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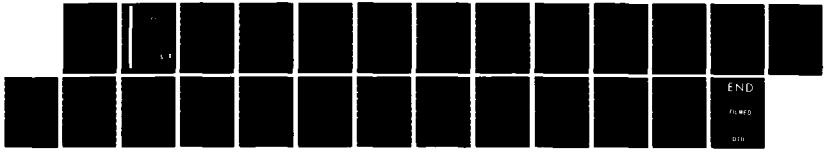

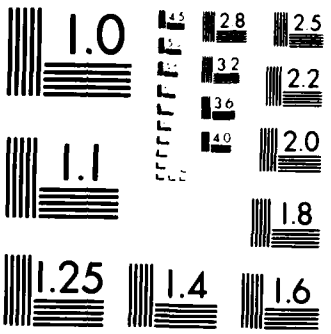

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Department of Defence
Defence Science and Technology Organisation
Armed Forces Food Science Establishment
Scottsdale, Tasmania

AFFSE REPORT 1/84

Laboratory Evaluation of Australian Ration Packs [U]

K. W. JAMES
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SUMMARY

Methods and results of chemical analysis of the 1982-83 packaging programme are presented. The contents of moisture, fat, protein, carbohydrate, thiamin, ascorbic acid, niacin, riboflavin, ash, and energy of rations are included. Daily available nutrients are estimated and evaluated with respect to daily requirement. Some rations were found to have an excessive protein content. Certain rations were found to be marginally energy deficient and deficient in ascorbic acid and thiamin. All rations were found to contain excessive salt.

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16. ABSTRACT:

Methods and results of chemical analysis of the 1982-83 packaging programme are presented. The contents of moisture, fat, protein carbohydrate, thiamin, ascorbic acid, niacin, riboflavin, ash, and energy of rations are included. Daily available nutrients are estimated and evaluated with respect to daily requirement. Some rations were found to have an excessive protein content. Certain rations were found to be marginally energy deficient and deficient in ascorbic acid and thiamin. All rations were found to contain excessive salt. (U).

ABBREVIATIONS

CHO	CARBOHYDRATE
NH&MRC	NATIONAL HEALTH & MEDICAL RESEARCH COUNCIL
CR1M	COMBAT RATION ONE MAN
CR10M	COMBAT RATION TEN MAN
PR1M	PATROL RATION ONE MAN
ADFFS	AUSTRALIAN DEFENCE FORCE FOOD SPECIFICATIONS

CONTENTS

INTRODUCTION

Previous reports (AFFSE 1970-82) (1-10) have detailed the results of analysis of ration packs from preceding packaging programmes. This report details the results obtained by analysis of complete packs of the 1982-83 packaging programme.

A sample of each ration component was analysed for moisture, fat, refractory ash, protein, thiamin (vitamin B1), ascorbic acid (vitamin C), niacin, riboflavin (vitamin B2) 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 & Corden (14). Table 1. The rations packaged at the AFFSE were also examined for microbiological quality.

TABLE 1

Energy per Gram of Nutrient

NUTRIENT	kJ/g
Protein	17
Fat	37
Carbohydrate	16

These evaluations are based on the nutritional requirements stated in the Army Staff Requirement, No. 69.1, Operational Rations (15). These requirements are those of a Reference Man as described by the National Health and Medical Research Council. The Reference Man is 70 kg and has the requirements for various grades of activity listed in Table 2.

TABLE 2

NUTRIENT REQUIREMENTS OF REFERENCE 70 kg MAN PER DAY

NUTRIENT	REQUIREMENT			
	GRADE 0	GRADE 1	GRADE 2	GRADE 3
Energy kJ	8,400	11,600	13,400	15,800
Protein g	*70*	*70*	*70*	*70*
Protein 12% energy g		81.2	93.8	110.6
Ascorbic acid (vit C) mg	30	30	30	30
Thiamin (vit B1) mg	1.1	1.16	1.34	1.58
Niacin	12.8	19.2	22.4	25.6
Riboflavin	1.0	1.4	1.7	1.9
Description of Activity	Maint.	Normal 8 hrs light physical work/day e.g. Clerical	Moderate e.g. Infantry	Strenuous e.g. Labouring

Sources: NH & MRC. Dietary Allowance for Use in Australia (11) Thomas & Corden (14).

METHODS OF ANALYSIS

Chemical

The determination of moisture, fat and salt were undertaken according to the same procedure as used in the previous report (10). New methods were introduced for the determination of protein, thiamin, ascorbic acid and ash.

Protein was calculated from the nitrogen determined according to the microchemical procedure (AOAC, 1980, 47.013) (13) using the factor 6.25.

Ash was determined from the residue left after the microchemical method for protein and carbon.

Carbon was determined by the microchemical procedure (AOAC 1980, 47-013) (13). This result was used to calculate the content of carbohydrate by the formula

$$\%CHO = \frac{\%\ \text{Carbon} - (\%\ \text{Protein} \times 0.5) - (\%\ \text{Fat} \times 0.765)}{\text{Carbohydrate factor}}$$

The carbohydrate factor was 0.4445 for items considered to contain mainly starches and 0.421 for items considered to contain mainly sucrose.

Thiamin was determined by a flow injection procedure based on the fluorimetric procedure (AOAC, 1980, 43.024) (13) using a fluorimetric high pressure liquid chromatography detector.

Ascorbic acid was determined by high pressure liquid chromatography using an amperometric detector. (19)

Microbiological

Samples of freeze dried products were tested by the appropriate Australian Standard Methods, within one week of production.

Standard Plate Count was conducted using the pour plate method as described in AS 1766 Part 2.1.1, 1976.

