

Packaged Indian Food

- Sushil Chavan

Napoleon did say an Army marches on its stomach. Weapons and techniques alone never win a war. Man using them is important. He must be fit for fighting. His performance, which leads to success, depends upon his physical and mental health.

Historical background :

Before World War I, the British army serving in India was supplied rations besides some allowances. But the Indian soldiers in it used to get only cash allowances. They were to make arrangements of their own rations themselves. The nutritive value of the food was totally neglected by them. During the Mesopotamian campaign of world War I (in 1916), Indian soldiers were suffered by the disease Scurvy whereas the British soldiers were unaffected. The World War I made to think the authorities of supplying certain food items along with cash allowance to Indian soldiers.

During World War II, supply of rations became difficult due to rise in the cost of living. Malnutrition cases were commonly observed among Indian soldiers. The authorities again recommended the food with higher nutritive values for them.

After independence, the Indian soldiers used to get food which was preserved by traditional methods. But there were difficulties of protecting the food items from physical and chemical deterioration during storage, transport, handling and packaging.

Indian defence troops include soldiers having mainly a rural background and they represent a great diversity from the regions, states, clans and tribes. Many a times they operate in a far-flung mountainous regions and hostile weather conditions where transportation and communication facilities are not easily available. They use multiple means of transport including animals and human also. There is a deficiency of fresh food for survival in such situation. If they get packed food that is simple to cook, preserved for 6 months to 1 year period under varying climatic conditions, gives nutrition and energy, the morale of soldiers remains high all times.

DFRL :

The Defence Food Research Laboratory (DFRL), Mysore, was established on 28th December 1961 under Defence Research and Development Organization (DRDO) to fulfill the needs of varied foods of Indian Army, Navy, Air force and paramilitary forces. Their aim is to design and engineer light weight convenient packed food with longer shelf-life under varying climatic conditions.

Using the self-developed technologies, DRFL has produced many ready-to-eat, quick cooking and instant foods with longer shelf-life. Some of them are, long keeping chapatias (shelf-life 6 months), high protein snacks (shelf-life 9 months), spiced potato

parothas (6 months), fruit bars (9 months), mutton pickle (6 months), stabilized chikki (1 year), Fruit juice powder (mango, pineapple, mosumbi - 1 year), chicken pulav (1 year), precooked dehydrated (PD) dal/curries, PD rice, PD potato peas curry (each 1 year); instant pulav mix, instant curries, dal, instant kheer mix, instant khichadi mix, instant basmati rice, instant upama mix (each 1 year), instant carrot halwa mix (9 months). Few of the technologies for Food products/processing and Packaging developed by DFRL are introduced below.

Food products/processing :

DFRL has developed various rations, such as meals ready-to-eat ration, one man compo pack ration, modified (mini) compo pack ration, Main Battle Tank (MBT) ration, submarine ration and survival ration for Army, Navy and Air Force. Meals ready-to-eat ration is specially developed for Army and Navy. Besides, DFRL has also designed emergency ration for Army, emergency flying ration for air crew, survival ration for Navy and Commandos. These rations are successfully tried and accepted.

Meals-Ready-To-Eat [MRE] ration for Indian Army: This ration does not require any cooking since the contents are thermally processed. It can be consumed readily after little warming if required. The ration consists of Indian dishes namely, Chapatias (preserved), Sooji halwa (300 g), Vegetable pulav (300 g), Potato Peas Curry (300 g), Chocolate bar and Tea (3 servings). Items like spoon, tissue paper, matchbox, specially designed foldable stove and fuel tablets for warming the food are also included. The products like sooji halwa, vegetable pulav and potato peas curry are processed in a specially designed bulk sterilizer. The food products are processed in a special retort to internationally accepted food standard. After processing their microbiological quality is tested. The Indian MRE supplies adequate calories and nutrition during operation and competes very well with well-known international rations like MRE of USA and UK in nutritional quality and hygienic. Its shelf-life is 12 months.

