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OPINION

Need for the Development of Theatre and Terrain based Food Technologies - An Appraisal

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Armed forces have to operate in a variety of challenging environments. Indian Defence forces operates in various theatres of operations including difficult terrains, high altitude, underwater, confined space, air and hot humid environments. Human endurance and survival is extremely challenged under these terrain and climatic conditions. For example, in the case of Ladakh sector, the troops operate above 13,000 feet and areas such as Siachen glacier the operation altitude goes up to 23,000 feet. The conditions include hypoxia and very low temperature wherein human physiology is adversely affected. Several physiological activities get impeded, e.g., impaired digestion, hepatic and renal activities, neuro-cognitive system, sensory perceptions, gastrointestinal movements, and imbalanced alertness and disturbed sleep etc. Therefore, while formulating the operational rations in the form of MREs it is highly essential to have a food basket comprising of products amenable to high altitudes both in the Ladakh sector and North-Eastern mountainous terrains such as Tawang valley. These foods need to be rich in carbohydrates with adequate quantity of protein, low in fat, less spicy with optimal input of fibre, minerals and anti-oxidants. The calorie output shall be variable as per the ration scale, Variable calorie output is essential in a multi-entree system to suit various operational requirements of specific terrains. This would avoid wastage of food and also optimal carry weight for the troops depending on operational requirements and task assigned. The multi-entree system would facilitate flexible user choice within the food basket as per the assigned calorie output values and the menus that include vegetarian and non-vegetarian items. Another advantage of terrain specific multi-entree MRE is addition of more variety of foods in addition to the traditional breakfast, lunch and dinner provisions. The additional items in ready-to-eat form include low calorie snack foods in the form of crisps and munches where the aesthetic requirement are met with deviating from the monotony of the conventional foods. Freezing of food/drinks at subzero temperature also should be taken care of.

While offering specific operational MREs for various terrains/weapon platforms and combat theatres such as low intensity conflicts, it is highly important to keep the operational requirements in terms of food logistics and also the adverse effects caused by the extreme environments on human physiology and also the psychological aspects. Each terrain has specific requirements and the same needs to be addressed by the food to mitigate the adverse effects. In the case of weapon platforms, specific requirements need to be kept in picture besides the constraint in operational space, specific temperatures under which the crew shall operate, the ventilation levels, inability of the troops to perform formal cooking, shortage of time for the crew in arranging their food for quick consumption without impeding the combat readiness, situations such as low intensity conflicts pose additional problems as it is a continuous operation without break for food consumption. Moreover, 'signatures' of consumption of food in terms of flavours, odour, cooking process and left over packaging and, plastic cutlery should be minimum. Marine commando operations, para-operations, patrol/ambush duties also add to the list in terms of combat theatres and the foods shall be amenable for such situations in terms of time duration for optimal energy inputs by the food within the digestive tract, facilitation of food consumption within a short period, controlled appetite and thirst, restricted urinary metabolism as per the combat duty, etc. Crews operating in tanks and mechanised units usually face high temperatures, crank in operational space and extreme thirsts due to the high temperatures. Food specific to these operations shall be carbohydrate rich with less fat to avoid dehydration. Supplementation with isotonic beverages and aero-fermented drinks will be extremely useful for optimal performance. In the case of submarines specific operational conditions exist and some of the requirements include acoustic neutralisation during any food based operation to avoid enemy detection. Another requirement is the ability of the submarine to store higher quantities of perishables inclusive of fruits, vegetables, milk, meat, etc., besides adequate processed foods. This requirement is highly significant as the modern submarines such as nuclear submarines remains submerged at times for more than 2-3 months. The other issues concerned with submarines include accumulation of fumes from the kitchen within the confined space, wastage disposal, etc. Therefore, the target foods shall be amenable to the operational conditions for the well being and optimal performance by the naval personnel.

The other specific requirements of the Indian Army include packaging and transportation of meat with extended shelf life.

In this matter, it is important to stabilise the meat with suitable preconditioning and packaging to keep up the freshness of meat for a longer duration preferably under ambient conditions due to the lack of a continuous cold chain in the forward areas. Meat is a highly perishable commodity, which undergoes continuous changes at room temperatures and, therefore, a comprehensive protocol is required amenable for field adaptation. There is a requirement of suitable transportation containers as the devices currently used are based on crude technologies which are heavier giving hardships during transportation.

