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Field Acceptability and Consumption of CR1M and Potential New Food Items during the Hot Weather Ration Trial

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ABSTRACT

The Combat Ration One Man (CR1M) is the combat ration pack (CRP) used predominately by the Australian Defence Force (ADF). Soldiers frequently discard a large number of items within this pack for various reasons. To enable continuous improvement of CRP, it is important that both acceptability and consumption of current and potential new items be regularly reviewed. This report details an analysis of the data collected during the trial of a prototype Hot Weather Ration (HWR). Poor acceptability and consumption rates were found for some products, whilst others were highly acceptable and well consumed. Recommendations are made for improvement or replacement of several items, which can be used to inform future CR1M versions.

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Field Acceptability and Consumption of CR1M and Potential New Food Items during the Hot Weather Ration Trial

Executive Summary

The Combat Ration Pack (CRP) used predominately by the Australian Defence Force (ADF) is the Combat Ration One Man (CR1M). Soldiers often do not consume the ration packs in their entirety, discarding many items.

Acceptability is believed to be a determinant of whether or not items will be consumed. Therefore, there is a need to regularly review the acceptability of ration items.

There are other factors that influence consumption and indeed some determinants are not well understood. Therefore, it is also important to monitor actual consumption of ration pack items.

DSTO has reviewed the data collected during the trial of a prototype Hot Weather Ration (HWR) to determine the level of consumption and field acceptability of ration pack items used during the trial. The trial was a well designed study which closely monitored actual consumption via a bar-coding technique. Acceptability and reasons for discards were monitored using questionnaires.

Recommendations are made for improvements to the main meals to increase variety and palatability. Some snacks and confectionery are acceptable and consumed well, while others need removal/replacement or reformulation. Suggestions are made for inclusions of new products. Improvements to drinks are recommended through the introduction of pouch packaging and new flavours.

This analysis will inform decisions on which ration pack items should be considered for replacement. It may also indicate which items should be considered for introduction into the CR1M.

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Julia Carins, BSc, MBA (Tech Mgt) is part of the Nutrition and Food Technology group of the Human Protection and Performance Division. Since joining DSTO in 1996, she has been involved with many research projects of varying nature, including work on the development of a prototype hot weather ration, iron supplementation for female cadets, calcium intake of female cadets, salivary markers of immune function, nutritional analysis of combat ration pack items and determination of food acceptability. Her special interests are the behavioural aspects of eating, food preferences, food attitudes and eating patterns.

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1. Introduction

The Combat Ration One Man (CR1M) is the combat ration pack (CRP) used most commonly by the Australian Defence Force (ADF) to feed ADF members when no form of organised messing is practicable, or as the tactical situation dictates. It provides sustenance over a 24-hour period at an average energy value of approximately 15 000kJ; it must be self-contained and have a weight of approximately 1.9 kg [1].

Research indicates that soldiers do not consume combat ration packs in their entirety, often discarding many items [2-5]. Along with load carriage, acceptability is believed to be a major determinant of an item's consumption. Acceptability of CRP is likely to alter over time, as users become bored with eating the same food and as personal tastes change.

Acceptability¹ is not the only determinant of consumption. Other factors include those related to the food (including temperature, compatibility, variety, authenticity), the individual (including preferences, expectations, attitudes, mood, cultural) and the environment (including appropriateness, time of day, weather, and convenience), some of these determinants are not well understood [6]. Acceptability has been shown to be a poor predictor of consumption, explaining only 14% of the variance in consumption (Figure 1)[6]. Therefore, it is important to monitor actual consumption of ration pack items in addition to regular acceptability studies or surveys.

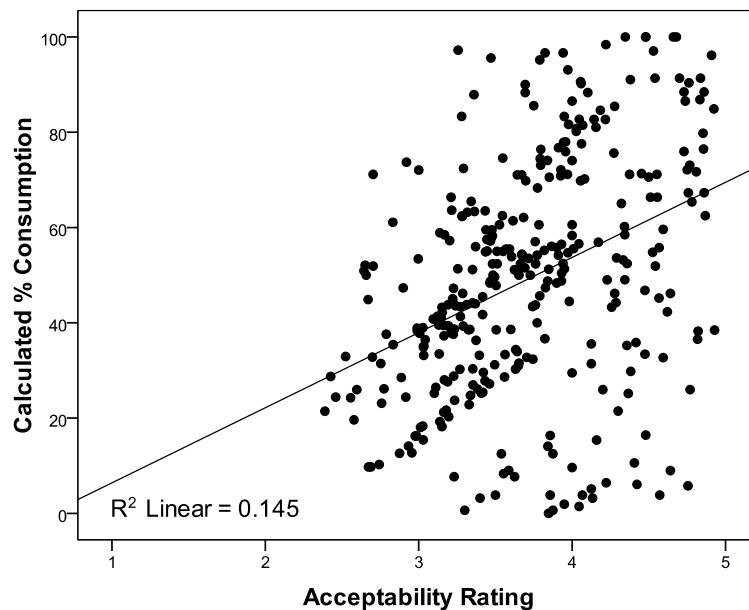


Figure 1: Scatter plot of consumption vs. acceptability, six studies, 2002–2007

This report consists of a review of consumption and acceptability data collected during the trial of a prototype Hot Weather Ration (HWR). The purpose of this report is to inform future CRP builds.

¹ In this report 'acceptability' means sensory hedonic rating of food items.

2. Methodology

2.1 Overview of the Hot Weather Ration (HWR) Trial

From 2006 to 2008 DSTO conducted extensive research on nutrition in the heat, which culminated in the development of a prototype Hot Weather Ration (HWR) [7], and the field evaluation trial of this prototype in 2008 [8]. The trial examined ration acceptability, consumption, dietary intake, energy expenditure, anthropometry, environmental stress, hydration status and other physiological measures. This report examines only the acceptability and consumption data from that trial.

2.2 Participants

Sixty-five male soldiers from 1RAR (B COY) volunteered to participate in the HWR trial whilst undertaking a two-week jungle warfare training course in Tully, far north Queensland. Throughout the trial, these soldiers operated in two platoons: 4PL and 5PL, which were involved in similar activities but operated independently. During the day, participants undertook a variety of activities that included general patrolling, basic infantry tactics, fire and movement, enemy camp searches, and participating in the obstacle course and bayonet assault course. During the night they participated in night ambushes and conducted routine night activities. Table 1 shows the demographics of the participants who commenced the trial.

