

Chapter 3

Traditional Foods and Associated Indigenous Knowledge Systems and Its Role in Nutrition Security in Mongolia



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3.1 Introduction

Food and food consumption of Mongolians are part of their cultural heritage. The researchers noted that depending on the culture of making and consuming food and drinks, the religion, economy, customs, and natural and climatic features of any nation can be revealed and told. Our ancestors understood the laws of nature and prepared food rich in nutrients and easy to store in nomadic conditions. With the rapid increase in population and the shrinking space of nomadic civilizations, as well as the growing effect of manufacturing, the heritage culture of food and drink preparation is being developed and implemented in accordance with modern scientific and technical progress, hygiene and sanitation requirements. Producers, researchers and scientists are working together to make it more sophisticated and produce innovative products that combine tradition and innovation. Mongolian traditional foods and drinks have been compared to the history of their development, chemistry, function, importance, and use, based on the research done by food and food industry scientists.

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3.2 Mongolian Traditional Foods and Drinks and Their Origin and Development

3.2.1 *Foods During Paleolithic Period*

In ancient times, until the Paleolithic period or Old Stone Age, people used to collect their food from surrounding ecosystems by hunting and gathering. This method of food collection continued to improve over the centuries to the time when animals and plants could be domesticated and large amounts of food could be accumulated in a short period of time. If we look at the present time, Aborigines, Inuits, Pygmies, and Eskimos, the last remaining hunter-gatherers on the earth, are healthy people with sharp eyesight, strong slender bodies, and quick movements. They have relatively well-preserved traditions of direct consumption of natural foods or unmodified or primary consumption of nutrients.

Anthropologists from the University of Arkansas conducted a study that clarified the perception of the diet of Australopithecus, the great ancestor of humans. They had features such as the shape and size of the ape's teeth, enamel structure and wear, and the maxillofacial system. Compared to apes, the front teeth are relatively small, the molars are large and flat, and the tooth enamel has evolved to become thicker. It was discovered that the development of jaw and facial muscles in apes is better than that of humans (Pfeiffer 1985). These unique anatomical features suggest that the diet of Australopithecines was different from that of apes, which fed on soft things such as fruits, nuts, leaves, worms, and insects. According to the research, it is clear that Paleolithic people were omnivores and consumed foods of animal as well as plant origin.

Dietary patterns of humans and animals are preserved in their bones, so in the developed countries of the world, the study of the diet of ancient people is revealed by isotopic analysis of bones (Boutton et al. 1991). Human bones are made up of organic matter, water and minerals. Isotope analysis to determine the chemical composition of bone begins with the organic compound collagen protein, and collagen carbon atoms exist in two stable primary forms. The ratio of these in the bones can be determined by isotope-ratio-mass-spectrometry, and the index ranges from 0 to 30, and it is possible to determine the type of human food by this ratio. C13 is commonly found in edible plant species (C3 plants) of the continent. For example, if a person eats a lot of grain, the carbon isotope ratio of his bones should be high. This information allows us to clarify the food consumption of very ancient people. There is relatively little research on the history of the diet of the ancient people living in Mongolia, but the very ancient history of food consumption can be imagined from the tools used such as fossils and broken stones. At the beginning of the Paleolithic period, tools used for food harvest were of simple design and few types, but eventually they became sophisticated, and the range of activities such as hunting and gathering plants were expanded. Archeological evidence proves that the ancient people living in Mongolia during the Paleolithic period used stone, bone, and wood to make weapons for hunting animals, and harvest plant-based food. Although

climates such as interglacial warming and dryness alternated, a cold and temperate climate prevailed; the necessity of consuming high-calorie foods was realized. From small animals such as marmots, squirrels, birds and fish, to large animals such as lions, elephants, bison, deer, foxes, cormorants and lynxes, in order to use animal meat and fat as a reliable source of nutrients, are depicted in rock paintings from the Paleolithic, Mesolithic, and Neolithic periods. End of the Mesolithic and from the beginning of the Neolithic period, the domestication of animals and plants made it possible to plan food supply and consumption in advance, and became somewhat independent of nature. In this way, the food source of the people who lived in Mongolia very early on turned from wild animals and plants to domesticated animal products, and the history of the food consumption heritage of the Mongols, who developed the methods of processing meat, milk, and seeds (Batsukh et al. 2013).

In many countries of the world, plants were domesticated and agriculture was further developed, while in Mongolia, domestication of wild animals and animal husbandry received more attention (Tumurjav and Erdenetsogt, 1999; Tumurjav 2003; Miller et al. 2022). The era of food production began when skilled hunters and gatherers who were well adapted to the natural and climatic conditions of Mongolia, domesticated wild animals and plants to use meat, milk, cultivated seeds and grains. The domestication of wild foods led to the emergence of a wide variety of tools for food production, and as a result, fundamental changes in human culture began to take shape. It is believed that from this period, the inhabitants of Mongolia began to think of unique methods of food production and invent equipment. In this context, it is worth mentioning that Mongolians adapted some practices such as shifting with their herds seasonally, changing their pastures, using wild plants in a coordinated manner, which in turn helped them to avoid the hazards of zoonotic diseases those were common in middle east and south Asia.

3.2.2 Mesolithic and Neolithic Period

During the Mesolithic and Neolithic period people stepped from the era of food collection to the era of food production. By domesticating wild food, the development of human society was matured and the history of thousands of nations and tribes existing on the earth was formed. The concepts of settlement, population growth, migration, new technologies, and cultural relations are connected to the process of domestication of animals and plants. The Neolithic period brought a revolution in the history of human consumption of food.

