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Influence of the traditional food culture of Ancient Egypt on the transition of cuisine and food culture of contemporary Egypt

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Abstract

Because of the largely arid desert landscape of Egypt, for millennia, Egyptians have been closely connected to living alongside the narrow fertile banks of the Nile River. Annually, melting snow cascading from the mountains in the highlands of the south triggers the Nile River to flood on its journey northbound toward Egypt. As the flood water recedes, it leaves in its wake a rich layer of fertile, volcanic dark soil deposits. The Egyptians mainly rely on this annual natural event to grow various staple food crops, including emmer wheat for making bread, vegetables for cooking molokhia, fruits, and legumes for making koshary. Further, the Nile River provides a source of drinking water, fishing, and raising livestock for meat and dairy products for making halloumi and kariesh cheeses. Ancient Egyptians devoted a sizable portion of Pharaonic history to food, both as nourishment and for the preparation for the mythical religious experience on the journey into eternal life. Food played an essential role in performing religious rites, mummification, coronation and wedding banquets, burial ceremonies, and particularly in preparation for entering eternal life in the afterlife. Because the ancient Egyptians meticulously kept descriptive records, there is a considerable body of archaeological evidence and hieroglyphic accounts regarding ancient Egyptian tangible food history and culture. However, ancient Egyptian food culture has not received adequate scholarly investigations as did the Pharaohs, Pyramids, and mummies. This article aims to examine the under-researched area of the influence of the traditional food culture of Ancient Egypt on the transition of the cuisine and food culture of contemporary Egypt, and how the Pharaohs employed food to achieve longevity during their life and prepare for successful admission into their afterlife. Three factors have contributed to the development and continuation of the 5000-year Egyptian food culture. First, the existence of the Nile River provides reliable, rich silted soil for growing various staple crops. Second, the annual inundation of the Nile River transports fresh layers of silt-rich fertile soil, which provides stable agriculture and supports cultivating various food crops and raising livestock. Third, as a result, of the first two factors, Egypt has been experiencing abundantly diverse staple food sources for millennia.

Keywords Ancient Egypt's foodways, Pharaohs, Egypt, Book of the dead, Food for the afterlife, Nile River, Genesis of Egyptian gastronomy

Introduction

Egypt is a country situated in northeastern Africa bordered by the Mediterranean Sea from the north and the Red Sea from the East. Egypt's millennial history dates back to the period of the Pharaohs and the Great Pyramids of Giza. This strategic geographical location links northeast Africa to the Middle East, making Egypt

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readily accessible to the African, European, and Asian continents connected through the Suez Canal waterway. For millennia, this strategic location together with the fertile land of the delta of the Nile River valley provided sustained agriculture for growing grain crops, rich green vegetation, and raising animals and fowls to provide meat, milk, wool, fur, and other food products. This combination of factors was instrumental in the development of Egyptian civilization, Pharaonic history, and tangible food culture. Despite successive colonization by a myriad of major foreign powers, Egypt largely maintained its diversified ethnic, language, and cultural identities, as well as centuries of a meticulously preserved chronological account of tangible food culture. According to the chronology of hieroglyphic and hieratic scripts, as well as various monuments and artifacts, Egypt is considered one of the oldest and preeminent civilizations in the Eastern Mediterranean and North African regions. Egypt's history tracks back to around 5000 years ago. Although most of the Egyptian land is desert, the Nile River provided both ancient and present-day Egypt with a lifeline of fertile land, transport system, irrigation system, raising crops, cultivating construction materials, and fresh drinking water. Most of the Egyptian geography is an arid landscape; however, the Nile River Valley supplied Egypt with a soil-rich silt ideal for growing staple crops, chiefly among them papyrus, wheat, and flaxseed. Throughout its history, emmer wheat has been the main staple food source for Egyptians [1–4]. Whereas ancient Egyptian Civilization is renowned for its architectural styles, colossal monuments, extravagant temples, and tombs such as the Great Pyramids of Giza, there is a lesser-known aspect of ancient Egyptian history that is understudied, which is ancient Egyptian food culture.