Table 1: Demographics of the participants who commenced the trial

Group	Number	Age (years)	Years in service
		Mean (Range)	Mean (Range)
All	65	22.0 (17–39)	2.0 (0.1–13)
4PL	33	22.1 (17–39)	2.3 (0.1–12)
5PL	32	22.0 (17–30)	1.7 (0.5–13)

2.3 The Rations

2.3.1 Ration Design and Contents

The HWR was designed to permit a more flexible or ‘grazing’ eating pattern using items that required limited preparation. It was also designed to meet the (unofficial) specifications for total energy, macronutrients, sodium and calcium for soldiers operating in hot weather recommended by DSTO [9]. The HWR packs consisted of a combination of commercial-off-the-shelf (COTS) products and popular (existing) CR1M items. These packs were labelled RED A, B and C (see Appendix A for details). Data collected in the formative stages of the HWR project, along with unpublished data collected from previous DSTO CRP acceptability surveys informed the selection of individual food items for the three prototype HWR menus.

The CR1M (control) ration packs were developed from the 2006/07 ration packing build. At the time of the study, ADF personnel were unlikely to have been previously issued rations

from this 2006/07 build, however the soldiers would have been familiar with most of the components. These packs were labelled BLUE A, B and C (see Appendix B for details).

Table 2 shows the calculated daily average energy and macronutrient content of the CR1M and HWR.

Table 2: Nutritional composition of the CR1M and HWR

Ration	Energy (kJ)	Protein (g)	Carbohydrate (g)	Fat (g)
CR1M	16 360	100	660	110
HWR	15 580	140	560	100

To reduce the effect of novelty, all ration packs used in this trial were built, labelled and repacked by DSTO. Where possible, commercial items used in the HWR were repackaged into drab olive wrapping. Both ration packs were repackaged and labelled in the same style, as RED Menus A, B and C and BLUE Menus A, B and C as shown in Figure 2.



Figure 2: CR1M (BLUE) and HWR (RED) packs packaged and labelled similarly

To minimise the risk of bias in favour of a new pack that was specifically designed for use in hot weather, participants were informed that they would be participating in a field evaluation of two new styles of HWR pack, one called the RED ration and the other called the BLUE ration. They were not informed that the RED ration was actually the HWR and the BLUE ration was the CR1M (control). Participants were not permitted to consume 'Jack rations' (non-ration foods or beverages) during the trial. This requirement was strictly enforced by military staff.

2.4 The Trial

2.4.1 Design

The trial employed a controlled, balanced, crossover design. Each of the groups (platoons) was given three days rations, labelled only as RED A, B and C or BLUE A, B and C. Group 1 was rationed for three days with the control (BLUE) ration, one day of fresh feeding, and then three days of the HWR (RED) ration. Group 2 followed the same pattern but in reverse order. Figure 3 shows the trial design.

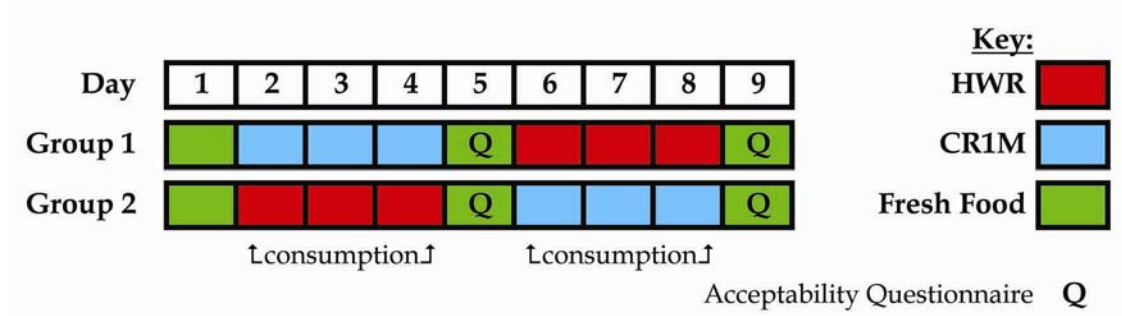


Figure 3: Design of the HWR Trial

2.4.2 Trial execution

At the beginning of each three-day period, participants were issued their rations and waste collection bags. Soldiers were free to consume the ration pack items whenever they desired over the three-day period. All discarded or partially-eaten food items and empty wrappers were collected each day between 0530 and 0730.

The fresh feeding day between the first and second ration periods enabled completion of data collection and prevented any ration treatment overlap.

Consumption was measured over each three-day treatment period. An acceptability questionnaire was completed by each group on the day immediately after each treatment period and group discussions were conducted to gather additional feedback.

2.5 Consumption of Ration Pack Items

A ration tracker database was designed for the trial to enable accurate collection of consumption data.

During the ration pack assembly, each individual food item (e.g. each muesli bar, drink sachet, sugar sachet, and main meal pouch) was labelled with a unique item barcode. When these items were packed together to form an individual ration pack, each pack was then labelled with a unique pack barcode.

Prior to the trial, each participant was also assigned a unique barcode, so that when the ration packs were issued, the appropriate pack barcode was scanned into the ration tracker database against that participant's barcode.

Participants were requested to retain all food packaging and uneaten items for collection by the researchers and not to exchange ration items with other participants. Each day, participants collated their rubbish (and/or unused items) in a waste bag labelled with their name and gave it to the researchers. The barcodes on the collected items were then scanned into the ration tracker database against each participant's barcode, which registered each item as 'returned'. The status of the item (i.e. *returned full*, *partially used* or *empty*) was also registered. The ration tracking database accurately tracked each ration item and determined if items had been returned, exchanged between participants or not yet returned, providing additional means by which the completeness of data could be determined.