Meals-Ready-To-Eat [MRE] ration for Marine Commandos of Indian Navy: Marine Commandos of the Indian Navy are expected to land in unknown and hostile territories to carry out specific duties. Their nature of duties are of very high order and important. Unlike other sailors of the Navy, they need specialized rations with required calories, easy to carry and of high quality, safety and the palatability.

For this purpose, DFRL developed the retort processing technology using indigenous food and packaging materials and prepared a food that can be eaten with little warming. Unlike the foreign rations which are based mostly on pork, ham or beef, the Indian rations are based on mutton, chicken and a vegetarian food. The ration packet provides approximately 3300 ó 3800 calories / day and weighs less than a kg. The items in the packet can be reconstituted by adding hot water. The rations have a shelf life of one year.

One Man Compo Pack Ration (Dehydrated Foods Based): It consists of early morning tea, breakfast, mid morning tea, lunch, evening tea and dinner. The contents are pre-cooked dehydrated and ready-to-eat products. It is easy to reconstitute in a short time by using hexamine fuel tablets. A simple foldable stove is also provided with the ration for this

purpose. The total weight of the ration is 880 grams and is easy to carry and handle. It provides adequate calories under various conditions of use. Very simple technology is involved in its processing and manufacturing. Flexible packaging material is used for packing which is easy to open and dispose.

This ration contains only Indian foods and is specially designed to meet the Indian palate. It provides maximum satiation and psychological satisfaction. The shelf life of the ration is one year under ambient condition. It is easy to prepare, found to be very popular and particularly useful for short duration patrol duties.

Mini Compo Pack Ration (Dehydrated Foods Based): It is a simplified version of one man compo pack ration. It contains two items namely Sooji Halwa mix (100 g) and Pre cooked dehydrated vegetable pulav (125 g) along with 3 times tea, which provide sufficient calories. It weighs about 400 g. Foldable stove, fuel tablets (100 g), match box, spoon for reconstitution / preparation of tea are also supplied with it. The shelf life of the ration is one year under ambient condition.

Survival Ration: It consists of 2 pieces of soft bar each of 100 gm , 3 pieces of Chikki each of 50 gms and 3 pieces of Chikki (Jaggery base) each of 50 gms. The calorie content stands with the world standards.

Main Battle Tank (MBT) Ration: DFRL has developed a suitable operational ration pack for Main Battle Tank (MBT) and other Armoured vehicles. It helps in survival of a soldier who is in closed conditions for 3 days. First and second day ration packs weigh 2 kg each and provide 4000 calories and third day ration weigh 1.5 kg and gives 3000 Calories. It contains instant/ready to eat food and survival bar as per the palate of soldiers.

Role of DFRL during Operation Vijay: DFRL processed and supplied 50,000 survival rations and 30,000 MRE rations to the Army for Kargil operation at a very short notice of only 48 hrs. Besides, it supplied 1,000 MRE rations to Navy and 125 MRE rations to Air Force station, Pune. These rations have been found highly acceptable, palatable and stable. In addition, based on laboratory process, Indian Army was able to procure 1.5 lakh supplementary compo pack rations from industry during Kargil operation.

Packaged Biryani for defence jawans: The army personnel deployed in icy heights like Siachen and Kargil, can now expect mutton and chicken biryanis or non-vegetarian sandwiches with all nutrients and home-made taste. DFRL has developed a biryani, which contain pieces of non-vegetarian food, having a shelf life of 1 year. It is developed by using non-thermal technology, which helps retain nutrients and taste for a long time.