Wild animals and plants have been domesticated in Mongolia since the Mesolithic period. Bone and dung remnants of wild animals from Paleolithic sites and Mesolithic rock paintings depict cattle pastoralism, while Neolithic archeological evidences are related to the cultivation of domesticated animals and plant species. As already stated earlier, unlike other contemporary civilizations in the Middle East, Southeast Asia, and South America where plants were domesticated and

agriculture was developed, Mongolia developed domestication method of some wild animals. It is assumed that the Mongolian domesticated horses during the Neolithic period. One of the crops that may have been domesticated in Mongolia is the wheat which is able to grow in a cold and temperate climate. The seeds and roots of wild plants were collected and crushed, ground and soaked. Bones of wild animals and fishing tools are found in Neolithic sites. People in the lake region used spears, bows, and knives to catch fish for food.

3.2.3 Bronze and Iron Age

From the years when tools were made using stone, wood, and bone, it gradually shifted to the age of metal. The creation of the method of making tools from bronze brought a big change in the development of food production. The classic model of nomadic animal husbandry in the Mongolian steppes was formed during this period. At this time, the number of domesticated animals increased rapidly and spread over the steppes, forests, and Gobi deserts. In this way, the nomadic clans settled in the steppes of Eurasia and developed methods for milk and meat processing.

In countries with a warm and humid climate, such as Mesopotamia, Egypt, India, and China, ancient kingdoms began to form, while in the great part of Eurasia, the classic form of nomadic animal husbandry was developed and the art of producing food suitable for it was matured. Nomadic herding tribes lived in steppes and Gobi deserts during four seasons in long-distance and short-distance migrations. With the introduction of animal husbandry, Mongolians were able to live safely with a constant supply of food in all seasons of the year. With the increase in the number and type of domesticated animals, it was necessary to expand the amount of pastures for migration, to raise the species of animals under natural conditions, and to create breeds of animals that are resistant to them. Nomads made, bridle, pots, and food containers out of bronze and iron. Eating food in many ways has had a positive effect on human body development, aging and health. Pots, ladles, cups, knives and livestock equipment were made of metal. Bronze sickles, hoes, crowbars, hammers, and grain objects indicate that Mongolians plowed the land and planted crops in addition to herding horses and cattles. Thus, the main form of agriculture of people in the Bronze and Iron Age was animal husbandry, which was started since the Neolithic period, and the process of food production continued at the household level.

3.2.4 Period of Ancient States in Mongolia

Around the beginning of the present era, people who migrated according to the flow of water and grass, built portable homes with sheep felt and mountain wood in any season, invented food production technology based on the classical method of

animal husbandry. The Huns, a nomadic tribe, settled in the grasslands from Lake Baikal to the Great Wall and the Khyangan Range to the Great Tarvagatai Mountains at the beginning of the present era. The nomadic tribes, freed from the control of the settled nations in the south, had a guaranteed and independent supply of food by herding livestock, hunting deer, and using native seed plants in the sand dunes of the Gobi desert. The meat, milk, grains, and fruits of the five animals having horns (camels, horses, cattle, sheep, and goats) adapted to the ecosystem of the Gobi steppe supplied sufficient amounts of nutrients necessary for the body of the people of this area (Batsukh et al. 2013). Most of the livestock kept by the Huns were sheeps but horses, cattles and camels were few. Gradually the tribe developed the processing animal products such as hair, wool, milk, meat, and leather, the classic form of nomadic life.

The nomads were provided the essential proteins and minerals, necessary for the human body, from animal and animal raw materials, and enriched them with plant-derived substances such as carbohydrates, phenolic compounds, fiber, vitamins, and unsaturated fatty acids. Since then, fermented foods such as fermented milk, yogurt and chutney have been used in the daily diet. These fermented foods are known as probiotic foods in today's science. There are historical records of vegetables being grown and used for food during the Kidan Dynasty. According to Chinese sources, the northern neighbors opened many large markets to trade animal meat, milk, skins, game skins, wool, and hair as well as plant species and therefore, had in influence on Mongolian diet. Mongolian tribes started using foreign foods such as tea, sugar, and white rice from this period.

3.2.5 Period of the Mongol Empire

During the period of Mongol empire, the pastoralist tribes established relations with foreign powers and developed technological advancements in the field of war strategy and animal husbandry (Batsukh et al. 2013). At the same time, foreign foods were imported through trade and tribute. The more powerful and wealthy a nation is, the more diverse and high-quality its population's diet is. During the 1st century BC, the Khunnu dynasty created the classic technology of meat, milk and grain processing by herding animals in the steppe region, while this model was further developed during the ancient Turkic and Uighur periods and reached its peak during the Mongol tribes.

Dairy products are the main food of Mongolians, and it is noted that they drink milk from sheep, cows and camels, and eat meat from wild animals and birds. Regarding plants, it is noted that millet is eaten in winter, and bread, vegetables, wine, beer, and honey were received as gifts from foreign countries.

Even today, when Mongolians go on long-distance campaigns, they carry two leather jugs for milk and a clay pot for cooking meat. The dairy products generally used by modern Mongolians, include Shim alcohol, fermented milk, milk powder, curd, and curd with egg. Mongolia vodka, or airag, is drunk in large quantities in the

summer, and it is fermented in large vats until the oil comes out with a wooden plunger with a perforated ring. Cow's milk was kept as a drill, and the harvested drill was put in a well-boiled sheep's stomach and kept frozen. The meat of sheep and horse was used as food and in case of illness, but beef was dried and used as a meal more than that of other animals. Grains and vegetables, which contain substances necessary for the human body, were an important source of food for the population during the Mongol Empire. Amuu rice was the food used by the population of the Mongol Empire. During the 12th and 13th centuries, the Selenge River basin was inhabited by tribes of people who specialized in farming, cultivating black rice, barley, wheat, and millet. In addition, raisins, figs, plums, peaches, apples, pears, walnuts, fruits, and nuts, black pepper, cucumber, rice, oats, rye, snow melon, parsley, and some foreign tea plants were also used as foods.