These data were then used to calculate the percentage consumption of each ration item using the categories *not consumed*, *partially consumed* and *fully consumed*. Percentage consumption of a food item by a given participant was calculated using the following formula (Equation 1):

$$\% \text{ consumed} = 100 * (1 * \# \text{ fully consumed} + 0.5 * \# \text{ partially consumed} + 0 * \# \text{ not consumed}) / \# \text{ scanned}$$

Equation 1

where # = number of items in each category

For the purposes of this report, any item with a consumption rate of 50% or below has been targeted for further investigation of why this item may not have been well-consumed. Further investigation included examining acceptability and reasons for discarding.

2.6 Ration Acceptability

Acceptability of food items and reasons for discarding items were determined using a 2-page, in-house questionnaire – see Appendices C and D for details. Each questionnaire provided a complete list of items contained within the ration. Acceptability of each item was determined using a 5-point scale (1 = *dislike a lot*; 2 = *dislike*; 3 = *neutral*; 4 = *like*; 5 = *like a lot*). Participants were only required to enter an acceptability rating if they consumed the item.

For each item, mean and median acceptability ratings were calculated. In this report, a result for mean acceptability was considered invalid if the response rate was less than 40% (that is if less than 40% of participants rated the item) and was not reported.

2.6.1 Reasons for Discards

Reasons for discarding items were also determined by questionnaire. Participants were asked 'For items that you did not eat, indicate why you did not eat the item'. Five likely reasons for discarding rations were listed to choose from, including *taste*, *packaging*, *no time*, *didn't feel like it* and *didn't need it*. These specific categories were determined in consultation with the client. For each item, the number of responses under each category was calculated and converted to a percentage of total respondents. In this report, a reason for discarding is reported only if 20% or more of respondents identified it as a reason for discarding that item.

3. Results

3.1 Compliance

Eleven participants left the trial prior to completion due to injury, illness or personal reasons and their data were excluded from the dataset. Data from two other participants was removed due to poor compliance. On the final night of the trial, a medical incident resulted in 4PL being quarantined for the remainder of the trial which prevented access to that platoon. Waste collection bags were eventually released and acceptability questionnaires were distributed post-trial to these participants. However, follow-up on consumption data was not possible and many participants failed to return their completed acceptability questionnaires.

Demographics and some anthropometric results for the participants who completed the trial are shown in Table 3.

Table 3: Demographics for the participants who completed the trial

Group	Number	Age (years)	Years in service	Height (cm)	Weight (kg)
		Mean (Range)	Mean (Range)	Mean (Range)	Mean (Range)
All	52	22 (17–32)	2.1 (0.1–13)	180 (165–192)	76 (60–102)
4PL	23	22 (17–32)	2.5 (0.1–12)	181 (165–191)	75 (63–87)
5PL	29	22 (18–30)	1.8 (0.5–13)	180 (165–192)	77 (60–102)

3.2 Consumption, Acceptability and Reasons for Discards

The percentage consumption, mean acceptability and reasons for discards for each item are shown in tables in Appendix E. Table 4 shows the items from the CR1M that were consumed as part of the control ration. Table 5 shows the items from the CR1M that were consumed as part of the prototype HWR. Table 6 shows commercial items that were consumed as part of the HWR.

In each table, items have been grouped together into main meals², snacks, drinks and ancillary items. A consumption rate of 50% or below has been highlighted for further investigation of why this item may not have been well consumed. Mean acceptability ratings are reported for each food item (items with a response rate of <40% are considered invalid and not reported; there are 15 of these items). Mean acceptability ratings of below 3.0 are highlighted for attention. Reasons for discarding each item are indicated where 20% or more of respondents identified that particular reason for discarding an item. There were no instances where packaging was indicated as a reason for discarding by 20% or more respondents, so that column has not been shown.

² Main meals refer to food items, generally casserole style meals, which form the main part of a meal. They may be eaten without accompaniment (e.g. Spaghetti Bolognese) or with complementary food items (e.g. BBQ Beef might be consumed with rice or noodles).

4. Discussion

4.1 Main meals

Main meals from the CR1M that contained meat (and which were present in the both CR1M and HWR) were consumed reasonably well with consumption rates in the range 60–80%. Mean acceptability ratings for these meals were all moderate (all above 3.0) except for Sweet and Sour Meatballs which rated 2.7. Vegetarian main meals from the CR1M (which were present only in the CR1M) were not consumed well, and had low mean acceptability (2.7), indicating that they were generally not liked. This result is supported by findings from other studies [6].

The commercial main meals in the HWR were consumed well, and had higher mean acceptability ratings than the existing CR1M main courses. These meals were selected for the HWR as they could be eaten without heating. Consideration should be given to including main meals of this type in future builds of the CR1M; this is consistent with a recommendation in an earlier report [6].

The existing CR1M muesli mix and the commercial muesli mix used in the HWR had low consumption rates but high mean acceptability ratings. Indications were that there was insufficient time to prepare or consume these items. This may suggest that finding time to eat breakfast is a problem or that the product does not lend itself to being prepared and consumed quickly. Investigation of other suitable breakfast items is recommended.

4.2 Snacks

A number of CR1M snacks (including tuna, cracker biscuits, sweet biscuits, fruit grains and canned two fruits) had reasonable-to-high consumption rates accompanied by high mean acceptability ratings. Other snacks (canned pears and cheese) had marginal consumption rates and moderate-to-high mean acceptability.

CR1M snacks with low consumption rates included noodles, potato and onion powder and soup. 'No time' was clearly identified as a major reason for discarding these items, which should be considered for reformulation or replacement with items that are more convenient to prepare and consume. These items have previously displayed poor performance in terms of acceptability [6].

All commercial snacks provided in the HWR were well consumed (72–96%), with moderate-to-high mean acceptability. These snacks include bite-sized sweet and savoury biscuits, jerky, protein bars, cereal bars, dried fruits and trail mix. Consideration should be given to introducing some of these items into future CR1M versions.

4.3 Confectionery

Ration chocolate and candy chocolate had relatively high consumption rates (70% or above) whether present as part of the CR1M or the HWR. Mean acceptability ratings for these

products were high when presented as part of the CR1M, and moderate when part of the HWR.

Chewing gum and hard candy were consumed poorly, but had high mean acceptability. 'No time' was indicated as a reason for discarding PK chewing gum but not for the other flavours. In the absence of any other explanation, and considering the nature of these items, it might be speculated that these confectionery items are viewed as 'optional extras' and are consumed only occasionally.