Yeasts and moulds were enumerated using the pour plate method as described in AS 1766 Part 2.2, 1980. Dichloran rose-bengal chlortetracycline was substituted for oxytetracycline glucose — yeast extract agar.

Coliforms and *E. coli* were enumerated using the Most Probable Number Method as described in AS 1766 Part 2.1.3.5, 1976.

Staphylococcus aureus were enumerated as described in AS 1766 Part 2.1.4.5, 1976.

Salmonellae were enumerated as described in AS 1766 Part 2.5, 1983.

Niacin was determined turbidimetrically according to AOAC 1980, 43.126 and 43.131.

Riboflavin was determined turbidimetrically according to AOAC 1980, 43.126 and 43.131.

RESULTS

The total nutrients found in each of the rations Combat Ration Ten Man (CR10M), Combat Ration One Man (CR1M) and Patrol Ration One Man (PR1M) are summarised in Table 3

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

DISCUSSION

COMBAT RATION TEN MAN (CR10M)

Nutritional Evaluation:

The detailed results of chemical analysis of CR10M are listed in Appendix 1.

Table 3 is a summary of the total nutrients available in each pack and includes the results found in the CR10M. The contribution from the supplements bread, rice and survival biscuits are listed for the nutrients moisture, fat, protein, carbohydrate, salt and energy, followed by the total for each of the packs with each of these supplementary issues provided under the ration scale.

There is insufficient energy in the basic packs, i.e. without any supplement, for a grade 1 level of activity. The energy content including the various supplements is marginally adequate for a grade 1 level of activity and is not sufficient for grade 2 activity. 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.

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 is excessive in each of the versions of the ration. A desirable level is between 10 and 12 percent of energy derived from protein. It would therefore be desirable to reduce the proportion of meat in favour of vegetables in some components.

The content of vitamins shown in the various versions of packs B and C is marginal and may be inadequate for extended use, especially after the more deleterious conditions of storage. The soup powders appear to be type I soup powders rather than the fortified type II powders. The latter type are fortified with thiamin, ascorbic acid, niacin, and riboflavin. The thiamin content of all packs is likely to be inadequate after extended storage. It is recommended that type II soup powder be used rather than type I to provide a greater safety margin for the vitamins, particularly thiamin.

The salt content, as shown in Table 3, is excessive for all versions of the ration. The maximum recommended intake of salt is 5.8g per adult per day (17). The salt content of each of the versions of the ration approaches five times this recommended maximum daily intake. 23 items have in excess of 1% salt. The main contributors of salt in these rations are salt in sachets 84g, potatoes 15g, tomato sauce 6g and vegemite 5.6g in the common items contributing a total of 110g salt or about 44% of the total salt. Each of the soup powders contributes 24g to 34g of salt or about 10%. There should be some opportunity to reduce the salt content in the rations by modifying these components.

TABLE 3

SUMMARY OF RATION PACK TOTALS

RATION	Net Wt g	Moisture g	Fat g	Ash g	Protein g	CHO g	Energy kJ	Salt g	Thiamin mg	Ascorbic Acid mg	Niacin mg	Riboflavin mg
CR10BIS A	14021	7181.71	1334.67	84.95	1149.81	3786.14	128716	267.18	20.446	2003.44	336.59	34.94
CR10BIS B	13611	7757.20	1010.55	77.99	999.45	3287.35	106308	262.58	14.479	2237.55	317.40	35.03
CR10BIS C	14749	7953.83	1144.12	151.59	1024.49	4026.30	123507	283.77	12.969	2658.53	298.29	28.37
CR10BIS D	14136	7375.57	1096.77	104.18	1156.64	3949.05	122767	260.60	26.437	2051.90	346.43	32.01
CR10BRD A	15221	8076.71	1180.17	84.95	1204.91	4186.64	130946	280.68	20.446	2003.44	336.59	34.94
CR10BRD B	14811	8652.20	856.05	77.99	1054.55	3687.85	108538	276.08	14.479	2237.55	317.40	35.03
CR10BRD C	15949	8848.83	989.62	151.59	1079.59	4426.80	125737	297.27	12.969	2658.53	298.29	28.37
CR10BRD D	15336	8270.57	942.27	104.18	1211.74	4349.55	124997	274.10	26.437	2051.90	346.43	32.01
CR10M BISC	1300	80.00	192.00		139.90	857.00	23190	18.30				
CR10M RICE	1700	195.50	10.20		110.50	1377.00	25410					
CR10M83 A	12721	7101.71	1142.67	84.95	1009.91	2929.14	105526	248.88	20.446	2003.44	336.59	34.94
CR10M83 B	12311	7677.20	818.55	77.99	859.55	2430.35	83118	244.28	14.479	2237.55	317.40	35.03
CR10M83 C	13449	7873.83	952.12	151.59	884.59	3169.30	100317	265.47	12.969	2658.53	298.29	28.37
CR10M83 D	12836	7295.57	904.77	104.18	1016.74	3092.05	99577	242.30	26.437	2051.90	346.43	32.01
CR10M83com	3953	1922.94	381.15	21.52	156.01	1183.17	35029	126.24	11.461	1672.60	175.63	19.88
CR10MBREAD	2500	375.00	37.50		195.00	1257.50	25420	31.80				
CR10RIC A	14421	7297.21	1152.87	84.95	1120.41	4306.14	130936	248.88	20.446	2003.44	336.59	34.94
CR10RIC B	14011	7872.70	828.75	77.99	970.05	3807.35	108528	244.28	14.479	2237.55	317.40	35.03
CR10RIC C	15149	8069.33	962.32	151.59	995.09	4546.30	125727	265.47	12.969	2658.53	298.29	28.37
CR10RIC D	14536	7491.07	914.97	104.18	1127.24	4469.05	124987	242.30	26.437	2051.90	346.43	32.01
CR1M83 A	1178	425.60	138.93	8.73	79.03	473.53	13801	17.73	3.162	80.68	0.22	
CR1M83 B	1178	425.50	134.19	8.26	75.81	479.52	13668	18.09	3.361	90.17	0.22	
CR1M83 C	1178	394.87	157.93	12.31	98.57	450.56	14469	16.41	3.122	73.68	0.22	
CR1M83 D	1176	422.28	155.27	9.09	108.41	431.64	14250	28.74	3.357	83.21		
CR1M83 E	1176	390.69	162.18	8.71	109.11	434.41	14564	19.14	3.157	74.63		
CR1M83com	613	56.20	106.24	5.54	45.30	363.02	10252	12.17	3.046	64.24		
PR1M83 A	707	34.65	106.33	9.75	159.75	348.32	11940	16.93	1.886	89.82	8.02	1.31
PR1M83 B	707	34.18	104.83	9.59	172.98	337.69	11939	15.60	1.874	87.18	8.02	1.31
PR1M83 C	707	34.09	86.06	8.82	146.25	380.10	11469	19.26	1.715	90.64	8.02	1.31
PR1M83com	473	30.33	62.69	4.67	39.07	292.70	7384	11.00	1.604	51.08	8.02	1.31