Dairy products, including fermented milk, are important in Mongolian soldiers' food consumption. The technology of fermented drink made from mare's milk is regarded as an intellectual property of Mongolia. Meat also played an important role in the diet of Mongolian soldiers. For Mongolians, the way to cope with the cold weather and climate was to eat foods that contained a lot of calories. Meat and fat of five horned animals occupy an important place among these high-calorie foods. While using animal meat, a unique technological solution was devised to process guts, head, and blood without waste, which has been passed down to the present day. Dairy products and animal meat played a decisive role in the formation of Mongolian warriors who were physically fit and mentally tough, who found the ability to resist disease and adapt to the harsh and harsh conditions of nature. Thus, one of the secrets of Genghis Khan's conquests can be seen in connection with their eating habits and types of food. Researching the composition of food used by Mongolian warriors demonstrated that it is rich in perfect animal proteins, living microorganisms, vitamins and minerals (Batsukh et al. 2013). These substances have an important physiological role, such as determining the immunity and physical development of the human body, and conditioning bone strength to intensify metabolism.

3.2.6 Period of Manchurian Rule

The great trade route that connected the East and West continued to play an important role in the food consumption of the nomads after the collapse of the Mongol Empire. It was important to exchange animal raw materials with agricultural and hunting furs and goods with neighboring countries. In the following years after the collapse of the Great Empire of the steppes, the ancient practice of enriching livestock with grains, game meat, and wild fruits continued in Mongolia. Horses, sheep, and cattle were relatively abundant among the livestocks. During the Manchurian rule, deer hunting was common in the lives of Mongolians, and a large percentage of people, especially poor people, were provided their food source with game prey. Fur animals were hunted and traded. The Mongolian plain became one of the free

trade zones between China and Russia. In 1727, Russia and Mongolia-Qin state treaty was signed and the trading city of Svoboda-Maimaa was established (Bazarova 2011). This agreement stipulates the conditions for a 200-person convoy of Russian merchants carrying game fur, hides, medicinal herbs, and game animals to pass through Mongolia and arrive in Beijing. In Maymaa market, West England velvet fabrics, fruits, berries, pepper, perfumes, fish, flour, tobacco, paper, silk, crepes, sweets, pottery and porcelain are sold (Bazarova 2011). According to researchers, the tea plant was originally used only for medicinal purposes. The Mongolians of this period were already used to rice, tea, sweets, and ginger, so they exchanged them for raw materials of animal origin.

Many of today's concept of proper nutrition, such as the emphasis on vegetarianism, the practice of fasting, limited eating, the healing of disease through food, and strict observance of traditional foods, were ancient religious practices. Modern science has proven that appropriate consumption of vegetarian food at the specified time reduces the content of harmful metabolic substances resulting from high consumption of animal protein and facilitates the functioning of the digestive organs (Batsukh et al. 2013).

3.2.7 *Period of Modern Food Production*

At the beginning of the twentieth century, the world began to produce food intensively to feed the increasing population and it was possible with the progress of scientific development and technological inventions. With the development of food production technology, hundreds of types of food have been added to people's diet, the quality of the foods has been improved, the safety has been ensured. Similarly, the food habit of Mongolia was also influenced by globalization. At this time, the nomadic lifestyle continued in the Mongolian plains, and a certain section of the population began to move to the settled areas. Dumplings, pancakes, tofu, *yewen*, *tanzur*, *mayur*, pickled spices, Chinese tea, and using Chinese porcelain cups and utensils from the south become popular among the population. Mongolians started using a lot of processed foods such as bread, cookies, sweets, Georgian tea, canned food, and vegetables like cabbage, carrots, and learned to use spoons and forks in the European way.

Intensive livestock industry began in 1960. Irrigation of pastures, measures to fight against infectious diseases and hay harvesting were started. Measures such as improvement of animal breeds, pure breeding of local hybrids, cross-breeding of productive animals, and establishment of academic institutions and schools began to train specialists. Since 1990, the number of livestock reached more than 90 million.

Using the milk and meat of the livestock, the method of making traditional food products such as fermented milk, *urum*, cream, *eezgi*, mongolian vodka, and borts was not much different from the time of our ancestors. New types of products such

as butter, cheese, drinking milk, yogurt, ice cream, sausage, smoked meat, and toppings have been produced using modern methods.

In 1924, the rules of agriculture were approved, experts were invited from Russia, and the work of using agricultural tools was started. In order to increase the consumption of plant-based foods, vegetable cultivation was started throughout the country in 1941. As before, Mongolians mainly consumed animal meat and milk, and still extracted plant-based foods commercially and from nature. By cultivating and multiplying plant species, the amount of yield obtained from a unit area has increased, and thus the possibility of producing more products and providing food to more people has increased. The development of science and technology created the conditions for the creation of added value in the food industry. Crops and vegetables grown in the soil of Mongolia have dramatically changed the food consumption of the population. Plant-based foods, including rice, flour, and vegetables, have become the staple food of Mongolians. Significant proportion of the vegetables, fruits, sweets, flour and rice sold in the Mongolian market are supplied by neighboring countries (Tumurjav 1989, 2003). Since the 1940, along with the increase in the production of agricultural and agricultural products, chicken, pig, and fish breeding have been created, and the products of this industry have played an important role in the livelihood of Mongolians. By the beginning of the twenty-first century, Mongolia has more than 173 types of edible plants, about 20 types of fruits, and 375 types of mushrooms (Tumurjav 1989, 2003).