Ancient Egypt's gastronomy includes the methods of ingredients choices, kitchen planning, cooking tools used, banquet preparation, and consumption. The recorded historical evidence from the portrayals of ancient Egyptian's daily life depicted on tombs and in hieroglyphic texts showed that the ancient Egyptians were especially particular about the type of food they consumed for two key reasons. The first was to achieve longevity in life, and the second was to prepare for their journey to their eternal life in the afterlife, which ancient Egyptians believed it is a facsimile of their life on earth [5, 6]. As stated by [7], religious and customary beliefs wield a considerable influence on dietary habits, particularly through prescribed food laws that regulate the type of permissible or impermissible consumption of certain food items. A team of French researchers examined the carbon atoms in mummies that had lived in Egypt between (3500 BC and 600 AD) to uncover what type of food they consumed. The study suggested that in ancient Egypt, there

were different diets for different age groups. An isotopic analysis found chemical differences inferred from diets consumed by children and adults. In particular, researchers associated these differences with the consumption of milk or millet porridge during infancy and childhood. Founded on the results from the isotopic analysis, the most commonly consumed foods included plant-based such as eggplants, pears, lentils, garlic, and wheat. Findings from this analysis suggested that ancient Egyptians followed a mostly vegetarian diet [8]. Consistent with the aforementioned findings, [9] maintained that the staple foodstuffs consumed by both poor and wealthy Egyptians included bread and beer, which were often supplemented by green onions, vegetables, lentils, chickpeas, figs, and to a lesser extent meat, game birds, and fish, which considered a luxury food that was consumed mostly by royals, nobilities and well-off Egyptians (Fig. 1). In related but different research by [10] analyzed tissues of calcified bones and teeth of ancient Egyptians who lived in Aswan, then called Nubia in Upper Egypt. The findings suggested that they consumed imported food and cereals during years of drought and famine under the rule of the 17th Dynasty in Upper Egypt from (1580 to 1550 BC). These findings support the argument that ancient Egyptians consumed mainly a vegetarian diet.

The Pharaoh's role in ancient Egypt was not only the political head of the state or military commander but also the religious leader and deity. In this sacred position, the Pharaoh wielded considerable influence on employing food in religious rituals. Throughout the dynastic rules of ancient Egypt, food offerings and banquets occupied an influential role in various social events, religious ceremonies, mummification rituals, and burial rites. Frequently served at ancient Egyptian banquets, including bread, beef, goose, cheese, fish, beer, and an assortment of fruits and vegetables (Fig. 1). Ancient Egyptians did not have a hieroglyphic word for "banquets." However, paintings found in tombs depicted that the Pharaohs and nobility-class Egyptians had extravagant feasts comparable to present-day banquets. Feasts or banquets were most likely held to observe important social events and religious occasions such as births, deaths, and weddings (Fig. 2). Although various foods were served, meat dishes were uncommon because they were scarcely available except for the Pharaohs and affluent Egyptians [7, 11].

Role of food in preparation for the afterlife

There is a consensus in the literature that in ancient Egypt, food occupied an essential function as an integral part of religious practices, culture, and social status. This food function was important in life, death, and the afterlife. According to ancient Egyptians' beliefs, when they died, their souls would continue to exist in immortality



Fig. 1 Ancient Egyptian food painting found in the Tomb of Menna, a high-ranking official during Egypt's New Kingdom over 3,000 years ago when Amenhotep III was the Pharaoh of Egypt. This image was retrieved from URL: <https://eng.majalla.com/node/190491/cultureancient-egyptian-cuisine>



Fig. 2 A painting depicting an ancient Egyptian banquet. This image was retrieved from URL: <https://www.pinterest.co.uk/pin/593912269593637909/>

in the afterlife, which will be comparable to their lives before death; however, their admission into the afterlife has not yet been ensured because the deceased Pharaohs must first navigate a precarious underworld passage and reckon with a final judgment before being permitted access to the afterlife. If successful, they expected to

provide sufficient food supplies to sustain their spirit in their afterlife. These requirements could be realized when adequate preparations were made during a deceased person's lifetime [12]. In preparation for that journey, they adorned their tombs and temples with images depicting a variety of food items as offerings to the deities as a