Other Food items : There is less oxygen at high altitudes. Army men in areas, like Siachen and Kargil in the Himalayas, suffer from acidity and feel their stomach always full. Thus they tend to lose appetite and eat less food, lose their weight and face health problems. DFRL found the solution of this by developing appetizer foods and drinks. The appetiser foods and drinks can be consumed 30 minutes or one hour before a meal to improve appetite. Theses are based on some of the spices and fruits like lemon, ginger, ash gourd, cummin or are even curd-based. DFRL has developed a technology to preserve tender coconut water for up to six months at room temperature and up to nine months under refrigeration. This process is simple and uses a combination of preservation technique with

thermal treatment and a bio preservative. It can be packaged in convenient cans, bottles and poly pack pouches.

DFRL is in the process of developing beverages based on ash gourd, 'pudina', cucumber and betel leaves for the use of personnel working in high altitudes and humid areas.

Minimally Processed Vegetables : It is a latest technology by which variety of tropical, sub-tropical and temperate vegetables like cauliflower, cabbage carrot, beetroot, potato, sweet potato, sponge gourd, ridge gourd, radish, papaya raw, mango raw and French beans etc. are processed. Additives and preservatives are used upto permissible level. The technology does not include any thermal treatment. This retains the freshness of vegetables for a longer period. They are safe from microorganisms besides being rich in ascorbic acid. The process condition and additive treatment change with the vegetable. This technology gives the product a shelf-life of 14 to 28 days.

Technology:

Instantiation of Cereals and Pulses : DFRL developed Freeze-Thaw dehydration technology in which cooked and dehydrated pulses, whole legumes and cereals are made. These products are instantly reconstitutable in less than 8 minutes by mere mixing in hot water. In this technology, before dehydration of the cooked cereals or pulses, a cold shock is given to it. Instant cooking pulses like Bengal gram, red gram, lentils and whole legumes (whole green gram, whole kabuli channa and rajma) are developed by this technology. Their shelf-life is 12 to 18 months. DFRL has successfully used this technology to prepare 6.25 tons of instant khichadi (rice and dal mix) for supply to victims in Gujarat earthquake. Efforts to develop snacks product using this technology are going on.

Self-heating Technology : DFRL has recently developed self-heating ready-to-eat food packets. It has three compartments - one of food and other two of a special liquid and a chemical powder. By connecting the liquid and the chemical powder compartments, heat is generated due to chemical reaction. This heat is transferred to the compartment of food and make it ready to eat in few minutes. DFRL is going to manufacture food items using non-thermal processing techniques, which help in combating diabetes, high BP and improving memory. The canned food supplied to military forces have chances of losing sensitive nutrients. So, DFRL is planning to introduce food products using ultrasonic, microwave, infrared technologies to retain the nutrients in food products for a longer period.

Packaging :

All over the world, packaging of the food for defence forces is a very specialized activity. Although the materials, equipments and methods used here are similar as that of in the normal commercial packaging, the purpose differs. For military food packing, the factors such as conditions of usage, modes of transportation and storage are to be taken into account on priority. The packaging must remain intact during rigorous transportation and varying storage conditions. The food items inside must sustain during storage, handling, transportation and different climatic conditions like sub-zero temperature of Siachin glacier, hot and humid north-eastern forest, hot dry desert, high sea etc. The things like packed food

should preserve for a longer period, its weight and volume should be less and the food should be readily available, are also important.

The processed food supplied to the defence includes dehydrated food, semi-processed food and ready-to-eat processed food. Each of them requires different storage facility. So they also need different packaging materials.

Packaging of Dehydrated food : Beyond certain level, a residual moisture content in the food causes its damage. So food is dehydrated by using different technologies like hot air drying, foam-mat drying, freeze drying etc. As the technology differs, the packaging requirement differs. Temperature, moisture and oxygen affect the shelf-life of the dehydrated food. High moisture affect crispness of the food, oxygen causes oxidation thereby affecting rancidity and odour, light causes darkness and enhances oxidation, aroma causes odour picking from packing material and fragile structure of the food causes its mechanical damage. The packaging for such food should have high tensile strength, resistance to shock and vibration, light weight and low price, chemical inertness. It should be pilfer-proof against substitution and adulteration. It should be clean and hygienic.