3.3 Traditional Foods and Drinks and Their Safety

Mongolians developed a volume of traditional wisdom to prepare traditional foods and drinks that are rich in nutrients and can be stored well. The technology based on the indigenous knowledge system (IKS) of Mongolians is characterized by the fact that the main food items are produced in a clean form with little effort required in nomadic and settled conditions. However, from the beginning of the twenty-first century, sedentary life, urbanization, and free trade and globalization, arguably westernization began to have a significant impact on dietary transition. The consumption of fast food, processed and ultra-processed food, often characterized with high carbohydrate, oil and salt, has been increased. As a result, the consumption of natural or traditional foods has been decreased. This dietary transition could result into increasing number of lifestyle diseases such as cardiovascular disorder, diabetes, even cancer (Dugee 2009; Dugee et al. 2009). Proteins, carbohydrates, fats, vitamins, minerals, and water should be obtained from foods. Because there is no perfect food that contains all the nutrients, it is recommended to consume a variety of foods in certain amounts and proportions and therefore, food diversity is essential. Excess or deficiency of these nutrients can cause diseases in the human body. For example: lack of protein leads to loss of tissue regeneration, weakening of the immune system, physical and intellectual development, and anemia due to iron

deficiency. Young children, adolescents, and pregnant women are more susceptible to malnutrition.

3.3.1 Mongolian Traditional Dairy Products

As already stated above, for Mongolia which is mainly engaged in animal husbandry, one of the main foods is milk and dairy products (Indra et al. 1976; Gombo 1992; Indra 2000). Fat, protein, and sugar contents of the milk are processed into different types of products *viz.* fat type products, protein type products and fermented products (Fig. 3.1).

3.3.1.1 Fat Type Product

Most of the fatty acids in milk fat melt at a lower temperature than the human body temperature, so they melt quickly and are fully absorbed (Indra et al. 1976; Indra and Batsukh 2000). Milk fat is broken down into glycerol fatty acids, which play an important role in metabolism. Milk fat contains different essential polyunsaturated fatty acids such as linoleic, linolenic, and arachidonic acids. Phospholipids, which belong to lipids, are in the film of milk fat bubbles and participate in the body's protein synthesis and activate the brain. Cholesterol is responsible for regulating sex and adrenal hormones, neutralizing toxins, and hematopoiesis. The composition of



Fig. 3.1 Milk and traditional dairy products of Mongolian culture; (a) Fat of pasteurized milk; (b) Ghee; (c) Melted butter; (d) Enriched fat of milk; (e) Foremilk; (f) Mongolian cheese; (g) Process of separating of whey from curd; (h) Curd drying process; (i) Dried milk protein with whey; (j) Fermented milk of horse kumiss; (k) Mongolian yogurt; (l) Fermented milk of Camel; (m) Process of distill milk vodka

the oil includes oil-soluble lecithin, lipids such as sterols, vitamins A, E, D, but to a lesser extent water soluble vitamins (C, B12), and nicotinic acid (Indra et al. 1976; Indra 2000; Indra and Batsukh 2000). Fat has twice as many calories as protein and carbohydrates have.

Urum Urum is a creamy pudding that sits on top of skimmed milk.

Ghee The unique paste separated from the oil is called ghee (Fig. 3.1b). Depending on the local customs and climate, the method of making ghee varies. In the Western, Southwestern, and Southern provinces, oil is produced by churning animal milk and yeast, while in the Central and Eastern provinces, it is customary to produce oil by melting. Chromatographic analysis of the composition of fatty acids in yak ghee showed that the ghee contained the most oleic acid (41.8%), linoleic, linoleic, and stearic acids, which are essential for human, 15.54%, saturated acids (48.96%), and unsaturated acids (51.04%) (Indra and Batsukh 2000). Regular use of ghee protects against hardening of the arteries, osteoporosis, and loss of sexual and renal hormones, fatty liver and accumulation of excess fat on the vessel walls (Khishigmaa 2013). However, if the amount is exceeded, there will be symptoms such as vomiting and diarrhea. In some cases, tea with ghee, eating barley flour kneaded with ghee, and gargling with ghee are used to suppress gas.

Khailmag A kind of unique pudding made by melting new and fresh oil, extracting ghee and adding a small amount of flour or starch to the remaining fat is called khailmag. Enriched with sweet puddings such as candy, buram, and raisins, it can be used fresh or frozen for food.

3.3.1.2 Protein Type Products

Dried protein products are adapted to the dry climate of Central Asia, such as dried curds and *eezgi*, are widely used by Mongolians. These products are suitable for long-term storage.

Foremilk Mongolians call the thick yellow milk of newly calved animals protein. After calving, the protein milked in the first 1–2 days is called colostrum protein. Mongolians process the protein of animals other than horses. Put the egg whites in a pot and slowly heat it until it boils and thickens (Fig. 3.1e).

Mongolian cheese Mongolian cheese is made from cow, yak, sheep and goat milk (Fig. 3.1f). Cheese technology is available in almost all regions of our country. It consists of the stages of heating milk, curdling, molding and squeezing. Only in some areas of the western province, there is a custom of using stomach enzymes for preparation. Compared to other types of cheese, Mongolian cheese does not require cutting, salting, or processing. The taste and quality of Mongolian cheese is unique. Mongolian cheese is also called raw *edem*. Raw milk cheese is considered better in

quality. *Byaslag* is one of the most popular dishes of Mongolians, and it is mainly used fresh.