gesture of atonement. They also decorated temple walls with colorful paintings of tables packed with pottery jars and bowls of a variety of their actual favorite food [13]. Fundamental to ancient Egyptian mythology was the belief in the afterlife and reincarnation. According to that belief, ancient Egyptian's average lifespan lasted only up to their forties, therefore, they believed in the concept of having eternal life in which they will continue to live in the afterlife after they die, where they will be resurrected to live for eternity. The belief in the afterlife motivated them to prepare well for the afterlife by erecting edificial tombs, monuments, temples, and elaborate great pyramids. They also stockpiled various food supplies and belongings in their tombs to ensure the food security of the deceased Pharaohs and other royalties in their afterlife (Fig. 1). Research by [14] presented the results of lipid biomarkers and stable carbon isotope analyses of tissues and bandaging of mummies from the tomb of the high-ranking nobility "Yuya" and his wife "Tjua" (18th Dynasty, 1386–1349 BC). The results revealed that one of the ointments used in this funerary process was extracted from a tree related to the pistachio, which was profusely anointed over prime beef ribs before the deceased was buried in the Valley of the Kings at Thebes in Upper Egypt, which was the cradle of ancient Egyptian Civilization. Food, including meat, poultry, bread, cereals, fruit, jars of wine, beer, and oil were consigned into the "grave goods" to be available for the deceased in the afterlife. To underscore the significant role of food in preparedness for eventual death, it was a mythological belief that having meat and poultry placed in the tomb of the deceased from the highest ranks of ancient Egyptian society intended to ensure achieving the interminable preservation of their mummies while awaiting entering the afterlife.

Book of the Dead is approximately 3,000 years old. Generally, the book was inscribed on a compendium of nearly 200 spells of ancient Egyptian funerary prayers, hymns, magic charms, or hieroglyphic formulas composed by high priests as a guide to the deceased to enter the afterlife. Further, the book intended to protect the deceased Pharaoh or his queen and guarantee that they have all the necessities, including their belongings and food provisions to embark on their long journey navigating the mythical underworld into the afterlife (Fig. 4). According to the Book of the Dead, the afterlife doctrine was established on the belief that after death, the deceased will be reborn and live eternally in the afterlife [15]. Subsequently, the soul of the deceased person who had lived their earthy life will be guided by the "gods" to be reincarnated and eventually finds their way to the afterlife if they were successful in passing the final judgment by Osiris, the "god" of fertility and judge of



Fig. 3 A broken jar containing a 3,200-year-old piece of halloumi cheese found in a high ranking Egyptian official's tomb discovered in 2018 by a team of archaeologists from the University of Catania, Sicily, Italy, and Cairo University, Egypt. This image was retrieved from URL: <https://www.bbc.com/news/world-africa-45233347>

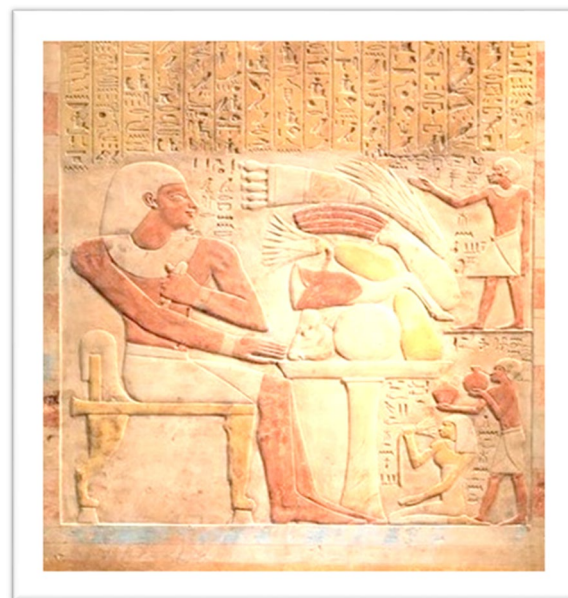


Fig. 4 Stela depicting food offerings for the afterlife found in a Middle Kingdom tomb in ancient Egypt. This image was retrieved from URL: <https://www.metmuseum.org/blogs/now-at-the-met/2015/food-and-feasts-in-middle-kingdom-egypt>

the deceased's deeds in the underworld [16]. In preparation for entering the afterlife, the deceased person would normally need the same food and other belongings that they had possessed during their life before death. Food items and other personal possessions-known as "grave goods" were transferred to the tombs of the Pharaohs and wealthy nobles to provide them with sufficient provisions of food and drink in the afterlife. Bread, beer, and dehydrated fruits, as well as luxury food items at the time

such as beef, poultry, halloumi cheese, and fish, were among ancient Egyptian's dietary needs to be placed with them in their tombs for consumption by the soul in the afterlife (Figs. 1, 3, 4). The main purpose of “grave goods,” including foodstuffs, was not necessarily intended to boast about the deceased person's wealth or social status but to provide them with the essentials they would need to continue living in the afterlife. A noteworthy illustration of the preparation for the afterlife by ancient Egyptians is that archaeologists found 48 wooden cases of butchered cuts of beef and poultry in the tomb of the famed Pharaoh Tutankhamun (a.k.a. King Tut) who ruled Egypt as a boy Pharaoh at the age of for nine years until his death between (c. 1332–1323 BC). His name in Hieroglyphics designates his deific status and authority as the living image of Amun-Ra, the “god” of sun and air [17, 18] (Figs. 1, 3, 4).