CR10BIS = Combat Ration Ten Man with Biscuit Supplement
CR10BRD = Combat Ration Ten Man with Bread Supplement
CR10M BISC = Biscuit Supplement to Combat Ration Ten Man
CR10M RICE = Rice Supplement to Combat Ration Ten Man
CR10M 83 = Combat Ration Ten Man
CR10M 83 com = Combat Ration Ten Man Common Items
CR10MBREAD = Bread Supplement to Combat Ration Ten Man
CR10RIC = Combat Ration Ten Man with Rice Supplement
CR1M 83 = Combat Ration One Man
CR1M 83 com = Combat Ration One Man Common Items
PR1M = Patrol Ration One Man
PR1M 83 com = Patrol Ration One Man Common Items

TABLE 4

PERCENT ENERGY DISTRIBUTION FOR RATION PACKS

RATION	FAT % ENERGY	PROTEIN % ENERGY	CARBOHYDRATE % ENERGY	TOTAL ENERGY kJ
CR10BIS A	38.36	15.18	47.06	128716
CR10BIS B	35.17	15.98	49.47	106308
CR10BIS C	34.27	14.10	52.15	123507
CR10BIS D	33.05	16.01	51.46	122767
CR10BRD A	33.34	15.64	51.15	130946
CR10BRD B	29.18	16.51	54.36	108538
CR10BRD C	29.12	14.59	56.33	125737
CR10BRD D	27.89	16.48	55.67	124997
CR10M BISC	30.63	10.25	59.12	23190
CR10M RICE	1.48	7.39	86.70	25410
CR10M83 A	40.06	16.26	44.41	105526
CR10M83 B	36.43	17.58	46.78	83118
CR10M83 C	35.11	14.99	50.54	100317
CR10M83 D	33.61	17.35	49.68	99577
CR10M83com	40.25	7.57	54.04	35029
CR10MBREAD	5.45	13.04	79.15	25420
CR10RIC A	32.57	14.54	52.61	130936
CR10RIC B	28.25	15.19	56.13	108528
CR10RIC C	28.31	13.45	57.85	125727
CR10RIC D	27.08	15.33	57.20	124987
CR1M83 A	37.24	9.73	54.89	13801
CR1M83 B	36.32	9.42	56.13	13668
CR1M83 C	40.38	11.58	49.82	14469
CR1M83 D	40.31	12.93	48.46	14250
CR1M83 E	41.20	12.73	47.72	14564
CR1M83com	38.34	7.51	56.65	10252
PR1M83 A	32.94	22.74	46.67	11940
PR1M83 B	32.48	24.63	45.25	11939
PR1M83 C	27.76	21.67	53.02	11469
PR1M83com	31.41	8.99	63.42	7384

CR10BISC = Combat Ration Ten Man with Biscuit Supplement
CR10BRD = Combat Ration Ten Man with Bread Supplement
CR10M BISC = Biscuit Supplement to Combat Ration Ten Man
CR10M RICE = Rice Supplement to Combat Ration Ten Man
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CR10MBREAD = Bread Supplement to Combat Ration Ten Man
CR10RIC = Combat Ration Ten Man with Rice Supplement
CR1M 83 = Combat Ration One Man
CR1M 83 com = Combat Ration One Man Common Items
PR1M 83 = Patrol Ration One Man
PR1M 83 com = Patrol Ration One Man Common Items

COMBAT RATION ONE MAN

(CR1M)

Nutritional Evaluation

The detailed results of chemical analysis of CR1M are listed in Appendix 2.

Table 3 includes a summary of the total nutrients available in each CR1M pack. The energy available in each of the packs is adequate to sustain a reference 70 kg man at a grade 2 level of activity for one day. The protein level in each of the packs is satisfactory, packs A & B are close to the recommended daily intake of 70g.

The percent distribution of energy from fat, protein and carbohydrate is shown in Table 4. The proportion of energy derived from fat in packs C, D and E is considered excessive and should be reduced. The proportion of energy derived from protein in packs D and E is also considered excessive and should also be reduced. Therefore, it is recommended that meat content should be reduced in favour of vegetables in components of the packs C, D and E.