Curd After distilling the cow's milk to obtain alcohol, the thick curd is poured into a container other than the distillation pot and left for 10–12 hours to cool and allow the protein to settle. Then put it in a cloth bag and press it down with something heavy. When the moisture content is 65–70%, add about 30% of the weight of the curd and filter again. Thus, by diluting it with milk and rinsing it, the acidity of the curd is reduced and its taste is improved.

Yoghurt curd fresh coated yogurt is boiled for 30 minutes on low heat and strained. Filtered and ready curd is stored in stomach and stomach. Curd is made in the evening in the fall and kept frozen throughout the winter, and is intended for use in winter and spring. But in summer, curd is used to make curds and fingers. A good quality curd is a protein product with a uniform density and sour taste (Batsukh 1995a, b).

Dried curd Dried curd is rich in protein and fat and is suitable for storage and transportation. Dried curd is made from whole animal milk, especially sheep's milk, in a delicacy in Mongolian culture. 1–1.5% skimmed milk curd is considered to be the most suitable in terms of quality (Batsukh and Indra 2002). Dried curd is rich in nutrients especially vitamins C, D, B, and long-term storage does not cause significant changes in taste and composition. It is an important daily food product for the rural people. Also, people believe that a certain amount of hard *aaruul* has the quality of strengthening gums and teeth. Dried curd contains about 90% dry matter, 30% fat, and 10% soluble protein.

Eezgii Eezgii is made with the milk of animals other than mare's milk. It is prepared in spring and autumn, after calving and before drying. In the early spring and late autumn, it is difficult to maintain a constant temperature in the home to make other types of lactic acid porridge (the conditions for the growth of lactic acid bacteria).

3.3.1.3 Fermented Milk Product

Fermented milk products are divided into two categories: lactic acid products and lactic acid and alcohol products. Yoghurt, mare's fermented milk, cow's milk and cow's milk, many types of curds, cheese are not only the daily food of the herdsmen, but also intermediate products or raw materials for the processing of many types of dairy products (Damdinsuren 1978, 2001, 2002). Mongolians use *Iseg Idee*, which is a probiotics, since ancient times.

Mongolian yogurt Mongolian yogurt is a popular dairy product widely distributed in the country. Curd is made from sheep, goat, cow, and yak milk. Taking into

account the quality of milk used to coat yogurt, it can be divided into raw milk, skimmed milk, and processed milk. The fat content of raw milk yogurt is at least 3.2%, skimmed milk is 1.3–1.5% fat, and processed milk is 0.05–0.07% fat.

Ukher bogi dotke The fermented product by combining the oxidation of lactic acid and alcohol in wooden barrels and containers is called *dokte*. Another vernacular name of the drink is *Khoormog*. In the western provinces mare's fermented milk is known as *chigae*.

Khoormog Since milk has a lot of carbohydrate, the combination of lactic acid and alcohol will create suitable conditions for oxidation. *Khoormog* is thicker than mare's beer, but it melts in the mouth with a foaming sound, a sour taste, and a unique carbonated drink that tingles the lips and nose. The fat content of the sausage is 3.3%, protein is 3.76%, and total dry matter is 12.6% (Batsukh 1995a, b). *Khoormog* is unique in its nutritional and therapeutic qualities, and because it is mainly composed of globular proteins called albumin and globulin, it creates a uniform, very unique structure that does not cause dense edema and does not secrete whey. This milk not only reactivates the digestive system, improves the physical strength of the body, but also medically treats chronic diseases of the liver, gall bladder, and kidneys (Batsukh 1995a, b).

Mongolian milk vodka Fermented with milk of various animals is distilled to produce Vodka. Mongolians call this process “pot distillation”. The essence of the pot distillation process is to separate the alcohol from the oxidation of sugar in the milk into a liquid by evaporating and cooling it back. Mongolian pot brewing equipment consists of a pot for boiling fermentation, a cover to create a closed environment, a jar for cooling water, and an atrium for drinking alcohol. The distillery pot is made of cast iron, the fins are made of aluminum, and the bucket and atrium are made of wood.

Traditional milk processing technology is relatively simple, labor-intensive, does not require sophisticated equipment, uses a small number of simple containers and equipment, and is characterized as a zero-waste technology.

3.3.2 *Mongolian Traditional Meat Food*

Meat occupies a major part of Mongolian diet (Fig. 3.2). There are more than 200 types of national dishes in which meat is the main ingredient and among them there are more than 70 types of food made from the intestines of animals. Meat has been processed by methods such as cooking, roasting, smoking, and burying. To name a few delicacies, especially foods that Mongolians bring to their most honored guests are *bood*, *khorgo*, fried mutton juice, etc. Mongolian soup is a dish made by enriching meat with plant-based foods.



Fig. 3.2 Traditional meat products of Mongolian culture; (a) Whole sheep; (b) Back of the sheep; (c) Mixed meat in pericardium; (d) Goat meat with stone; (e) Boiled meat with stone; (f) Gobi boiled meat; (g) Mongolian barbecue; (h) Whole meat; (i) Head and leg; (j) Nutrient dense soup; (k) Fish; (l) *Tegmen*; (m) Dried meat; (n) Dried horse meat; (o) Salted meat; (p) Frozen blood with internal organs

Mongolia's animal husbandry is dominated by pastoralism, rooted in centuries-old traditional nomadic animal husbandry. Primarily the livestock include camels, horses, cattle, sheep, and goats. The recommended meat (boneless) consumption for Mongolian people is 6 kg per month in the 9 months of the cold season, and 4.5 kg in the summer months, i.e. a total of 67.5 kg of boneless meat per year. The meat consumption of urban and rural population differs (Damdinsuren et al. 2002). Mongolians not only use fresh meat, but also store it for a long time by drying, smoking, salting, and freezing. The above-mentioned methods have been used in food, either alone or in combination, to extend the shelf life of meat and improve its taste.