Food culture across ancient and contemporary Egypt

Historic documents and artifacts showed that the ancient Egyptian diet concentrated on a variety of staple foods, including whole wheat bread, beans, barley, cereals, vegetables, and fruits. This food menu persuaded some Egyptology researchers to argue that ancient Egyptians may mostly have followed a vegetarian diet. Juxtaposed with this argument, archeological evidence showed that they also consumed animal and game meat, albeit that was mainly available for the Pharaohs and wealthy upper-class Egyptians (Figs. 1 and 4). Papyrus scrolls and temple murals illustrated that both men and women were engaged in cooking. In an open-fire kitchen, they prepared food through several cooking methods such as frying, grilling, roasting, stewing, baking, and boiling. However, men engaged in most of the food preparation in the temples and cooked for themselves while working in the fields [13]. Notably, numerous of the traditional foods that were consumed in the ancient Egyptian era are still being consumed in present-day Egypt; however, they have been adapted with different ingredients and recipes. Some of the food items discussed in the present study in greater detail are modern-day Egyptian foods that have a lineage to foods dating back to ancient Egypt's food culture.

Koshary (also spelled *koshari* or *kushari*)

Historically, as described in the Egyptian Books of Genesis, the modern-day koshary originated in ancient Egypt, and was then called “Koshir.” This ancient name denotes “Food of the rites of the gods.” Koshir was a breakfast meal that incorporated an ingredient of whole brown lentils, chickpeas, wheat grains, garlic, and onions cooked together in an open fire in clay pots [19].

The present-day Koshary (Arabic: كشرى) by far is the most popularly consumed among Egypt's national traditional dishes. It is an affordable and nutritional food sold in street carts. Egyptians considered it “the comfort food of the poor.” Whereas it originated as a breakfast meal, currently, koshary is a meal that Egyptians eat for breakfast, lunch, dinner, and snacks [20]. Incipently, Koshary was a dish made at home by amalgamating leftover cooked rice, grains, pieces of thin pasta, and whatever other cooked grains or beans were available to add to the dish. In later years, koshary has developed into the classic ingredients made of short macaroni, brown or yellow whole grain lentils, white rice along with a spicy tomato sauce, and topped with cooked chickpeas and thinly sliced fried onions. It is served in specialty Koshary full-service sit-down restaurants or street kiosks in Cairo and other major Egyptian cities (Fig. 5). Research on the nutritional values of koshary suggested that cooking koshary ingredients—lentils, chickpeas, rice, and macaroni—enhanced the nutritional benefits of proteins and the digestibility factor compared to raw koshary ingredients. Especially, cooked rice in koshary was found to possess a higher digestibility factor than cooked whole lentils [21]. In connection to ancient Egypt, lentil grains were discovered in a tomb dating back to (2000 B.C.). Whole grain lentils are especially nutritious and healthful to consume. Whole grain lentils provide adequate measures of dietary fiber, protein, carbohydrates, and minerals, as well as other phytochemicals, including phenolic, phytic acid, and tannic acid. In addition, lentils provide beneficial substitutes for a wide range of functional properties as a replacement for other cereal and legume starches [22, 23].



Fig. 5 Present-day Egyptian koshary. This image was retrieved from URL: <https://www.washingtonpost.com/world/2022/12/26/egypt-economy-inflation-food-prices/>

Egyptian molokhia

Molokhia (Arabic: ملوخية) is a quintessentially traditional Egyptian vegetarian cuisine consumed widely by most Egyptians, including ancient Egyptians. For most Egyptians, molokhia has been for a long time considered a symbol of their homeland. It is a nutritious dark-green leafy vegetable with small flat leaves cultivated and consumed in several Middle Eastern and African countries as a thick gelatinous soup-like dish (Fig. 6). Botanically, molokhia is a summer-grown plant commonly known as “Jute” or “Nalta jute,” which is a member of a plant family known as “Malvaceae” of the hibiscus or mallow species of herbs and shrubs. Pharmacologically, its small leaves are exploited as medicinal plants, usually administered to treat fever, aches and pain, chronic cystitis, swellings, and inflammation. Further, the plant possesses anti-inflammatory and immunomodulatory effects, as well as anti-oxidation properties that are derived from the extract of molokhia leaves. Further, the plant was reported to possess demulcent, diuretic, galactagogue, purgative, and tonic attributes. Molokhia plant leaves have also been used as an ingredient in facial creams, lotions, hair tonics, and hand creams [24–27]. Nutritionally, molokhia is acclaimed as a “superfood” as it provides three times the calcium and phosphorous as kale, and four times the amount of riboflavin. Additionally, molokhia provides (70%) of the recommended daily allowance (RDA) value for vitamin C, and (25%) of the RDA of vitamin A, together with a multitude of other essential vitamins and minerals [28]. These findings have been corroborated by [29] who found that the molokhia plant contains essential nutrients, including carotenoids, polysaccharides, phenolics, minerals, proteins, some sugars, and the vitamins B1, B2, C, and E.