The thiamin and ascorbic acid levels found are substantially in excess of recommended daily requirements. However, there is a risk of inadequate vitamin C (ascorbic acid) after two years storage. Under the more deleterious conditions of storage such as high humidity and high temperatures the ascorbic acid concentration is likely to fall to the marginally adequate to inadeq[illegible]e. This situation is brought about by several factors. The analytical method used to determ[illegible]iscorbic acid in this evaluation is more reliable and specific, which results in lower results for asc[illegible]ic acid in some items. In particular, the ascorbic acid concentration in coffee is a little over one third that found in the previous evaluation (10). The concentration of ascorbic acid in chocolate has again fa[illegible] meet the specification (18). The soup powders meet the vitamin specification for unfortified type I soup powder rather than that for fortified type II soup powder. The remaining items fortified with ascorbic acid are the fruit drink powders, which about 70% of users discard (16).

Only rice was analysed for niacin and riboflavin because the ADFFS prescribes its fortification. The results obtained confirm that the rice is not fortified with these vitamins.

The salt content of the five packs is very high. All are higher than in CR1M reported in previous reports. This high level cannot be justified even for acclimatization purposes and should be drastically reduced. About 60% of the salt is provided in the common items, which includes 7g of salt as a separate item. It is recommended that the salt content of these rations should be reduced.

PATROL RATION ONE MAN (PR1M)

Nutritional Evaluation:

The detailed results of chemical analysis for PR1M are listed in Appendix 3.

Table 3 includes the summary of total nutrients available in each PR1M pack. There is an energy deficiency for grade 2 level of activity of 1560 to 2000 kJ. This energy deficiency can be rectified by foraging, or by supplementing the ration with one to three chocolate rations. Table 4 summarises the distribution of energy available from the rations. The proportion available from protein greatly exceeds the recommended maximum of 12%. This imbalance could also be redressed by supplementing the ration with the results of foraging or with chocolate ration. The protein content of the ration is sufficient to meet the needs of two men for one day. If this quantity of protein were consumed by one man per day it is likely to generate a demand for an additional 0.35 to 0.43 L of water to excrete protein metabolites.

The vitamin contents, as shown in Table 3, may be inadequate. Thiamin concentration found is considerably lower than that found in previous reports (1-10). The contribution derived from coffee is low due to failure to meet specifications, and the contribution from chocolate is less than half that of the previous report although still meeting the specification. The contribution from the freeze-dried meals is also lower than reported previously (10). Ascorbic acid content reported is about 60% the content in the previous report (10) due to the use of a more specific method. In particular the concentration of ascorbic acid in coffee is of the order of a third to a half that found in the previous report. Chocolate again fails the specification (18) for ascorbic acid. However, the fruit drink powders, which failed specifications in the previous reports, met specifications. This leads to considerable concern at the likely intake of ascorbic acid due to the likelihood of the fruit drink powder being discarded rather than used.

Only coffee and rice were examined for niacin and riboflavin. The rice is confirmed to be unfortified type I rice rather than fortified type II. The coffee, though fortified, fails to meet the specification (18). The total reported in Table 3 represents the contribution from these items; there will also be a contribution from other items such as the freeze-dried meals, milk powder and cheese. However, these results indicate that the niacin and riboflavin content of the ration warrants further investigation, and may be inadequate.

The salt content of each of the ration packs is of a similar order to that of CR1M. It is of the order of three times the maximum recommended daily intake of 5.8g. 11g of this salt is supplied with the items common to each of the packs, and includes 7g of salt in a sachet. It is recommended that the salt content of these rations be reduced.

MICROBIOLOGICAL

All freeze-dried meals for Army consumption were tested for microbiological quality. Five subsamples were taken from each batch of each freeze-dried meal produced. All, except for one batch of Roast Pork and Gravy, passed the ADFFS specifications. The batch of Roast Pork and Gravy which failed was rejected and not dispatched.

All the results obtained from the testing programme were pooled. None of the freeze-dried meal items had significant levels of yeast, moulds, *E. coli*, salmonellae or coliforms. Only the sample batch of Roast Pork and Gravy which was destroyed had significant levels of coagulase positive staphylococcus. Most freeze-dried meals had a standard plate count of less than 100 colony forming organisms. Generally, less than 1% of meals examined failed the marginal specification (20% permitted to fail) of 10^4 colony forming organisms/g. Only Lamb and Vegetable Curry approached the specification with 12% of meals failing.

Beef blocks produced at AFFSE were also tested with similar results to the freeze-dried meals. Ten per cent of standard plate counts for beef block are of the order of 10^7 which is to be expected in this type of product, due to the additional handling during the compression process.

COMPLIANCE WITH AUSTRALIAN DEFENCE FORCE FOOD SPECIFICATIONS (ADFFS)

Table 5 summarises the items from each ration which fail at least one ADDFS (18) specification. 24 separate items fail at least one specification. In many cases the failure is in respect of the only specification measurable by chemical means.

The instant coffee component of each of the rations fails in respect of the thiamin content, which is generally less than a quarter of the specified amount. One of the coffee samples also failed in respect of the moisture content, which may be a contributing factor in the low thiamin content. Both chocolate rations examined failed with respect to the ascorbic acid specification. The failures in respect of these two items is of particular concern since they are important fortified items which are common to most rations. Failures for these items have been noted in previous years.