3.3.2.1 Thermally Processed Meat Products

Whole sheep The most honored meal of the Mongolian national dish is a big whole sheep (Fig. 3.2a). It is made from the belly of the sheep, and the remaining meat is cooked without breaking it.

Back of the sheep This is a preparation of sheep's spine including the two ribs, and fat tail (Fig. 3.2b). Since the rump is a very respectable delicacy in Mongolian traditional cuisine.

Pericardium It is a dish made by putting meat in the skin of an animal's heart, seasoning it with salt and onion, and then wrapping it with string or stringing it with wood (Fig. 3.2c).

Boodog Meat is cooked in its own moisture without the use of water and seasoned with salt, onion, and cumin and a little water to make the soup. This item is prepared with stones. Ingestion of the soup and rub the palms on a hot stone are believed as an ailment of fatigue and gastritis.

Khorhog A dish similar to *boodog*, but cooked in a container with a tight lid.

Jimbii A kind of celebratory meal similar to making *khorkhog*, which is said to have originated from the Gobi Provinces, especially the Umnugovi Province. *Jimbii* is unique in that the meat is fried and cooked in its own oil without the use of stones, but with various vegetable spices.

Bulmag Prepared and seasoned whole meat is peeled, wrapped in birch cork and buried in a hot pile of dung and wood firewood.

Shorlog When grilling game meat, Mongol warriors used to put their shields on an open fire and stir, skewer, and fry it with a sword or bow arrow, which later became famous as "barbecue".

Whole meat meal Only meat with bones cooked in salted water.

Heads and skins There are ways to peel the heads of small animals and wash them with hot water and cook them, or to clean them and cook them without skinning them.

Three nutrients soup It refers to the soup made by removing the meat from the shank bone, rump bone, and head bone of sheep and cooking it in a closed container.

Fish meat meal Mongolians have been using fish for food since the Sianbi period. The records of the Mongolian secret bureau and other sources such as writings of scholars like Rashid Ad din, Plano Carpini, V. Rubruk, and Chang Chun Bumba provide information about the widespread use of fish by the Mongols. Fish meat is prepared in many different ways, such as cooking, grilling, baking, slicing, battering, making dumplings, pancakes, etc. In addition to salting, curing, and freezing, the caviar was mixed with a little ghee and flour and eaten as pancakes.

3.3.3 *Mongolian Ancient Meat Feast*

Tegmen It is Khamnigan Buriad Zona dish, which consists of horse's veiled liver, core, meat, and horse meat, which is cooked in water after adjusting the taste with salt and *mangir*.

Uralsuur It refers the meat from both sides of the sheep's rib, season it with salt, onion, and garlic, turn the esophagus inside, and give it to the boys as "go fast and strong" and to the girls, "go smart and beautiful".

Sagsai It is a preparation of beef with fat in water, with the salt.

Tuley This is the name of the boiled sheep's head and the delicacy is famous in Buriyad.

Tugnu It is a Hamnigan dish in which the meat is undercooked inside the bod and seasoned with salt, *mangir*, and anise, then rolled in flour and baked.

3.3.3.1 **Meat Food with Extended Shelf Life**

Borts dried meat. The method of browning meat, which has been used by Mongolians for a long time, is a unique technology based on the nature and climate of our country. The essence of the meat curing process is that after cutting the meat, it is cut into small pieces, frozen in the natural cold, then exposed to the wind, and the moisture is evaporated without thawing back. Meat food prepared in this way is called *borts*. *Borts* is made in winter, usually at the end of November and December. By browning the meat, the biochemical processes that take place in its structure and the oxidizing action of bacteria are basically stopped. *Borts* is a food suitable for nomadic life, as well as a suitable food for long journeys and tourism. Mongolians make *borts* with beef, camel and goat meat, and horse and mutton meat is usually fresh or frozen.

Kaz salted horse meat. It refers to the dried intestine of horse seasoned with salt. It is one of the most respected dishes of the Kazakh people of Bayan-Olgii province.

Shuuz It refers to the fresh meat seasoned with salt and preserved in a sealed container. This is one of the traditional ways to preserve and use fresh meat during the heat of summer and autumn is the method of making *shuuz*.

Khyaramtsag frozen blood. Mongolians use the fattened meat of small and large animals for winter food by extending the storage period through the winter and spring using the above methods. Put the blood of the animal into the stomach and small intestine and freeze the lungs and liver in the middle. Blood can be poured

into the small intestine of the stomach and kept separately. In winter, it is usually used in soups, but it can be used in all other dishes. It is a nutritious food that is very useful for blood circulation and relieving fatigue.

3.3.4 Plant-Based Foods

Although Mongolia has an extreme climate and four seasons, many kinds of fruits and vegetables, such as legumes and sweets, have been wisely used since ancient times (Avdai et al. 2003). Mongolians mainly cultivated barley and wheat with a little black rice or small grain and sago or triangular rice. There were two species that were most suitable for Mongolia's soil and climate: barley and wheat (Batsukh et al. 2013). Figure 3.3 represents some of the plant based traditional food items.

