0.44	32.4	ND	ND
	Vegemite	7-5-1	96	38.4	0.53	15.0	31.5	800	15.05	10.43	13.3	136	ND
	Whole Potatoes	7-1-14	1128	80.5	0.07	13.2	1.6	240	ND	1.19	0.5	1.1	ND

APPENDIX A
COMBAT RATION RESULTS 1985
PROCUREMENT
COMBAT RATION ONE MAN (CRIM)

Menu	Item	Specification	Net Mass g	Moisture %	Fat %	Carbo hydrate %	Protein %	Energy Calc. kJ/100g	Ash %	Salt %	Ascorbic Acid mg/100g	Niacin mg/100g	Riboflavin mg/100g
A	Beef and Vegetables	5-3-1	223	75.0	2.75	8.6	10.7	420	ND	1.21	0.00	1.72	ND
	Ham and Egg	5-3-17	112	66.9	15.32	4.1	13.0	850	ND	1.54	0.00	1.13	ND
	Orange Beverage Powder	8-1-9	14	0.44	0.02	98.9	0.10	1590	0.52	0.009	256	ND	ND
	Plum Jam	4-5-1	23	33.3	0.02	66.4	0.22	1070	0.09	0.003	54	0.19	ND
AB	F.D.Rice	6-1-5	54	0.82	0.72	90.0	7.26	1590	ND	0.15	0.00	0.24	ND
	Peach Juice	8-3-3	10	83.8	ND	16.2	ND	260	ND	0.003	0.00	0.49	ND
	Peaches	4-1-12	150	83.0	0.09	16.1	0.57	270	0.19	0.003	0.00	0.54	ND
ABC	Curry Powder	8-3-3	3.4	10.1	6.99	60.9	14.2	1480	ND	6.21	1.28	2.57	ND
B	Corned Beef Hash	5-3-6	225	76.9	1.46	10.6	9.2	380	ND	1.28	0.00	1.2	ND
	Pork and Beans	5-3-20	110	71.3	4.87	6.8	15.2	550	ND	1.39	0.00	2.21	ND
BC	Lemon Beverage Drink	8-1-9	14	0.30	0.15	98.6	0.68	1600	0.43	0.017	781	0.1	ND
C	Beef and Gravy	5-1-1	243	72.5	3.23	2.9	20.0	510	ND	0.97	0.00	2.46	ND
	Luncheon Meat Type II	5-1-6	118	65.5	10.44	8.8	12.0	730	ND	1.87	0.76	1.4	ND
	Pear Juice	4-1-8	28	81.1	ND	18.9	ND	300	ND	0.001	0.00	0.07	ND
	Pears	4-1-8	152	94.1	0.06	5.6	0.21	100	0.12	0.000	0.00	0.10	ND
	Potato and Onion Powder	7-2-12	48	4.8	7.39	72.5	11.7	1630	ND	0.42	3.8	2.6	ND
CB	Raspberry Jam	4-5-1	23	29.8	0.07	69.6	0.40	1120	0.17	0.005	62.5	0.18	ND
D	Beef Soup and Gravy Base	7-4-4	6.7	1.05	4.74	20.5	17.9	810	ND	50.56	35	38.0	ND
	Blackberry Jam	4-5-1	23	31.4	0.06	68.2	0.24	1100	ND	0.009	50.1	0.16	ND
	Luncheon Meat Type I	5-1-6	221	68.5	13.86	0.0	15.4	780	ND	2.14	0.76	2.02	ND
	Orange Beverage Powder	8-1-9	13	0.44	0.02	98.9	0.10	1590	0.52	0.009	256	ND	ND
	Sausages and Vegetables	5-3-19	113	77.5	8.03	8.1	5.7	530	ND	1.23	0.69	1.5	ND
DE	Diced Two Fruits	4-1-8	152	80.9	0.08	18.5	0.30	310	0.15	0.003	0.75	0.22	ND
	Diced Two Fruits Juice	4-1-8	24	81.7	ND	18.3	ND	290	ND	0.003	0.00	0.10	ND
	Potato and Onion Powder	7-2-12	49	4.7	6.9	73.2	11.2	1620	ND	0.41	1.75	1.41	ND
E	Beef and Egg	5-3-18	108	69.8	11.2	1.9	15.2	700	ND	1.11	0.0	1.17	ND
	Chicken Soup and Gravy Base	7-4-4	7.1	1.7	8.0	29.1	11.6	960	ND	39.3	72	42.5	ND
	Corned Beef Type E	5-1-3	217	63.4	13.3	0.7	19.5	830	ND	2.64	0.51	2.1	ND
	Lime Beverage Powder	8-1-9	15	0.27	0.08	99.6	0.00	1600	ND	0.009	188	0.10	ND
	Peach Jam	4-5-1	24	31.2	0.02	68.4	0.28	1100	ND	0.005	111	0.19	ND