TABLE 5

Items Failing to Meet ADFFS

ITEM	PARAMETER	RATION	SPECIFICATION	FAILED (9) AFFSE REPORT 1/81	FAILED (10) AFFSE REPORT 1/82	RESULT OBTAINED AFFSE REPORT 1/84
Apricot Jam	Ascorbic acid	CR10M A	>35 mg/100g			27.8 mg/100g
Beef Noodle Soup Type II	Thiamin	CR10M A	>5.2 mg/100g			0.5 mg/100g
	Ascorbic acid	CR10M C	>106 mg/100g			1.5 mg/100g
	Niacin	CR10M C	>35.3 mg/100g			1.1 mg/100g
	Riboflavin	CR10m C	>5.2 mg/100g			0.1 mg/100g
Coffee	Thiamin	CR10M	>21.1 mg/100g		Y	3.92 mg/100g
	Niacin	CR10m	>140 mg/100g			111.5 mg/100g
	Riboflavin	CR10M	>21.1 mg/100g			19.1 mg/100g
Condensed Milk	Fat	CR10M	>8%**			6.13%
Chicken Noodle Soup Type II	Thiamin	CR10M C	>5.2 mg/100g			0.14 mg/100g
	Ascorbic acid	CR10M C	>106 mg/100g			1.5 mg/100g
	Niacin	CR10M C	>35.3 mg/100g			1.1 mg/100g
	Riboflavin		>5.2 mg/100g			0.05 mg/100g
Pea & Ham Soup	Thiamin	CR10M D	>5.2 mg/100g			0.102 mg/100g
	Ascorbic acid		>106 mg/100g			4.0 mg/100g
	Niacin		>35.3 mg/100g			1.8 mg/100g
	Riboflavin		>5.2 mg/100g			0.26 mg/100g
Luncheon Meat Type II	Fat	CR10M	>10%	Y	Y	11.71%
Tomatoes Peeled	Ascorbic acid	CR10M A	>17.5 mg/100g			11.7 mg/100g
Vegemite	Salt	CR10M	10-14%			9.91%
Beef & Vegetables	Moisture	CR10M D	>78%		Y	81.87%
Beef & Beans	Moisture	PR1M	<2%			2.15%
Jam Biscuits	Moisture	PR1M	<7%		Y	7.27%
Chocolate	Ascorbic acid	PR1M	>22 mg/100g		Y	14.4 mg/100g
Coffee	Thiamin	PR1M	>21.1 mg/100g		Y	0.038 mg/100g
	Niacin	PR1M	>140 mg/100g			111.5 mg/100g
	Riboflavin	PR1M	>21.1 mg/100g			18.8 mg/100g

TABLE 5 (continued)

ITEM	PARAMETER	RATION	SPECIFICATION	FAILED (9) AFFSE REPORT 1/81	FAILED (10) AFFSE REPORT 1/82	RESULT OBTAINED AFFSE REPORT 1/84
Savoury Steak Fingers	Moisture	PR1M	< 2%			2.18%
Skim Milk	Moisture	PR1M	< 4%		Y	4.64%
Shortbread Biscuit	Moisture	CR1M	< 4%	Y	Y	4.58%
Survival Biscuit	Moisture	CR1M	2-4%**	Y	Y	6.16%
Cereal Block	Moisture	CR1M	< 6%	Y	Y	6.11%
Chocolate	Ascorbic acid	CR1M	> 22 mg/100g	Y	Y	7.3 mg/100g
Coffee	Moisture	CR1M	< 4%		Y	4.03%
	Thiamin	CR1M	> 21.1 mg/100g	Y	Y	0.9 mg/100g
Beef Soup	Thiamin	CR1M	> 5.2 mg/100g			1.29 mg/100g
	Ascorbic acid	CR1M	> 106 mg/100g			11 mg/100g
	Niacin	CR1M	> 35.3 mg/100g			1.0 mg/100g
	Riboflavin	CR1M	> 5.2 mg/100g			0.1 mg/100g
Chicken Soup	Thiamin	CR1M	> 5.2 mg/100g			0.3 mg/100g
	Ascorbic acid	CR1M	> 106 mg/100g			11 mg/100g
	Niacin	CR1M	> 35.3 mg/100g			
	Riboflavin	CR1M	> 5.2 mg/100g			
Sweetened Cond. Milk	Fat	CR1M	> 9%**	Y	Y	7.74%

** Passed specification according to Australian Government Analytical Laboratory reports.
Y Failed ADFFS specification in AFFSE report.

A total of 14 items failing in respect of at least one specification were also noted in the previous report (10) as having failed for the same reason. Only two of these items have appeared on reports by the Australian Government Analytical Laboratories (AGAL) as having been tested. They were reported as passing the specification.

Table 6 lists the incidence of failures with respect to particular parameters. The 5 samples of soup powders which fail the specifications for the vitamins thiamin, ascorbic acid, niacin and riboflavin may in fact have been unfortified type I soup powder rather than fortified type II powder, in which case they pass their specification.

TABLE 6

Incidence of Failures to Particular Specification Parameters

Parameter	Number of Items Failing
Moisture	9
Fat	2
Thiamin	8 (3 not soup)
Ascorbic acid	8 (3 not soup)
Niacin	7 (2 not soup)
Riboflavin	7 (2 not soup)

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 (18). The results obtained are considered reliable, but are derived for the purpose of nutritional assessment rather than testing for compliance with specifications. However, the methods for thiamin, niacin, and riboflavin closely correspond with the ADFFS (18) methods. 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. The method for moisture, in general, will be close to the ADFFS procedure. Most results relate to only one sample rather than five required by ADFFS.

CONCLUSION

The energy content of each of the ration packs is adequate for the intended operational use. The protein content of CR10M and PR1M is excessive. The options for reduction of protein in CR10M are currently under investigation. New components are being introduced to the 1984-85 PR1M packing programme to reduce the total protein provided. The salt content of the rations is of some concern. The number of salt sachets provided has been reduced to half in the current packaging programme for CR10M. The options are being investigated for reducing salt content by reformulation of selected ration components. The vitamin content of the PR1M is of some concern and fortification of freeze-dried meals is being investigated.

The continuing problem of obtaining components which fail to meet some specifications has been brought to the attention of the purchasing authority. It is expected that there will follow tighter control of purchasing these items, particularly those items with a history of failing specifications.