Wheat flour Flour is a powdery crumb obtained by cleaning the grain, processing it with water and heat and sifting it in a mill. The origin of flour industry dates back to the Stone Age or Neolithic period. As the demand for flour grew, water, wind and electric mills were developed using horses, donkeys and natural power. Mongolians have traditionally made many types of baked goods using wheat flour. The most common of these are loaves and normal buns. The basis of the technology for making normal bread or jam products from pods is based on changes in the structure and properties of its starch and protein compounds. When water is added to wheat flour to prepare dough, colloidal and biochemical processes take place. One of the first



Fig. 3.3 Traditional plant based foods of Mongolian culture; (a) Pudding made with plain pastry; (b) Comb style pastry; (c) Rope style pastry; (d) Barley flour with ghee; (e) *Polygonum viviparum*

products that Mongolians began to make and use was fennel, and the tradition of using it continues to this day. Flour, water, oil, flour, and sugar are used as raw materials for the bean paste.

Shape pastry It is assumed that it was first made for religious occasions in the sixteenth to seventeenth century, when Zoroastrianism began to spread widely in Mongolia. Normal buns are round, oblong, oval, and still printed with beautiful symbolic patterns. A simple pastry is more of a ritual than a food. The main ingredients are good quality wheat flour, milk, butter, ghee, butter, sugar, and some sweeteners.

Samnaa pastry It is a bun prepared by adjusting the thickness of the wheat flour dough and flattening it according to the needs, then cutting it into oblong squares and cutting three rows in the middle.

Gurmel pastry It is used in the western provinces of our country for daily and ritual food preparation. It is similar to other types of bread in terms of recipe and ingredients, but different in shape. The length of the rolled pastry prepared in this way is approximately 17–20 cm, and the width is 5–7 cm.

Barley flour Barley flour is prepared by roasting the barley from the mixture, separating the husks and removing the seeds, then steaming gently, removing the husks completely, soaking and sifting the husks, and milling them. Such flour is called *zambaa* in Western Mongolia. In the traditional folk method of making barley flour, the barley is whitened, harvested, sieved, and threshed. Barley flour contains 6–8% moisture, 1.8–2.5% ash, 13.5–20.5% protein, 59–63% starch, 1.9–3.5% oil. Barley flour and brown rice have high nutritional value, are easily digested by the human body, and contain a lot of fiber, minerals, and unsaturated fatty acids such as oleic and linolenic (Chimedtsogzol and Dugersuren 1974).

Because of their high nutritional value and good shelf life, sorghum, and sorghum bread are commonly used by nomadic herders. The composition of animal fats is dominated by saturated fatty acids, and on the other hand, the composition of vegetable oils is dominated by unsaturated fatty acids (Batsukh 2012; Batsukh et al. 2013). The quality of animal and vegetable oils depends largely on their polyunsaturated acid content. They are of physiological importance as they form the structural elements of the body's cells. Linoleic and linolenic acids are essential fatty acids as they cannot be synthesized by the human body. Arachidonic acid is synthesized in the body with the participation of linoleic acid, vitamin B6 and biotin (Batsukh 2012, Batsukh et al. 2013). Palmitic, stearic, myristic and other acids are the main sources of heat, and they melt at high temperatures and are solid. Excessive use of oils containing these acids has some negative effects on the body. Herbs should be consumed as it contains micronutrients, fibers, etc.

Berries and other fruits Natural wild berries are very commonly used for medicinal purposes. Fruits are useful for improving the digestive process, increasing the

secretory activity of the digestive process, and regulating the activity of beneficial intestinal microorganisms.

Fruits are a rich chemical composition containing dry matter, sugar, various vitamins, amino acids, starch, minerals, salt, carbohydrates, proteins, oils and biologically active substances. In the mountains of Khangai, Khentii, Khuvsgul, and Altai, and along the river basins, many plants with sweet seeds and fruits such as gooseberry, rockberry, strawberry, *Prunus padus*, *Rosa dahurica* Pall sea buckthorn, etc. grow. Berries and fruits were mainly used by Mongolians for medical purposes. The plants grown in Mongolia surpass all other types of food in terms of the content of biologically active substances that have a positive effect on the human body, and they are considered natural medicinal preparations.

One of the plants that Mongolians have traditionally prepared and used for food is *Polygonum cordifolium* Turcz. Many types of plants have been used by humans for the treatment of animal diseases, food, and agriculture, and currently more than 2000 species of medicinal plants belonging to about 100 genera have been studied (Georgievski et al. 1990). Among these, important plants with medicinal properties such as gorse, sea buckthorn, antelope, *Prunus padus*, *Crataegus sanguinea* Pall, *Glycyrrhiza uralensis* Fisch, *Plantago major* L, *Bergenia crassifolia* L Fritsch, blackcurrant, *Cynomorium songaricum* Rupr, white mushroom, and saffron are widely used in food (Volodya et al. 2010).

Polygonum viviparum is very widespread in every province of *Polygonum viviparum* /mekheer/ Khangai region and grows in mountain slopes. In the Mongolian folk hospital, its rhizomes are used in medical and veterinary clinics for diarrhoea, hemostasis. The extract is applied in cases of inflammation and purulent inflammation of the mucous membrane of the mouth. Because it is starchy, it is mixed with white oil and used as food. Traditionally *Mekheer* oil and *Mekheer* curd are prepared by drying and grinding *Mekheer* root and mixing it with oil and curd. The picture below shows the widely growing *Mekheer* in our country (Georgievski et al. 1990).