The commercial confectionery items provided as part of the HWR were all consumed well (rates of 73–92%) and had high mean acceptability. These items could be considered as replacements for the hard candy in future versions of the CR1M.

4.4 Drinks

All CR1M drinks had low levels of consumption (1–46%) whether consumed as part of the CR1M or the HWR. The sports drinks performed better than the cordial drink powder, both in terms of consumption and acceptability. 'No time' was indicated as a reason for discarding all of these items, and 'didn't feel like it' as a reason for not consuming tea (when presented as part of the HWR). This was an expected finding, considering that the trial was conducted during hot weather.

Most of the drinks presented as part of the HWR performed well, with consumption rates in the range 60–67% and high mean acceptability ratings. Sports drinks (three flavours) and protein drinks (two flavours) were presented in a zip lock pouch where the water could be added to the powder in the packaging rather than using a cups canteen. These all received high mean acceptability ratings, and this, together with the novel pouch, may have contributed to the greater consumption rate compared to the drinks in the CR1M. 'No time' was also indicated as a reason for discarding some of these drinks. It would be worthwhile investigating further these drink types and pouch options.

Cappuccino beverage was the exception; although it had a high acceptability rating, it had a consumption rate of only 35%. Again, this was expected, considering that the trial was conducted during hot weather.

4.5 Ancillary items

CR1M ancillary items were not consumed well, which was also expected. Mean acceptability ratings were high where valid response rates were obtained. 'No time' was indicated as a reason for discarding many of these items, along with 'didn't feel like it' and 'didn't need it'. Many of these items were condiments and do not greatly alter the nutritional content, weight or bulk of the ration. These results do not support any major changes to the ancillary items.

5. Conclusions

The HWR performed better than the existing CR1M in terms of both consumption and acceptability. Serious consideration should be given to improving the quality and variety of main meal items and introducing beverage, snack and confectionery items similar to those used in the HWR. No immediate action is warranted for the ancillary items.

6. Recommendations

For each of the following food item types in the CR1M it is recommended that:

1. Main meals

- New varieties should be sourced, or reformulations occur to improve acceptability.
- New varieties should be identified and introduced that are palatable in both heated and unheated forms.

2. Breakfast

- Breakfast items that are acceptable and convenient should be identified and introduced.

3. Snacks/Confectionery items

- Retain the successful types (including tuna, cracker biscuits, sweet biscuits, fruit grains and canned two fruits).
- Remove and/or reformulate the noodles, potato and onion powder and the soup.
- Investigate and develop for inclusion, the promising products used in the HWR, including eat-on-the-move and bite-sized snacks such as jerky, savoury biscuits, sweet biscuits, dried fruit and trail mix and nutrient dense food bars.

4. Drinks

- Novel packaging should be investigated to enable the addition of water in the pouch, rather than mixing drinks in the cups canteen.
- More drink powder options should be considered for introduction, including protein and/or carbohydrate drinks and new flavours of sports drink.

5. Research

- Reviews of CRP consumption and acceptability should be conducted regularly.

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Appendix A: HWR (Red) Menus

PROTOTYPE HOT WEATHER RATION PACK					
RED MENU - Contents Sheet					
The Prototype Hot Weather Ration Pack is available in the three menus shown below					
Nutritional, ingredient and use-by information is available from DSTO Scottsdale					
Menu A					
Chicken with Vegetables	1x175g	Sports Beverage Tropical (1L) #	1x70g	Original Jerky Pieces	1x25g
Fruit Muesli Mix	1x60g	Sweet Chilli Sauce #	1x10g	Canned Peaches #	1x140g
Skim Milk Powder #	2x3g	Dried Apricots	1x50g	Fruit Mentos	1x38g
Original Muesli Bar	1x45g	Honey Roasted Nuts	1x50g	Jam Sandwich Biscuit #	1x45g
BBQ Shapes	1x25g	Teriyaki Jerky Bar	1x25g	Chocolate Protein Bar	1x65g
Sports Pouch Berry	1x25g	Chocolate Protein Drink	1x50g	Cola Sports Gel	1x25g
Menu B					
BBQ Beef #	1x250g	Sports Beverage Mixed Berry (1L) #	1x70g	Original Jerky Pieces	1x25g
Almond & Sesame Muesli Bar	1x40g	Tomato & Basil Tuna #	1x85g	Canned Two Fruits #	1x140g
Ski D'lite Muesli Bar	1x24g	Pizza Shapes	1x25g	Skittles	1x55g
Trail Mix	1x25g	Sweet Chilli Sauce #	1x10g	Fruitip Pastilles	1x52g
Tortilla Bread	1x54g	Teriyaki Jerky Bar	1x25g	Scotch Finger Biscuit #	1x35g
Sports Pouch Lemon/lime	1x20g	Vanilla Protein Drink	1x80g		
Menu C					
Beef Minced with Tortellini #	1x250g	Sports Beverage Grape (1L) #	1x70g	Original Jerky Pieces	1x25g
Tropical Fruits Muesli Bar #	1x33g	Tomato Sauce #	1x10g	Canned Pears #	1x140g
Almond Nuts	1x50g	Cookie Flavour Protein Bar	1x40g	Orange Sports Beans	1x28g
Cereal Bar	1x35g	Sultanas	1x50g	Mint Mentos	1x37.5g
Cheddar Shapes	1x25g	Pepper Jerky Bar	1x25g	Tiny Teddy Biscuits	1x25g
Sports Pouch Pineapple	1x20g	Chocolate Protein Drink	1x80g	Ham and Potato	1x175g
				Cola Sports Gel	1x25g
Additional Food Items Common to all HWRP Menus					
Cracked Pepper Vita Wheat #	1x36g	Instant Coffee #	1x3.5g	Tea Bags #	1x2.5g
Cheddar Cheese (Canned) #	1x56g	Cappuccino Beverage	1x12g	Vegemite #	1x15g
Sweetened Condensed Milk #	1x85g	Pepper, Black #	1x2g	Chocolate Ration	1x50g
Sugar #	4x7g	Salt #	1x2g	Chewing gum #	1x2.7g
Non-Food Items Common to all HWRP Menus #					
Bag, Plastic, Resealable (Water/Food)	1 Only	Menu Sheet – Components	1 Only	Ingredients Sheet	1 Only
Bag, Plastic, Inner (Sundry)	1 Only	Opener, Can, Hand (Fred)	1 Only	Pads Scouring, Nylon	1 Only
Rubber Bands Size 32	2 Only	Rubber Bands Size 62	1 Only	Spoon, Plastic	1 Only
		Matches Safety, Vial	1 Only	Paper, Toilet, 2 Ply, 10 Sheet	1 Pkt
*All items in blue text are new/commercial items			*All items in black text (#) are from CR1M (06/07)		