As oxygen and moisture accelerates chemical decomposition of dehydrated food products, proper dehydration technique as well as packing material should be used. Different types of packaging materials used are, (1) Rigid containers like metal cans and plastic containers, which are air-tight and light proof and check the entry of moisture and oxygen. They are easy to handle during transportation. (2) Semi-rigid packs, like line carton and bag-in-box, maintains the freshness of the food product till it is opened. An ideal laminate is made up of layers of paper/low density polythelene (LDPE)/Al-foil/ which ensures the shelf life required. (3) Flexible pouches can be handled and opened easily. They keep the food inside fresh and hygienic. It is moisture-proof and barrier for oxygen and light.

Packaging of Hot AIR Dried products : The food products like dried vegetables, cereals and some ready mixes have very low moisture content. So they don't need high barrier packaging materials. A single structure polypropylene (PP) of thickness more than 75 microns, laminate of metallised polyester (PET) of thickness more than 12 microns and a heat sealable layer of low density polyethylene (LDPE) of thickness 75 microns are suitable for a shelf-life of at least 6 months. Triple layer laminate of paper/12 micron aluminium foil/ LDPE offers better quality, but its cost is higher.

Packaging of Freeze Dried Products and Vacuum / Inert Gas Packaging : The food products like pre-cooked mutton chunks have fragile structure with very low moisture content. Moreover they are prone to lipid oxidation causing off-flavour and rancidity. So it should be protected against moisture absorption, oxygen and mechanical damage. As with the decrease in foil thickness, the number of pin-holes increases, the Al foil of thickness more than 30 microns is suitable for lamination of these foods.

In case of inert gas packaging, multi-layer plastic film materials having better barrier against diffusion of inert gas are needed. Nitrogen or carbon-dioxide is used to flush the inside of packing material to control the internal atmosphere. Polyester with low density polyethylene (PET/LDPE) are used to retain the inert gas inside the package. This maintains the quality of the food throughout its shelf-life. Aluminium foil laminates or

tinplate containers are also used for high fat content foods like milk powder and egg powder.

Packaging of Retort (thermal) Processed food : Retort processing is the most acceptable form of food preservation. These are ready to eat food products. It requires just warming in a microwave oven or water bath before eating. Packaging of this food should withstand thermal processing. Retort pouch is the flexible laminated food package having light weight. It maintains the shelf-life, texture and nutritive value of frozen food. During war, soldiers can easily carry these packages. So they are very popular.

The selection of packing material of retort pouches is very important. It should have high melting point, physical strength, protect against light degradation, moisture changes, microbial invasion and oxygen ingress. It should resist penetration of fats, oils and other food components. Packing material should not contaminate the food inside. Japan and European countries use a multilayer polyester with 7-20 *microns* thickness aluminium foil and 75 *microns* thickness polypropylene for retort pouches. But they are very expensive for our country. DFRL by its research tried polypropylene (PP) and co-extruded material of polypropylene-nylon-polypropylene (PP-Nylon-PP). This packaging structure is now successfully used in the packaging of meat, vegetable curries, rice with meat and vegetables, sweet halwa, beans in sauce, etc.

Packaging of Cereals, Grains, Pulses/Milled Products : The food products like rice, pulses, atta and maida etc. may contain high moisture. They are prone to attack by insects and fungus. To avoid this, they are packed in jute bags or high density polyethylene (HDPE) woven sacks.

Packaging of Shelf-stable High Moisture Products : Besides fresh fruits, the shelf-stable high moisture products like mango bar, intermediate moisture fruits and fruits processed by hurdle technology are also supplied to the defence. Oxygen contact enhances enzymatic browning in the high moisture products. So the packaging material should be an excellent barrier to oxygen. The hurdle technology preserved fruits are pasteurized in polypropylene films and covered in aluminium foil lamination. This protects the product against oxygen. Metallised polyester film with high density-low density polyethylene (PET/HD-LDPE) as inner sealant layer is also useful here.