The high standard of microbiological quality has been maintained in the 1983 packing programme.

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APPENDIX 1

COMBAT RATIONS RESULTS 1983 PACKING PROGRAMME

RATION	Description	Net Wt g	Moist %	Fat %	Ash %	Protein %	CHO's %	Energy kJ/100g	Salt %	Thiamin mg/100g	AscA mg/100g	Niacin mg/100g	Ribofn mg/100g
CR10M83	A Apricot Jam	500	31.50	0.51	0.10	0.78	58.45	976	-1.00	-2.000	27.80		0.04
CR10M83	A Beef Noodle Soup	359	6.01	2.62	1.18	12.86	54.98	1195	15.17	0.500	0.75	1.00	0.10
CR10M83	A Braised Steak	1800	66.81	11.27	0.61	17.77	4.92	789	1.30	0.020	-2.00	2.85	0.16
CR10M83	A Chopped Pork	1360	63.00	18.35	0.71	15.87		949	1.56	0.399	7.00	2.80	0.15
CR10M83	A Fruit Pudding	1760	28.54	6.80	1.52	5.44	56.94	1255	0.23	0.036	-1.00	0.54	0.19
CR10M83	A Mince & Spaghetti	1800	71.77	9.82	0.42	8.82	6.72	620	2.03	0.026	-2.00	2.17	0.32
CR10M83	A Tomato Juice	309	89.58	0.38	0.36	1.35	7.09	150	0.69	0.048	9.90	2.07	
CR10M83	A Tomatoes Peeled	553	86.94	0.28	0.52	1.42	8.74	174	0.89	0.039	11.70	0.76	0.03
CR10M83	B Beef & Kidney	1800	75.81	6.09	0.70	13.46	3.07	503	1.57	0.027	2.00	2.70	0.51
CR10M83	B Fruit Salad	1210	80.72	0.25		0.53	18.56	315	-2.00	0.005	-2.00	0.21	0.01
CR10M83	B Fruit Salad Juice	420	82.62	0.30		0.18	14.35	244	-2.00	0.001	-2.00		
CR10M83	B Luncheon Meat	1360	68.59	14.73	1.21	13.20		769	2.22	0.043	19.00	3.05	0.13
CR10M83	B Meat & Beans	1800	64.35	5.68	1.15	12.28	15.37	665	1.45	0.039	-2.00	1.60	0.13
CR10M83	B Raspberry Jam	500	28.90	0.77	0.27		64.05	1053	0.01		53.40		0.06
CR10M83	B Sweet Corn	525	79.75	1.01	0.40	2.33	14.54	310	0.66	0.029	-2.00	0.59	0.05
CR10M83	B Tomato Soup	474	5.20	3.84	0.59	7.03	67.92	1348	11.35	0.082	1.50	2.80	0.29
CR10M83	C Apricot Jam	500	32.80	1.62	0.43	0.51	55.61	958	-1.00	0.005	39.00		
CR10M83	C Beans	503	33.04	0.62	0.29	1.63	6.14	149	1.38	0.018	5.00	0.08	0.07
CR10M83	C Beef & Vegetable Curry	1800	68.78	9.34	0.57	9.88	8.51	650	1.80	0.031	-1.00	2.23	0.10
CR10M83	C Blackberry Jam	500	27.25	0.44	0.14	0.57	79.82	1303	0.01	0.001	77.20		0.08
CR10M83	C Carrots	544	91.34	0.51	0.15	0.79	7.12	146	0.58	0.016	-2.00	0.38	0.02
CR10M83	C Chicken Noodle Soup	179	5.20	4.26	1.61	10.39	61.03	1311	18.77	0.140	1.50	1.10	0.05
CR10M83	C Corned Beef	1360	58.15	17.08	0.49	21.78		1002	2.27	-2.000	-2.00	2.40	0.21
CR10M83	C Peach Juice	450	80.56	0.53		0.20	16.28	283	-2.00	0.006	1.00		
CR10M83	C Peaches	1360	80.57	0.20	0.10	0.65	18.45	314	-2.00	-2.000	1.00	0.43	0.04
CR10M83	C Steak & Tomato	1800	74.45	7.23	5.71	11.50	15.07	704	1.79	0.025	-2.00	2.20	0.13
CR10M83	C Strawberry Jam	500	30.20	2.30	0.20	0.26	76.30	1310	-1.00	0.003	71.80		
CR10M83	D Beef & Vegetables	1800	79.86	4.53	0.47	9.71		333		0.027	2.00	1.55	0.12
CR10M83	D Beef Steak & Kidney	1800	73.02	7.49	0.73	15.95	3.99	612	1.32	0.026	1.00	4.09	0.42

APPENDIX 1 (cont)