Appendix B: CR1M Menus

PROTOTYPE HOT WEATHER RATION PACK					
BLUE MENU - Contents Sheet					
The Prototype Hot Weather Ration Pack is available in the three menus shown below					
Nutritional, ingredient and use-by information is available from DSTO Scottsdale					
Menu A					
Sausages & Vegetables	1x250g	Sports Beverage Lemon & Lime (1L)	1x70g	Savoury Vegetable Soup	1x30g
Forest Fruits Muesli Bar	1x32g	BBQ Beef	1x250g	Chocolate (M&M's)	1x55g
Freeze Dried Potato & Onion	1x50g	Sweet Chilli Sauce	1x10g	Mixed Berry Fruit Grains	1x15g
BBQ Sauce	1x10g	Juicy Fruit Chewing gum	2xpkt4	Tropical Fruit Muesli Bar	2x32g
Raspberry Fruit Spread	1x26g	Canned Pears	1x140g	Vanilla Cream Spread	1x50g
Cottees Mixed Berry Beverage	1x12g	Krispie Biscuit	1x43g	Apricot & Coconut Muesli Bar	1x32g
Menu B					
Sweet & Sour Meatballs	1x250g	Sports Beverage Orange (1L)	1x70g	Cracked Pepper Vita Wheat	1x36g
Blackcurrant Fruit Spread	1x26g	Sweet Chilli Sauce	1x10g	BBQ Chicken	1x250g
Cottees Tropical Beverage	1x12g	Canned Two Fruits	1x140g	Tropical Fruit Grains	1x15g
Skim Milk Powder	1x3g	PK Chewing Gum	2xpkt4	Fruitful Muesli Mix	1x60g
Tuna in Spring water (Canned)	1x85g	Chocolate (M&M's)	1x55g	Tropical Fruits Muesli Bar	1x32g
Menu C					
Baked Beans	1x250g	Sports Beverage Mixed Berry (1L)	1x70g	Krispie Biscuit	1x43g
Vegetable Curry	1x250g	Juicy Fruit Chewing Gum	2xpkt4	Apricot Fruit Grains	1x15g
Raspberry Fruit Spread	1x26g	Canned Two Fruits	1x140g	Shortbread Biscuit	1x33g
Cottees Tropical Beverage	1x12g	Chocolate (M&M's)	1x55g	Instant Beef Noodles	1x47g
Tomato Sauce	1x15g	Cream Chocolate Spread	1x50g	Apricot & Coconut Muesli Bar	1x32g
Forest Fruits Muesli Bar	1x32g	Worcestershire Sauce	1x10g	Tropical Fruits Muesli Bar	1x32g
Additional Food Items Common to all CR1M Menus					
Chocolate Drink Powder	1x40g	Instant Coffee	2x3.5g	Tea Bags	2x2.5g
Cream cracker (crisp bread)	1x34g	Pepper	1x2g	Hard Candy (Various Flavours)	1-2x30g
Cheddar Cheese (Canned)	1x56g	Vegemite	1x15g	Curry Powder	1x3.5g
Sweetened Condensed Milk	1x85g	Ration Chocolate	1x50g		
Sugar	6-8x7g	Salt	1x2g		
Non-Food Items Common to all CR1M Menus					
Bag, Plastic, Resealable (Water/Food)	1 Only	Menu Sheet – Components	1 Only	Ingredient Sheet	1 Only
Bag, Plastic, Inner (Sundry)	1 Only	Opener, Can, Hand (Fred)	1 Only	Pads Scouring, Nylon	1 Only
Rubber Bands Size 32	2 Only	Rubber Bands Size 62	1 Only	Spoon, Plastic	1 Only
		Matches Safety, Vial	1 Only	Paper, Toilet, 2 Ply, 10 Sheet	1 Pkt

Appendix C: Red Ration Questionnaire (HWR)