APPENDIX A
COMBAT RATION RESULTS 1985
PROCUREMENT
COMBAT RATION ONE MAN (CRIM)

Menu	Item	Specification	net Mass g	Moisture %	Fat %	Carbo hydrate %	Protein %	Energy Calc. kJ/100g	Ash %	Salt %	Ascorbic Acid mg/100g	Niacin mg/100g	Riboflavin mg/100g
com	Butter Concentrate	2-1-1	28	4.9	92.6	1.4	1.4	3470	2.58	2.36	0.53	0.05	ND
	Butterscotch	8-2-1	54	3.3	1.2	94.3	0.39	1560	0.76	0.638	6.6	0.16	ND
	Cereal Biscuits	1-1-6	58	5.2	20.4	59.2	9.0	1860	ND	0.575	0.00	2.66	ND
	Cheese	2-2-2	51	46.1	26.4	4.8	20.7	1400	5.35	2.52	0.00	0.05	ND
	Chewing Gum		6.9	2.1	ND	ND	0.03	1	ND	0.050	0.75	ND	ND
	Chocolate	8-2-4	52	3.4	29.6	54.3	8.6	2110	ND	0.327	14.0	0.33	ND
	Coffee	8-1-7	7.2	3.1	1.2	73.7	18.9	1540	ND	0.125	400	142	ND
	Salt	8-3-17	7.2	0.08	ND	0.0	0.00	0	ND	99.9	0.00	ND	ND
	Shortbread Biscuits	1-1-1	87	4.3	20.4	68.0	4.8	1920	ND	1.12	0.68	0.64	ND
	Sugar	8-3-19	85	0.06	ND	99.9	0.00	1600	ND	0.002	0.00	ND	ND
	Survival Biscuits	1-1-3	93	4.7	13.8	66.4	10.9	1760	ND	1.45	0.53	1.94	ND
	Sweetened Condensed Milk	2-5-3	61	25.5	9.0	54.5	9.2	1360	1.84	0.507	2.2	0.23	ND
	Tea Bag	8-3-26	4.2	8.6	2.5	74.3	18.9	1600	ND	0.215	10.2	6.08	ND

APPENDIX A
COMBAT RATION RESULTS 1985 PROCUREMENT PATROL RATION PAPUA-NEW GUINEA (PRPNG)