3.4 Conventional Packaging

Traditional and modern food products' containers and packaging with good quality and craftsmanship is required as they have positive effects on the health of the population and the environment. Ecologically clean packaging has an important effect on the process of delivering finished products to consumers. The Mongolians used tools and packaging adapted to the unique conditions of migration, which have been passed down to the present day. Figure 3.4 represents the traditional utensils, food packaging and storing techniques. Traditional utensils and packaging can be divided into two general categories: hard and soft tissue. Iron, wood, and pottery utensils are considered to be of hard tissue origin, and those made of animal skin, wool, and cloth are considered to be of soft tissue origin. Archaeologists have noted that pottery and porcelain vessels were made by tribes who grew crops and vegetables because of their connection with the land and water (Khukhuu et al. 2009).



Fig. 3.4 Traditional utensils and packaging of food in Mongolian culture; (a) 270- year old pot weighing 541 kg from Manzushir Monastery in Tuw province; (b) Silver cup and bag; (c) a cup made up of tree bark; (d) copper cup and *Dombo*; (e) Wooden pot; (f) Milk bucket; (g) *Dombo*; (h) Ghee into small intestine; (i) Mongolian yogurt in *Khukhuur*; (j) Campaign packs and bags; (k) Packaging boiled blood

3.5 Conclusion

Mongolians with a nomadic culture have developed their foods and drinks that are prepared in a simple way and packaged wisely, suitable for traveling and long-term storage. The country represents an example model of intergration of scientific advancement and rich traditional or culture. In most of the cases the diet of the present day represents their dietary tradition but the production and processing systems have been improved with the advancement of technology.

References

- Avdai CH, Tumurjav M, Songino CH (2003) Traditional methods of Mongolian nomads. Monograph, UB, IISNC, Mongolia. 384p
- Batsukh TS (1995a) Technological studies of Bactrian camel milkprocessing. Dissertation
- Batsukh T (1995b) Technological investigation and clinical experiences of camel milk. Mongolian Foundation of Science and Technology, Mongolia, p 767
- Batsukh TS (2012) Heritage and culture of food consumption in Mongolia, Ulaanbaatar
- Batsukh TS, Indra R (2002) Milk processing technology, Ulaanbaatar

- Batsukh TS, Altantsetseg YA, Enkhsetseg E (2013) Mongolian traditional foods for sustainable diet. Admon Company, Ulaanbaatar
- Bazarova BV (ed) (2011) History of Buryatia, T1,2,3, Ulan-Ude Publishing House, BSC SB RAS
- Boutton TW, Lynott MJ, Bumsted MP (1991) Stable carbon isotopes and the study of prehistoric human diet. *Crit Rev Food Sci Nutr* 30:373–385. <https://doi.org/10.1080/10408399109527548>
- Chimedtsogzol A, Dugersuren K (1974) Biochemical parameters of barley flour. Academy of Sciences, Ulaanbaatar
- Damdinsuren L (1978) Microbiology and technology of the Mongolian cheese “byslag”, Dissertation for Ph.D., Academy of Moscow
- Damdinsuren L (2001) Basics of science and technology for the development of dairy industry in Mongolia, Ulaanbaatar
- Damdinsuren L (2002) Scientific bases for elaboration of Mongolian dairy product’s industrialized technology. Mongolian Foundation of Science and Technology, Mongolia
- Damdinsuren L, Lhagva G, Lhagva L, Damdin B, Gombo G (2002) Mongolian food industry, Ulaanbaatar
- Dugee O (2009) Dietary patterns and obesity risk among adults in Mongolia. M.Sc. Thesis, University of Putra Malaysia. Available online: <https://core.ac.uk/download/pdf/42994158.pdf>
- Dugee O, Khor GL, Lye MS, Luvsannyam L, Janchiv O, Jamyan B et al (2009) Association of major dietary patterns with obesity risk among Mongolian men and women. *Asia Pac J Clin Nutr* 18:433–440
- Georgievski VP, Komissarenko NF, Dmitruk SE (1990) Biological active substances of medicinal plants. Novosibirsk, pp 198–199. [Russian]
- Gombo G (1992) Mongolian mares milk and its magic. Printing House of the State’s Standard, Ulaanbaatar
- Indra R (2000) Dairy products of Mongolia. А И Т А Н Ы Ц Ө Г, Ulaanbaatar
- Indra R, Batsukh TS (2000) Dairy technology, Ulaanbaatar
- Indra R, Osorkhaan U, Soodol DT (1976) Milk and milk products. State Printing House, Ulaanbaatar
- Khishigmaa B (2013) Milk processing technology. State Publication, Darkhan-Uul Province
- Khukhuu D, Badral P, Sainbuyan C, Erdenetsogt N, Badamdorj D, Gerel B (2009) Mongolian food packaging system, Ulaanbaatar
- Miller ARV, Wilkin S, Hendy J, Turbat T, Batsukh D, Bayarkhuu N, Giscard P-H, Bemmann J, Bayarsaikhan J, Miller BK, Clark J, Roberts P, Boivin N (2022) The spread of herds and horses into the Altai: how livestock and dairying drove social complexity in Mongolia. *PLoS One* 17(5):e0265775. <https://doi.org/10.1371/journal.pone.0265775>
- Pfeiffer JE (1985) The emergence of humankind. Harper and Row, New York
- Tumurjav M (1989) Pasture Mongolian meat, Ulaanbaatar
- Tumurjav M (2003) Traditional animal husbandry techniques practiced by Mongolian Nomadic people. In: Badarch D, Zilinskas R, Balint PJ (eds) Mongolia today science culture, environment and development. Routledge, Curzon, pp 86–113
- Tumurjav M, Erdenetsogt N (1999) Mongolian Nomads. Monograph, 23. Academy of Science Mongolia, Mongolian State University of Agriculture. International Institute for the Study of Nomadic Civilizations
- Volodya TS, Tserenbaljir D, Lamjav TS (2010) Medicinal plants of Mongolia, Ulaanbaatar