Ration Questionnaire																																																																																																																																																																																																																																																																																																																																																	
Last Name					FILLING IN INSTRUCTIONS Please use BLACK PEN ONLY Answer checkmark questions by filling in the circle of the correct answer a) None b) 1 c) 2 To make a correction, place a cross through the incorrect answer and fill in the correct one. a) None b) 1 c) 2 Fill in boxes by printing neatly and keeping clear of the box borders. Correct mistakes by crossing out the error and writing the correction outside the box margin. 																																																																																																																																																																																																																																																																																																																																												
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<table border="1"> <thead> <tr> <th colspan="5">For items that you DID eat</th> <th colspan="5">For items that you DID NOT eat</th> </tr> <tr> <th colspan="5">Rate your liking of the item</th> <th colspan="5">Indicate why you did not eat the item</th> </tr> <tr> <th>Dislike alot</th> <th>Dislike</th> <th>Neutral</th> <th>Like</th> <th>Like alot</th> <th>Items</th> <th>Taste</th> <th>Packaging</th> <th>No time</th> <th>Didn't feel like it</th> <th>Didn't need it</th> </tr> </thead> <tbody> <tr><td>A1</td><td></td><td></td><td></td><td></td><td>Chicken with Vegetables</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A2</td><td></td><td></td><td></td><td></td><td>BBQ Beef</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A3</td><td></td><td></td><td></td><td></td><td>Beef Minced with Tortellini</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A4</td><td></td><td></td><td></td><td></td><td>Fruit Muesli Mix</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A5</td><td></td><td></td><td></td><td></td><td>Skim Milk Powder</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A6</td><td></td><td></td><td></td><td></td><td>Tomato & Basil Tuna</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A7</td><td></td><td></td><td></td><td></td><td>Ham & Potato</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A8</td><td></td><td></td><td></td><td></td><td>Canned Peaches</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A9</td><td></td><td></td><td></td><td></td><td>Canned Two Fruits</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A10</td><td></td><td></td><td></td><td></td><td>Canned Pears</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A11</td><td></td><td></td><td></td><td></td><td>BBQ Shapes</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A12</td><td></td><td></td><td></td><td></td><td>Pizza Shapes</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A13</td><td></td><td></td><td></td><td></td><td>Cheddar Shapes</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A14</td><td></td><td></td><td></td><td></td><td>Teriyaki Jerky Bar</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A15</td><td></td><td></td><td></td><td></td><td>Pepper Jerky Bar</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A16</td><td></td><td></td><td></td><td></td><td>Original Jerky Pieces</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A17</td><td></td><td></td><td></td><td></td><td>Original Muesli Bar</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A18</td><td></td><td></td><td></td><td></td><td>Almond & Sesame Muesli Bar</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A19</td><td></td><td></td><td></td><td></td><td>Ski D'lite Muesli Bar</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A20</td><td></td><td></td><td></td><td></td><td>Tropical Fruits Muesli Bar</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A21</td><td></td><td></td><td></td><td></td><td>Cereal Bar</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A22</td><td></td><td></td><td></td><td></td><td>Chocolate Protein Bar</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A23</td><td></td><td></td><td></td><td></td><td>Cookie Flavour Protein Bar</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A24</td><td></td><td></td><td></td><td></td><td>Trail Mix</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A25</td><td></td><td></td><td></td><td></td><td>Dried Apricots</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A26</td><td></td><td></td><td></td><td></td><td>Sultanas</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>A27</td><td></td><td></td><td></td><td></td><td>Tortilla 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Protein Bar						A23					Cookie Flavour Protein Bar						A24					Trail Mix						A25					Dried Apricots						A26					Sultanas						A27					Tortilla Bread					
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Ration Questionnaire											
For items that you DID eat						Items	For items that you DID NOT eat				
Rate your liking of the item							Indicate why you did not eat the item				
Dislike alot	Dislike	Neutral	Like	Like alot			Taste	Packaging	No time	Didn't feel like it	Didn't need it
A28	☐	☐	☐	☐	☐	Honey Roasted Nuts	☐	☐	☐	☐	☐
A29	☐	☐	☐	☐	☐	Almond Nuts	☐	☐	☐	☐	☐
A30	☐	☐	☐	☐	☐	Jam Sandwich Biscuit	☐	☐	☐	☐	☐
A31	☐	☐	☐	☐	☐	Scotch Finger Biscuit	☐	☐	☐	☐	☐
A32	☐	☐	☐	☐	☐	Tiny Teddy Biscuits	☐	☐	☐	☐	☐
A33	☐	☐	☐	☐	☐	Sports Pouch Berry	☐	☐	☐	☐	☐
A34	☐	☐	☐	☐	☐	Sports Pouch Lemon/Lime	☐	☐	☐	☐	☐
A35	☐	☐	☐	☐	☐	Sports Pouch Pineapple	☐	☐	☐	☐	☐
A36	☐	☐	☐	☐	☐	Sport Beverage Tropical	☐	☐	☐	☐	☐
A37	☐	☐	☐	☐	☐	Sport Beverage Mixed Berry	☐	☐	☐	☐	☐
A38	☐	☐	☐	☐	☐	Sport Beverage Grape	☐	☐	☐	☐	☐
A39	☐	☐	☐	☐	☐	Vanilla Protein Drink	☐	☐	☐	☐	☐
A40	☐	☐	☐	☐	☐	Chocolate Protein Drink	☐	☐	☐	☐	☐
A41	☐	☐	☐	☐	☐	Cola Sports Gel	☐	☐	☐	☐	☐
A42	☐	☐	☐	☐	☐	Skittles	☐	☐	☐	☐	☐
A43	☐	☐	☐	☐	☐	Fruitip Pastilles	☐	☐	☐	☐	☐
A44	☐	☐	☐	☐	☐	Orange Sports Beans	☐	☐	☐	☐	☐
A45	☐	☐	☐	☐	☐	Cracked Pepper Vita Wheat	☐	☐	☐	☐	☐
A46	☐	☐	☐	☐	☐	Cheddar Cheese	☐	☐	☐	☐	☐
A47	☐	☐	☐	☐	☐	Sweetened Condensed Milk	☐	☐	☐	☐	☐
A48	☐	☐	☐	☐	☐	Vegemite	☐	☐	☐	☐	☐
A49	☐	☐	☐	☐	☐	Original Ration Chocolate	☐	☐	☐	☐	☐
A50	☐	☐	☐	☐	☐	Semi-Dark Ration Chocolate	☐	☐	☐	☐	☐
A51	☐	☐	☐	☐	☐	Dark Ration Chocolate	☐	☐	☐	☐	☐
A52	☐	☐	☐	☐	☐	Sweet Chilli Sauce	☐	☐	☐	☐	☐
A53	☐	☐	☐	☐	☐	Tomato Sauce	☐	☐	☐	☐	☐
A54	☐	☐	☐	☐	☐	Pepper	☐	☐	☐	☐	☐
A55	☐	☐	☐	☐	☐	Salt	☐	☐	☐	☐	☐
A56	☐	☐	☐	☐	☐	Instant Coffee	☐	☐	☐	☐	☐
A57	☐	☐	☐	☐	☐	Cappuccino Beverage	☐	☐	☐	☐	☐
A58	☐	☐	☐	☐	☐	Tea Bags	☐	☐	☐	☐	☐
A59	☐	☐	☐	☐	☐	Fruit Mentos	☐	☐	☐	☐	☐
A60	☐	☐	☐	☐	☐	Mint Mentos	☐	☐	☐	☐	☐
A61	☐	☐	☐	☐	☐	Sugar	☐	☐	☐	☐	☐
A62	☐	☐	☐	☐	☐	Chewing gum	☐	☐	☐	☐	☐

RR-P2 071
RR-P2

Barcode Area

HWR-08

Appendix D: Blue Ration Questionnaire (CR1M)