Modern warfare involves positioning of crews for prolonged time durations in weapon platforms such as tanks/ BMP platforms and submarines. The crews undergo tremendous stress due to confined operational and space, excessive heat, drudgery associated with mechanical and electronic gadgetry and psychological stress induced by prolonged operations on challenging weapon platforms. Therefore, to keep up the morale of the troops and overall nutrition and well being specific to the weapon platform, specific food baskets need to be provisioned. These weapon platforms usually develop temperatures around 50 °C making the crews highly susceptible to exertion, and thirst and fatigue as such. The crews get physically and mentally drained over a course of time. In the case of submarines the confined space and aloofness in submerged conditions make specific foods highly essential. Submariners undergo physico-psychological stress in addition to operational requirements such as minimal kitchen operations, minimal wastage and acoustic minimisation during food processing. The MREs for submariners need to have packaging and waste content as per the MARPOL maritime conventions. Weapon platform crews usually undergo lack of appetite and excessive thirst and the foods and beverages concerned need to address the same. The foods need to minimise muscle stiffness and fatigue as such by appropriate functional principles to minimise the adverse effects. The shelf life of the food is also of paramount importance in addition to the weight and volume of the packages as the products need to be amenable to confined space and suboptimal storage temperatures and due to the fact that most of the long shelf life period is consumed in food logistic operations.

Asymmetric warfare including those involving 'Chemical, Biological, Radiological and Nuclear' agents is on an increase. Food and drinks delivery system should be designed so as to be compatible with protective gears worn during operation. There is also a need to develop radio-protective foods for use by persons handling radiation equipment, cancer patients, persons working in radiation prone areas, nuclear submarines, cosmonauts, pilots, patients undergoing radiation treatments, etc. As food is important component for survival and intrinsic to basic human nutrition and health, therefore, it is imperative to develop certain kind of a wholesome meal system which can be consumed by the soldiers tasked with combating CBRN situations during such operations. Such meals can be in the form of solid or liquid type and packaged in suitable delivery system, compatible and amenable with the CBRN protective gears. Certain types of food products have been suggested for use under CBRN conditions. These include wholesome meals in paste or liquid forms, ready-to-eat items in suitable protective packaging, etc. Food can be contaminated during CBRN conditions by coming in direct or indirect contact with CBRN agents. Therefore, the food materials to be used under such conditions need to be protected in suitable coverings as consumption of contaminated food can be lethal. Operational rations are safe when surface decontamination is performed before disrupting or breaking the package. Operational rations stored close to ground zero may become contaminated.

One such product envisaged for use during CBRN operations will be in the form of pumpable liquid, aseptically processed and packed in suitable polymeric or metallic containers. The products will be stabilised using thermal/ non-thermal processing techniques. The product will deliver sufficient energy and calories on consumption besides answering the call of basic nutrition and will in addition provide all the essential micronutrients such as vitamins and minerals. The product shall have long shelf life and it should resist phase separation during storage of the product. The envisaged product will also have ingredients from plant/herbal sources to give immunomodulatory as well as radio-protective properties. There product shall be designed to have high sensory acceptance and need to ensure slow release of energy for the survival of the soldier for a longer duration. Most importantly, the product package shall be designed and customised to fit into the CBRN ensemble that the soldier may wear.

'Bugs as Drugs' and 'Nutraceuticals as Pharmaceuticals' are another interesting concepts. Prebiotic, probiotic and symbiotic foods are essential for maintaining good health. Foods that are energy dense will have a high concentration of calories per bite. Common processed foods that are energy dense are packaged snack foods. These types of foods are necessitated for those who are over stressed, sleep-deprived and heavy-worked. The intake of such foods boosts the energy level without leading to sugar crash. Such type of foods could be in the form of compressed ration or drinks. It is important such foods be loaded with digestible carbohydrates which are also packed with potassium which aids in maintaining nerves and muscle function. Energy dense foods can be prepared from high energy output based ingredients and the quick energy release can be facilitated by means of process and use of metabolic intermediates.

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