Menu	Item	Specification	Net Mass g	Moisture %	Fat %	Carbo hydrate %	Protein %	Energy Calc. kJ/100g	Ash %	Salt %	Ascorbic Acid mg/100g	Niacin mg/100g	Riboflavin mg/100g
A	Ham and Egg	5-3-17	104	66.8	15.8	6.8	16.4	970	ND	1.48	0.00	0.94	ND
	Luncheon Meat Type 1	5-1-6	225	69.5	11.8	0.0	15.2	700	ND	2.21	0.74	2.25	ND
AD	Potato and Onion Powder	7-2-12	49	4.4	7.2	73.5	10.3	1620	ND	0.41	3.2	1.96	ND
	Sweetened Condensed Milk	2-5-3	65	24.2	9.2	56.1	8.7	1390	1.87	0.54	1.3	0.16	ND
B	Beef and Vegetables	5-3-1	225	77.1	3.8	9.2	13.2	510	ND	1.40	0.00	1.89	ND
	Pork and Beans	5-3-20	106	70.9	4.2	6.0	16.9	540	ND	1.46	0.65	5.1	ND
BC	Butter Concentrate	2-1-1	24	0.84	92.4	2.4	1.9	3490	2.45	2.53	0.91	0.03	ND
	Fruit Candy	8-2-3	42	3.13	0.01	96.7	0.0	1550	ND	0.12	168	0.10	ND
C	Beef and Egg	5-3-18	225	71.5	10.3	3.6	14.1	680	ND	1.21	0.00	0.88	ND
	Corned Beef Type E	5-1-3	218	63.8	13.1	0.0	22.8	870	ND	1.95	0.00	2.5	ND
D	Beef and Gravy	5-1-1	233	72.8	3.7	3.3	19.6	520	ND	1.11	0.00	3.75	ND
	Luncheon Meat Type II	5-1-6	116	65.1	13.2	8.8	10.5	810	ND	1.97	0.80	1.2	ND
com	Chewing Gum		7.0	2.86	ND	ND	ND	0	ND	0.055	0.91	0.03	ND
	Chocolate	8-2-4	53	3.35	28.6	55.8	7.6	2080	1.80	0.33	24.5	0.42	ND
	Coffee	8-1-7	7.4	3.45	0.45	76.4	18.7	1560	ND	0.07	458	57.9	ND
	Rice	6-1-5	251	11.8	0.96	79.4	5.2	1390	ND	0.061	2.04	1.93	ND
	Salt	8-3-17	7.1	0.40	ND	0.0	0.0	0	ND	99.6	0.00	ND	ND
	Sugar	8-3-19	86	0.09	ND	99.9	0.0	1600	ND	0.003	0.00	ND	ND
	Survival Biscuits	1-1-3	91	2.37	13.5	66.5	12.0	1770	ND	1.47	1.2	2.15	ND
	Tea Bag	8-3-26	4.2	8.51	1.41	75.1	18.8	1570	ND	0.087	6.7	ND	ND

APPENDIX A
COMBAT RATION RESULTS 1985 PROCUREMENT
PATROL RATION ONE MAN (PRIM)