Ration Questionnaire									
Last Name					FILLING IN INSTRUCTIONS Please use BLACK PEN ONLY Answer checkmark questions by filling in the circle of the correct answer a) None b) 1 c) 2 To make a correction, place a cross through the incorrect answer and fill in the correct one. Fill in boxes by printing neatly and keeping clear of the box borders. Correct mistakes by crossing out the error and writing the correction outside the box margin. h h m m 0 6 : 1 5 ** 24-HOUR Time ** h h m m 0 6 : 3 0 ** 24-HOUR Time **				
First Name (Please print in BLOCK CAPITALS)									
Date (Please print in BLOCK CAPITALS)									
Gender									
Years in Service		Please rate your previous experience with ration packs							
d d / m m / 0 8		Male ☐ Female ☐			Negative ☐ Neutral ☐ Positive ☐ No Opinion ☐				
For items that you DID eat Rate your liking of the item					For items that you DID NOT eat Indicate why you did not eat the item				
Dislike alot Dislike Neutral Like Like alot					Taste Packaging No time Didn't feel like it Didn't need it				
Items									
A1	☐ ☐ ☐ ☐ ☐				Sausages & Vegetables				N1
A2	☐ ☐ ☐ ☐ ☐				BBQ Beef				N2
A3	☐ ☐ ☐ ☐ ☐				Sweet & Sour Meatballs				N3
A4	☐ ☐ ☐ ☐ ☐				BBQ Chicken				N4
A5	☐ ☐ ☐ ☐ ☐				Baked Beans				N5
A6	☐ ☐ ☐ ☐ ☐				Vegetable Curry				N6
A7	☐ ☐ ☐ ☐ ☐				Tuna in Spring Water				N7
A8	☐ ☐ ☐ ☐ ☐				Freeze Dried Potato & Onion				N8
A9	☐ ☐ ☐ ☐ ☐				Instant Beef Noodles				N9
A10	☐ ☐ ☐ ☐ ☐				Savoury Vegetable Soup				N10
A11	☐ ☐ ☐ ☐ ☐				Fruitful Muesli Mix				N11
A12	☐ ☐ ☐ ☐ ☐				Skim Milk Powder				N12
A13	☐ ☐ ☐ ☐ ☐				Canned Pears				N13
A14	☐ ☐ ☐ ☐ ☐				Canned Two Fruits				N14
A15	☐ ☐ ☐ ☐ ☐				Forest Fruits Muesli Bar				N15
A16	☐ ☐ ☐ ☐ ☐				Apricot & Coconut Muesli Bar				N16
A17	☐ ☐ ☐ ☐ ☐				Tropical Fruits Muesli Bar				N17
A18	☐ ☐ ☐ ☐ ☐				Chocolate M&Ms				N18
A19	☐ ☐ ☐ ☐ ☐				Cottees Mixed Berry Beverage				N19
A20	☐ ☐ ☐ ☐ ☐				Cottees Tropical Beverage				N20
A21	☐ ☐ ☐ ☐ ☐				Sports Beverage Orange				N21
A22	☐ ☐ ☐ ☐ ☐				Sports Beverage Mixed Berry				N22
A23	☐ ☐ ☐ ☐ ☐				Sports Beverage Lemon Lime				N23
A24	☐ ☐ ☐ ☐ ☐				Mixed Berry Fruit Grains				N24
A25	☐ ☐ ☐ ☐ ☐				Apricot Fruit Grains				N25
					Barcode Area				
					BR-P1 071 BR-P1				
HWR-08									

HWR-08

Appendix E: Tables of consumption, acceptability and reasons for discarding items

Table 4: CR1M items as consumed in the control ration

Item Name	Consumption %	Acceptability		Reasons for discarding			
		Mean (5pt scale)	Response rate %	Taste	No Time	Didn't feel like it	Didn't need it
Main meal items							
Sweet & Sour Meatballs	76.5	2.7	74				
Sausages & Vegetables	71.1	3.7	86				
BBQ Chicken	67.0	3.2	76				
BBQ Beef	61.3	3.5	76				
Baked Beans	54.6	2.7	74				
Vegetable Curry	52.0	2.7	70				
Fruitful Muesli Mix	45.3	4.3	62		32		
Snacks							
Tuna in Springwater	82.7	4.2	92				
Cracked Pepper Cracker	81.3	4.6	78				
Krispie Biscuit	71.8	4.6	94				
Shortbread Biscuit	67.0	4.5	86				
Tropical Fruit Grains	67.0	4.6	72				
Apricot Fruit Grains	55.8	4.6	74				
Mixed Berry Fruit Grains	55.5	4.5	80				
Cream Cracker Crisp Bread	53.9	4.3	78		22		
Canned Two Fruits	52.4	4.4	78				
Forest Fruits Muesli Bar	52.4	3.8	84				
Tropical Fruit Muesli Bar	49.0	3.9	86				
Cheddar Cheese	47.7	4.5	80				
Canned Pears	47.5	4.3	72				
Apricot & Coconut Muesli Bar	46.0	3.8	76		20		
Instant Beef Noodles	36.3	4.1	48		50		
Freeze Dried Potato & Onion	7.7	-	32		48		
Savoury Vegetable Soup	7.7	-	26		56		
Confectionery							
Chocolate Candy	76.5	4.8	90				
Ration Chocolate	71.8	4.5	84				
Chewing Gum	33.6	4.5	80				
Chewing Gum	30.5	4.4	68		26		
Hard Candy	29.9	4.0	76				
Drinks							
Sports Beverage Orange	45.9	4.6	60		32		
Sports Beverage Mixed Berry	42.3	4.6	58		32		
Sports Beverage Lemon/Lime	38.5	4.4	48		38		
Chocolate Drink Powder	10.8	4.3	44		52		
Instant Coffee	6.4	-	36		44		
Mixed Berry Beverage	5.8	4.0	44		34		
Tropical Beverage	1.8	-	36		42		
Tea Bags	0.6	-	32		42		
Ancillary items							
Vanilla Cream Spread	49.7	4.3	64				