COMBAT RATIONS RESULTS 1983 PACKING PROGRAMME

RATION	Description	New Wt g	Moist %	Fat %	Ash %	Protein %	CHO's %	Energy kJ 100g	Salt %	Thiamin mg 100g	AscA mg 100g	Niacin mg 100g	Ribofn mg/100g
CR10M83 D	Fruit Pudding	1800	29.10	6.99	0.92	5.41	57.40	1269	0.23	0.720	-2.00	0.54	
CR10M83 D	Jam Blackberry	500	28.61	1.32	0.16	0.81	79.84	1340	0.01	0.001	53.00		
CR10M83 D	Luncheon Meat type II	1360	65.69	11.71	0.69	12.76	6.89	760	1.59	0.021	1.20	3.27	0.09
CR10M83 D	Pea & Ham Soup Powder	345	7.18	1.71	8.94	22.85	43.35	1145	14.31	0.102	4.00	1.80	0.26
CR10M83 D	Red Kidney Beans	592	69.91	0.78	0.31	6.29	22.13	490	0.98	0.071	-2.00	1.50	0.05
CR10M83AB	Peas	506	78.92	0.53	0.37	4.87	14.40	333	0.61	0.165	-1.00	2.10	0.10
CR10M83CD	Green Beans	686	90.66	0.74	0.24	1.14	4.43	118	1.65	-2.000	4.40		
CR10M83com	Butter	145	0.30	93.20	0.25	1.96	0.27	3486	2.54	0.003	-2.00		
CR10M83com	Butter Concentrate	170	0.30	92.80	0.12	1.64		3461	2.55	-2.000			
CR10M83com	Coffee	56	3.78	0.84	0.09	9.88			0.04	3.920	635.80	111.50	19.10
CR10M83com	Coffee	56	3.52	1.21	1.31	19.93			0.08	3.600	776.00	193.10	21.20
CR10M83com	Condensed Milk	410	73.18	6.13	0.64	8.16	12.22	561	0.52	0.027	127.40	0.30	0.26
CR10M83com	Condensed Milk	410	72.27	8.17	1.06	8.04	5.94	534	0.53	0.013	158.00	0.30	
CR10M83com	Curry Powder	16	7.86	13.80	4.58	12.88	63.17	1740	4.66	0.095	1.00		
CR10M83com	Curry Powder	84	7.04	13.32	2.18	13.75	57.92	1653	4.53	0.066	1.00		
CR10M83com	Potatoes	3451	81.33	0.13	0.26	1.69	13.92	256	1.10	0.029	1.50	1.15	
CR10M83com	Potatoes Whole	704	80.85	0.09	0.53	1.71	13.53	248		0.025	1.40	1.15	0.02
CR10M83com	Salt	28	0.12						100.00				
CR10M83com	Sugar	280	0.02			-2.00	99.98	1600	-2.00				
CR10M83com	Tea	53	8.05		3.52	24.73			0.13		-2.00		
CR10M83com	Tea	75	7.46						0.43	0.098	1.00	7.30	
CR10M83com	Tomato Sauce	227	68.83	0.67	0.22	1.37	23.42	423	2.96	0.012	34.40	1.50	0.06
CR10M83com	Tomato Sauce	450	65.62	0.53	0.41	1.61	26.57	472	3.10	0.052	35.00		0.06
CR10M83com	Vegemite	56	34.28	1.20	4.43	29.95	16.33	814	10.80	15.380	0.60	108.12	10.80
CR10M83com	Vegemite	100	36.37	1.18	5.17	29.52	15.00	785	9.91	15.410	15.00		

= Not analysed
-1.00 = Only trace found
-2.00 = Below detection limit
AscA = Ascorbic Acid
Ribofn = Riboflavin

APPENDIX 2

COMBAT RATION RESULTS 1983 PACKING PROGRAMME

RATION	Description	Net wt g	Moist %	Fat %	Ash %	Protein %	CHO's %	Energy kJ/100g	Salt %	Thiamin mg/100g	AscA mg/100g	Niacin mg/100g
CR1M83 A	Beef & Vegetables	227	75.88	5.01	0.49	5.56	10.53	448	1.34	0.024	-2.00	
CR1M83 A	Ham & Eggs	113	65.68	17.00	1.13	13.28		855	1.87	0.038	-2.00	
CR1M83 A	Jam Plum	26	25.96	0.68	0.11	0.80	67.47	1118			50.00	
CR1M83 B	Corned Beef Hash	227	75.42	8.66	0.34	5.56	4.89	493	1.34	0.098	-2.00	
CR1M83 B	Jam Raspberry	26	25.68	0.76		0.79	66.53	1106	0.04	0.003	64.80	
CR1M83 B	Pork & Beans	113	66.58	5.45	1.04	10.43	16.85	649	2.18	0.065	5.00	
CR1M83 C	Beef with Gravy	227	63.50	15.09	1.72	14.58		806	0.88	0.020	-2.00	
CR1M83 C	Jam Apricot	26	27.76	1.47	0.23	0.37	65.50	1109		0.006	36.00	
CR1M83 C	Luncheon Meat	113	65.50	13.06	1.62	13.03	2.11	738	1.63	0.009	-1.00	
CR1M83 C	Pears	140	80.15	0.44	0.23	0.02	14.86	254	-2.00	-2.000	-2.00	
CR1M83 D	Jam Blackberry	26	24.87	0.59	0.20	3.91	64.53	1121	0.01	0.005	70.00	
CR1M83 D	Luncheon Meat	227	66.60	16.57	0.96	15.37		874	4.66	0.064	-2.00	
CR1M83 D	Sausages & Vegetables	113	79.92	6.17	0.38	18.12		536	1.62	0.006	-2.00	
CR1M83 D	Soup Beef	7	2.94	8.04	3.61	10.18	27.47	910	55.71	1.293	11.00	
CR1M83 E	Corned Beef	227	58.00	14.74	0.47	19.77	0.69	893	1.23	0.004	-2.00	
CR1M83 E	Jam Peach	26	24.53	0.39	0.15	1.13	68.02	1122		0.004	37.00	
CR1M83 E	Soup Chicken	7	1.69	8.86	7.04	8.76	31.73	984	38.39	0.380	11.00	
CR1M83 AB	Peaches	140	82.22	0.19	0.09	0.41	15.53	262	-2.00	-2.000	2.40	
CR1M83 DE	Potato & Onion Powder	50	5.91	6.82	0.99	11.32	61.66	1463	0.53	0.137	-1.00	
CR1M83 DE	Two Fruits	140	82.12	0.23	0.11	0.26	13.64	231	-2.00	-2.000	-2.00	
CR1M83ABC	Curry Powder	4	7.14	13.56	2.80	11.55	47.87	1463	5.56	0.422	2.10	
CR1M83ABC	Rice F D	55	1.47	2.08	1.00	8.86	82.58	1549	0.35	0.005	-1.00	0.40
CR1M83com	Biscuits Shortbread	85	4.58	22.98	1.09	6.97	59.28	1917	1.17	0.069	-2.00	
CR1M83com	Biscuits Survival	84	6.16	14.77	1.15	10.76	65.92	1784	1.41	0.171	-1.00	
CR1M83com	Butter	28	0.58	93.70	0.28	2.32		3506	2.06	0.001		
CR1M83com	Butterscotch	50	3.96	4.13	0.02	0.41	90.51	1608	0.50	-2.000	1.30	
CR1M83com	Cereal Block	56	6.11	23.95	1.24	10.01	54.25	1924	0.68	0.190		
CR1M83com	Cheese	47	43.70	27.22	5.34	21.30	0.15	1371	2.59	0.031	-2.00	
CR1M83com	Chewing Gum	15	3.42	11.04	0.36	0.18	69.89		0.04	-2.000	-1.00	