Menu	Item	Specification	Net Mass g	Moisture %	Fat %	Carbo hydrate %	Protein %	Energy Calc. kJ/100g	Ash %	Salt %	Ascorbic Acid mg/100g	Niacin mg/100g	Riboflavin mg/100g
A	Beef and Green Beans	6-1-8	76	0.91	22.5	15.1	53.1	1970	6.48	3.88	7.0	8.86	ND
	Lamb and Vegetable Curry with Rice	6-1-17	111	0.95	12.4	49.5	33.4	1820	2.71	1.09	5 4	5.88	ND
ACE	Shortbread Biscuits	1-1-1	87	3.6	20.8	66.9	5.9	1940	ND	1.10	0.66	0.66	ND
AD	Orange Beverage Powder	8-1-9	15	0.19	0.09	98.9	0.86	1600	ND	0.011	215	0.04	ND
B	Beef and Onions	6-1-3	73	0.73	13.3	22.9	55.9	1810	6.02	2.66	4.4	10.6	ND
	Lemon Beverage Powder	8-1-9	15	0.25	0.04	98.9	0.79	1600	ND	0.017	247	0.06	ND
	Spaghetti and Meat Sauce	6-1-4	105	1.8	10.0	49.9	33.3	1730	3.97	1.80	0.0	4.4	ND
BD	Jam Filled Biscuits	1-1-1	86	5.7	18.3	67.9	3.7	1830	ND	0.38	0.0	0.47	ND
C	Beef and Noodles	6-1-15	108	1.2	12.5	31.7	48.1	1790	4.48	1.56	0.0	7.5	ND
	Roast Pork and Gravy	6-1-13	76	1.2	27.2	1.76	64.4	2130	4.84	2.34	1.3	13.3	ND
CE	Lime Beverage Powder	8-1-9	14	0.32	0.07	99.6	ND	1600	ND	0.008	216	0.10	ND
D	Tuna and Rice	6-1-18	106	1.5	7.2	57.0	28.9	1670	5.03	3.40	4.6	12.5	ND
	Veal Italienne	6-1-19	73	1.2	8.3	49.8	34.8	1690	4.08	1.58	18.6	4.25	ND
E	Chicken Risotto	6-1-16	109	0.19	3.5	68.6	21.4	1590	2.66	1.89	12.5	8.18	ND
	Savoury Steak Fingers	6-1-11	73	1.2	13.6	15.3	60.8	1780	7.11	3.61	21.2	3.29	ND
com	Chewing Gum		7	3.5	ND	ND	ND	0	2.82	0.05	1.5	0.12	ND
	Chocolate	8-2-4	51	3.2	30.1	54.6	8.4	2130	ND	0.32	19.2	3.5	ND
	Coffee	8-1-7	7	2.9	0.68	76.2	18.7	1560	ND	0.14	390	146	ND
	Muesli Bars		62	4.5	13.9	72.5	6.2	1780	ND	0.66	0.0	1.45	ND
	Potato and Onion Powder	7-2-12	49	3.5	7.2	73.5	11.2	1630	2.75	0.44	1.7	1.15	ND
	Salt	8-3-17	7.3	0.06	ND	0.0	0.00	0	ND	99.9	0.0	ND	ND
	Sugar	8-3-19	81	0.04	ND	100.0	0.00	1600	ND	0.002	0.0	ND	ND
	Survival Biscuits	1-1-3	91	3.2	13.3	69.6	12.0	1810	ND	1.46	0.00	2.41	ND
	Sweetened Condensed Milk	2-5-3	65	24.9	8.7	56.0	8.7	1370	1.79	0.52	3.8	0.19	ND
	Tea Bag	8-3-26	3.8	7.6	2.2	73.6	19.5	1590	ND	0.87	6.8	6.1	ND

APPENDIX A
COMBAT RATION RESULTS 1985 PROCUREMENT INDIVIDUAL MEAL COMBAT RATION (IMCR)

Menu	Item	Specification	Net Mass g	Moisture %	Fat %	Carbo hydrate %	Protein %	Energy Calc. kJ/100g	Ash %	Salt %	Ascorbic Acid mg/100g	Niacin mg/100g	Riboflavin mg/100g	Thiamin mg/100g
A	Beef Minced with Tortellini	5-3-27	222	69.1	7.8	9.1	13.2	660	ND	0.80	0.87	1.84	0.35	1.22
ACE	Shortbread Biscuits	1-1-1	87	4.2	20.5	64.9	6.0	1900	ND	1.08	0.60	0.54	BL	BL
AD	Orange Beverage Drink	8-1-9	16	0.44	0.09	99.5	0.0	1600	ND	0.01	247	0.05	BL	BL
B	Beef Meat Balls and Sweet and Sour Sauce	5-3-28	221	73.5	4.4	13.2	6.7	490	ND	1.51	0.00	3.84	0.18	0.14
	Lemon Beverage Powder	8-1-9	15	0.69	ND	99.3	0.0	1590	ND	ND	375	ND	BL	0.05
BD	Jam Filled Biscuits	1-1-1	86	6.8	18.0	68.4	4.3	1830	ND	0.43	0.71	0.47	0.02	BL
C	Chicken and Vegetables	5-3-29	222	77.7	1.18	6.1	13.1	360	ND	0.70	0.52	7.76	0.17	1.46
CE	Lime Beverage Powder	8-1-9	15	0.23	0.10	99.7	0.0	1600	ND	0.005	161	0.02	ND	ND
D	Beef Meat Balls with Bacon and Vegetable	5-3-30	225	76.1	7.6	4.6	10.2	530	ND	1.37	0.00	1.35	0.11	BL
E	Lamb and Vegetable with Rosemary	5-3-31	222	76.6	5.2	7.1	10.3	480	ND	0.82	0.93	6.34	0.39	0.32
com	Coffee	8-1-7	4	4.2	1.53	72.5	18.2	1530	ND	0.077	408	109	14.2	10.2
	Lifesavers		23	2.5	0.19	97.2	0.05	1560	ND	0.075	2.15	0.04	BL	BL
	Sugar	8-3-19	28	0.29	ND	99.7	0.00	1600	ND	0.003	0.00	ND	ND	ND
	Sweetened Condensed Milk	2-5-3	26	27.8	8.7	53.2	8.6	1320	1.81	0.52	1.7	0.17	0.51	0.14
	Tea Bag	8-3-26	4	7.9	2.2	75.7	20.6	1640	ND	0.23	8.4	6.9	BL	0.6