Flexible packaging materials like low density polyethylene (LDPE) and linear low density polyethylene when impregnated with potassium permanganate and cinnamic acid respectively, become ethylene scavengers. Fresh fruit and vegetables like mango, tomato, banana and papaya get more shelf-life of two-three weeks with such packaging. The addition of ethylene scavengers improve the strength of the packaging material. The technology is perfected in the laboratory and the large scale production of this packaging material is now in progress.

Packaging of Fats, Oils and Fatty Food : Free flowing oil may contaminate sealing surface and so sealing surface is kept free from traces of oil or it should be coated with an ionomer for proper sealing. For packing of fats and fatty foods, packaging material should have proper seal strength and barrier against oxygen.

Pickle is required to the defence forces in small quantity. It is supplied in flexible packing material, instead of glass bottles or plastic containers. But here also there are

chances of penetration of oil through sealed surfaces. Paper coated with polyvinylidene chloride (PVDC) has solved this problem.

For Dried products having very high fat content, packing material which is a good oxygen barrier (like PVDC or nylon) is required. Multilayer materials like cellophane/low density LDPE with PVDC/LDPE/Nylon/EAA (Ethylene acrylic acid copolymer) are also proved to be good. Hydrogenated oil and other oils for defence supply are packed in high density polyethylene (HDPE) jerry cans. These containers are light in weight, easily available, hygienic and potable.

Packaging of few Other Products : Peanut Candy is the product rich in proteins and carbohydrates and also provides energy. But it absorbs moisture readily and is attacked by insects. It is also susceptible to rancidity. To overcome these problems, it is packed in paper/12 micron aluminium foil/low density polyethylene. Shelf-life of this packaged product is 6 months. Bread has very short shelf-life as mould attacks it. Its shelf-life is increased to 20 days by packing it in a fungistatic wrapper. Grease proof paper is coated with an emulsion containing Sorbic Acid (SA) and Carboxy Methyl Cellulose (CMC). This emulsion provides proper sorbic acid level. Hot bread removed from oven is immediately wrapped with this emulsion. Sorbic acid is volatile and due to heat in the bread, it is dispersed uniformly in the bread.

DFRL has also developed a biodegradable package material for the packaged food as its products were often used in high altitude areas like Himalayas and the packing material may cause environmental pollution.

Other services :

Paramilitary Force : DFRL is also engaged in the food supply to the paramilitary forces. The food requirement of the paramilitary force is different from that of the army in general. The paramilitary force needs energy-rich food with less volume since they are constantly on the move and are engaged in Low Intensity Combat (LIC) operations. The nutrition level is maintained as in case of the food supplied to the army. Research is going on for the new packaging material and technology to increase the shelf-life of the food products.

Expeditions/Calamities : DFRL have also supplied pack rations for Antarctica Expeditions, Mountaineering Expeditions (Kanchenjunga, Nanda Devi and Mount Everest), Rowing Expeditions etc. Moreover it has designed foods for Indian Space Mission. Their processed food were also found to be useful during natural calamities in Latur and Gujarat earthquakes, Malpa and Chamoli landslides and Orissa cyclone.

Civilians : DRFL has successfully fulfilled the food requirements of Indian Defence. Many of its products find immense application for civilian use also. The factors like changing lifestyle, entry of educated housewives into jobs, growing affluence of middle class, increasing aversion to traditional kitchen drudgery, craving to taste the new, etc. have opened a big market for the processed food. This has created a great need for traditional Indian foods in convenient pack forms. Processed food development and its packaging for a longer shelf-life is one segment where many of the defence technologies are being transferred to the civilian sector.

DRFL has obtained patents for many of its technologies. Its food products and process technologies can create a huge market for processed foods of Indian dietary on the lines of well-developed Western countries.