APPENDIX 2 (cont)

COMBAT RATIONS RESULTS 1983 PACKING PROGRAMME

RATION	Description	New Wt g	Moist %	Fat %	Ash %	Protein %	CHO's %	Energy kJ 100g	Salt %	Thiamin mg 100g	AscA mg 100g	Niacin mg 100g
CR1M83com	Chocolate	50	3.14	24.88		9.20	57.69	2000	0.34	5.141	7.30	
CR1M83com	Coffee	7	4.03	0.69		21.00			0.74	0.900	477.00	
CR1M83com	Fruit Drink Powder	14	0.33	1.14		0.70	95.13	1577	0.04	0.005	175.00	
CR1M83com	Salt	7	1.13						99.32			
CR1M83com	Sugar	84	0.05				99.95	1599				
CR1M83com	Sweetened Condensed Milk	71	24.31	7.74	0.43	10.81	63.31	1483	0.52	0.096	2.90	
CR1M83com	Tea Bags	15	8.31						0.13	0.139	-2.00	

	=	Not analysed
-1.00	=	Only trace found
-2.00	=	Below detection limit
AscA	=	Ascorbic Acid

APPENDIX 3

COMBAT RATIONS RESULTS 1983 PACKING PROGRAMME

RATION	Description	New wt g	Moist %	Fat %	Ash %	Protein %	CHO's %	Energy kJ/100g	Salt %	Thiamin mg/100g	AscA mg/100g	Niacin mg/100g	Ribofn mg/100g
PR1M83 A	Beef & Beans	110	2.15	16.75	2.82	58.96	13.87	1844	4.14	0.087	5.00		
PR1M83 A	Lamb and Vegetable Curry	110	1.75	22.82	1.77	50.51	24.97	2102	1.25	0.170	4.00		
PR1M83 A	Orange Drink Powder	14	0.23	0.87	0.26	1.91	92.14	1539	0.02	-2.000	206.00		
PR1M83 B	Beef & Onions	110	1.69	9.15	2.87	59.87	25.16	1759	1.73	0.094	2.00		
PR1M83 B	Lemon Drink Powder	14	0.30	2.10	0.70	0.30	90.44	1529	0.03	0.023	230.40		
PR1M83 B	Roast Pork & Gravy	110	1.78	28.90	1.52	61.83	4.23	2188	2.45	0.149	1.50		
PR1M83 C	Lime Drink Powder	14	0.28	2.98	0.29	0.01	92.95	1598	0.02	0.006	204.00		
PR1M83 C	Savoury Steak Fingers	110	2.18	9.69	2.42	64.34	17.73	1736	4.88	0.072	6.00		
PR1M83 C	Spaghetti Bolognaise	110	1.21	11.18	1.32	33.10	49.90	1775	2.63	0.029	4.00		
PR1M83com	Biscuits Jam	85	7.27	17.66	0.38	6.12	69.77	1873	0.53	0.080	1.00		
PR1M83com	Biscuits Shortbread	85	3.94	23.26	0.26	5.96	58.99	1906	1.88	0.100	-2.00		
PR1M83com	Chewing Gum	15	3.31	10.72	1.68	3.48	78.09		0.07	-2.000	5.00		
PR1M83com	Chocolate	50	3.26	26.85	1.32	8.57	52.06	1972	0.33	2.790	14.40		
PR1M83com	Coffee	7	2.63	0.96	0.70	20.22			0.03	0.038	537.00	111.50	18.80
PR1M83com	Processed Cheese	40	42.30	28.30	7.04	20.68		1398	3.00	0.041	1.00		
PR1M83com	Rice	55	0.03	2.03		8.52	83.84	1561	0.22	0.005	1.40	0.40	-1.00
PR1M83com	Rice	155	0.78	2.63	0.25	7.90	82.58	1553	0.30	0.005	-2.00	0.44	-1.00
PR1M83com	Rice	155	0.45	1.65	0.14	8.86	87.17	1606	0.22	-2.000	1.20	0.36	-1.00
PR1M83com	Salt	7							98.47				
PR1M83com	Skim Milk Powder	28	4.64	1.20	1.00	34.56	50.25	1436	1.85	0.111	5.00		
PR1M83com	Sugar	85	0.05				99.95	1600					
PR1M83com	Tea	16							0.21	0.020	2.50		

	=	Not analysed
-1.00	=	Only trace found
-2.00	=	Below detection limit
AscA	=	Ascorbic Acid
Ribofn	=	Riboflavin

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