ND — Not Determined   BL — Below Detection Limit

APPENDIX B
INDIVIDUAL MEAL COMBAT RATION METAL RESULTS

Ration	Name	Na %	P %	Ca %	Mg %	Fe mg/100g	Cu mg/100g	Zn mg/100g	Pb mg/100g	Cd mg/100g
A	Beef Minced with Tortellini	0.38	0.32	0.014	0.02	2.0	0.12	3.5	0.05	BL
ACE	Shortbread Biscuits	0.49	0.06	0.03	0.018	0.17	0.82	0.41	BL	BL
AD	Orange Beverage Drink	0.05	0.08	0.15	0.001	0.20	BL	0.5	BL	BL
B	Beef Meat Balls and Sweet and Sour Sauce	0.67	0.07	0.02	0.01	1.66	0.11	1.37	BL	BL
B	*Lemon Beverage Powder*	0.04	0.064	0.14	0.002	0.42	BL	0.20	0.012	0.05
BD	Jam Filled Biscuits	0.21	0.08	0.04	0.019	1.20	0.21	0.34	BL	ND
C	Chicken and Vegetables	0.31	0.12	0.012	0.020	3.89	0.21	1.27	0.027	BL
CE	Lime Beverage Powder	0.10	0.12	0.17	0.002	0.15	BL	0.29	BL	ND
D	Beef Meat Balls with Bacon and Vegetable	0.63	0.10	0.013	0.011	0.47	0.03	0.53	0.014	ND
E	Lamb and Vegetable with Rosemary	0.34	0.10	0.094	0.018	2.03	0.026	0.039	0.03	BL
com	Coffee	0.05	0.29	0.16	0.32	13.0	BL	5.2	1.5	BL
com	Lifesavers	0.06	0.01	0.004	0.002	0.17	0.15	2.64	0.01	BL
com	Sugar	ND	ND	ND	ND	ND	ND	ND	ND	ND
com	Sweetened Condensed Milk	0.12	0.20	0.29	0.026	0.25	BL	1.0	0.19	0.01
com	Tea Bag	0.01	0.10	0.02	0.07	0.43	0.44	0.71	BL	ND

ND — Not Determined BL — Below Detection Limit

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SUBJECT GROUPS 0090J

ABSTRACT

Results of chemical and microbiological analysis of the 1985 packaging program are presented. The contents of moisture, fat, protein, carbohydrate, salt, ascorbic acid, niacin and energy of rations are included. The content of thiamin, riboflavin, sodium, phosphorus, calcium, magnesium, iron, copper, zinc, lead and cadmium in the Individual Meal Combat Ration are also evaluated. Daily available nutrients are estimated and compared to daily requirement. Some ratios were found to have an excessive protein and salt content. Combat Ration Ten Man, Patrol Ration One Man and Patrol Ration Papua-New Guinea were found to be energy deficient. Individual Meal Combat Ration was found to be deficient in calcium, magnesium and copper. It was also found that certain components have not been fortified with the vitamins thiamin, riboflavin, niacin or ascorbic acid.

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