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Item Name	Consumption %	Acceptability		Reasons for discarding			
		Mean (5pt scale)	Response rate %	Taste	No Time	Didn't feel like it	Didn't need it
Cream Chocolate Spread	48.8	4.4	64				
Sweetened Condensed Milk	29.3	4.2	70	20			
Vegetable Extract	26.7	4.4	60	26			
Raspberry Fruit Spread	15.8	-	38	24	22		
Sweet Chilli Sauce	15.4	4.2	50	32			
Blackcurrant Fruit Spread	13.2	-	32	26	30		
Tomato Sauce	9.6	-	32	44			20
Sugar	6.1	4.4	52	30			
Salt	5.1	-	32	42			
BBQ Sauce	3.8	-	30	44			20
Skim Milk Powder	3.8	-	24	48			20
Pepper	3.7	-	30	40			20
Curry Powder	0.6	-	20	42			24
Worcestershire Sauce	0.0	-	26	42			

Key: Percent consumption highlighted in **red** when below 50%.
Mean acceptability highlighted in **red** when below 3.0.
Reasons for discarding highlighted in **red** when >20% of total respondents indicated that particular reason as contributing to discarding that item.

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Table 5: CR1M items as consumed in the HWR

Item Name	Consumption %	Acceptability		Reasons for discarding			
		Mean (5pt scale)	Response rate %	Taste	No Time	Didn't feel like it	Didn't need it
Main meal items							
BBQ Beef	64.5	3.5	73		22		
Beef Minced with Tortellini	61.3	4.0	73		20		
Snacks							
Jam Sandwich Biscuit	86.5	4.8	89				
Scotch Finger Biscuit	84.0	4.6	78				
Tomato & Basil Tuna	72.0	4.5	80				
Cracked Pepper Cracker	62.6	4.3	91				
Canned Two Fruits	58.5	4.3	71				
Canned Peaches	51.9	4.5	78				
Tropical Fruits Muesli Bar	50.0	3.7	73				
Cheddar Cheese	49.0	4.2	78				
Canned Pears	44.2	4.3	62		24		
Confectionery							
Ration Chocolate	74.7	3.9	87				
Chewing Gum	33.1	4.6	71				
Drinks							
Sports Beverage Mixed Berry	38.9	4.8	62		29		
Sports Beverage Grape	36.5	4.8	49		40		
Sports Beverage Tropical	26.6	4.8	58		36		
Instant Coffee	9.0	4.0	44		36		
Tea Bags	3.2	-	33		29	24	
Ancillary items							
Sweetened Condensed Milk	35.9	4.1	71				
Vegetable Extract	23.0	4.3	67				
Sugar	16.5	4.5	56		27		
Sweet Chilli Sauce	16.3	3.9	47		31		
Skim Milk Powder	12.5	-	29		53		
Salt	3.8	4.0	44		31		
Tomato Sauce	3.8	-	31		36	22	
Pepper	1.9	-	38		31		

Key: Percent consumption highlighted in **red** when below 50%.
Mean acceptability highlighted in **red** when below 3.0.
Reasons for discarding highlighted in **red** when >20% of total respondents indicated that particular reason as contributing to discarding that item.

Table 6: Commercial items as consumed in the HWR

Item Name	Consumption %	Acceptability		Reasons for discarding			
		Mean (5pt scale)	Response rate %	Taste	No Time	Didn't feel like it	Didn't need it
Main meal items							
Ham and Potato	78.0	4.1	78				
Chicken with Vegetables	75.8	3.8	87				
Fruit Muesli Mix	38.5	3.8	53		40		
Snacks							
Chocolate Biscuit Bears	96.2	4.9	98				
Pepper Jerky Bar	95.9	4.8	93				
BBQ Savoury Biscuits	92.0	4.8	96				
Cookie Flavour Protein Bar	92.0	4.7	89				
Pizza Savoury Biscuits	91.6	4.9	91				
Teriyaki Jerky Bar	91.1	4.8	93				
Chocolate Protein Bar	88.5	4.9	96				
Original Jerky Pieces	87.5	4.8	96				
Cheddar Savoury Biscuits	86.5	4.7	93				
Cereal Bar	86.0	4.2	84				
Honey Roasted Nuts	82.7	4.6	87				
Yoghurt Muesli Bar	82.1	4.0	80				
Dried Apricots	80.8	4.5	82				
Tortilla Bread	77.8	4.9	78		20		
Original Muesli Bar	74.4	3.8	84				
Cola Sports Gel	74.1	3.9	91				
Trail Mix	73.8	4.4	71		20		
Almond & Sesame Muesli Bar	72.5	4.0	73				
Almond Nuts	72.5	4.1	80				
Sultanas	72.2	4.1	82				
Confectionery							
Fruit Candies	92.0	4.9	93				
Orange Sports Beans	88.5	4.8	93				
Fruit Pastilles	87.6	4.7	82				
Bite Sized Chewy Lollies	84.9	4.9	89				
Semi Dark Ration Chocolate	83.2	3.9	87				
Mint Candies	76.8	4.7	82				
Dark Ration Chocolate	73.0	4.0	82				
Drinks							
Sports Pouch Berry	67.3	4.9	80				
Sports Pouch Lemon/Lime	67.3	4.8	73		22		
Vanilla Protein Drink	65.4	4.8	71		24		
Chocolate Protein Drink	62.5	4.9	84				
Sports Pouch Pineapple	59.6	4.6	71		24		
Cappuccino Beverage	35.3	4.4	62		27		

Key: Percent consumption highlighted in red when below 50%.
Mean acceptability highlighted in red when below 3.0.
Reasons for discarding highlighted in red when >20% of total respondents indicated that particular reason as contributing to discarding that item.

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19. ABSTRACT The Combat Ration One Man (CR1M) is the combat ration pack (CRP) used predominately by the Australian Defence Force (ADF). Soldiers frequently discard a large number of items within this pack for various reasons. To enable continuous improvement of CRP, it is important that both acceptability and consumption of current and potential new items be regularly reviewed. This report details an analysis of the data collected during the trial of a prototype Hot Weather Ration (HWR). Poor acceptability and consumption rates were found for some products, whilst others were highly acceptable and well consumed. Recommendations are made for improvement or replacement of several items, which can be used to inform future CR1M versions.					