Molokhia has a historical connection to the Pharaonic era. There are two divergent accounts connecting molokhia to that era. The first account claims that ancient

Egyptians believed that molokhia might be a wild poisonous plant that should not be eaten. However, the Hyksos, a Semitic people who invaded and ruled Egypt between c. 1782–c. 1570 BCE, compelled Egyptians to eat the presumably poisonous plant (molokhia) as a means of intimidation and punishment to control them [30, 31]. The ancient Egyptians were forced to eat the plant but were not poisoned after all. From that time forward, molokhia developed into the Egyptians’ most favored food. Whether it is a family lunch, dinner, or festive occasion, molokhia always has a place at their dining tables. The second competing account that connects molokhia’s origin to the Pharaonic era was somewhat later known in Egypt’s ancient history. This account purports that the name molokhia originated from the word that means “majestic” in hieroglyphics because it was an exclusive meal served only to the Egyptian Pharaohs, royal families, and the nobility class. The modern-day traditional molokhia dish is cooked with finely minced molokhia leaves, chicken or beef broth, ground coriander, and minced roasted garlic. It is usually served over rice or eaten with whole wheat pita bread together with either baked chicken or the more traditionally rabbit meat (Fig. 6). In the northern city of Alexandria, Egypt, and other coastal cities, instead of chicken or rabbit meat, molokhia is cooked with shrimp and is called in Arabic (ملوخية بل جميري) “molokhia-bel-gambary” [32].

Ancient Egyptian bread

From the Pharaonic era up to the present time, bread has been the foremost staple in the Egyptians’ diet, which was consumed daily by both upper-income and low-income Egyptians. The underpinning of the Ancient Egyptians’ diet centered mainly on bread consumption as the indispensable staple food for the proletarian class. Bread (Arabic: خبز, khobez) was primarily made using flour produced by grinding raw grains such as barley or emmer wheat to make diverse types of bread products. In ancient Egypt, milled emmer wheat was commonly used in bread making; however, it was more challenging than most other wheat varieties to transmute into flour for making bread [5]. Hieroglyphic records revealed that there were 14 diverse types of bread making, chiefly among them whole wheat pita bread and sourdough bread (Fig. 7). Egyptology scholars postulated that ancient Egyptian families typically ate leavened pita-style bread at home and ate pot-baked bread during temple festivals and special occasions [33]. During the construction of the Great Pyramids of Giza, bread and beer rations were used as a currency of payment to the construction workers who contributed to building the Pyramids. In present-day Egypt, the essential bread that the preponderance of Egyptians eat is a modern version of



Fig. 6 Cooked molokhia with an Egyptian-style recipe (right-side illustration) and molokhia plant leaves (left-side illustration). This image was retrieved from URL: <https://www.inside-egypt.com/the-famous-molokhia-soup.html>



Fig. 7 Royal bakery of Pharaoh Ramesses III was found in his tomb in the Valley of the Kings. Several types of bread, including loaves shaped in the image of animals are depicted. This image was retrieved from URL: <http://www.historicalcookingproject.com/2014/12/guest-post-ancient-egyptian-bread-by.html>



Fig. 8 Present-day whole wheat pita bread (Eish Baladi, Arabic: عيش بلدي) which is a modern version of the bread eaten by ancient Egyptians. This image was retrieved from URL: <https://www.memphistours.com/Egypt/Egypt-Wiki/Egypt-Information/wiki/Egyptian-Food>

the bread that their ancient progenitors ate thousands of years ago and was similarly made from whole wheat called (Eish Baladi, Egyptian Arabic: عيش بلدي) (Fig. 8). To emphasize the vital importance of bread as a staple food for Egyptians' daily diet, the word "Eish" in Egyptian

Arabic denotes "living." Hieroglyphics and mural portrayals found in temples suggest that 5,000 years ago, ancient Egyptians were pioneers in the formation of natural microbial contaminants made of flour and fruit juices containing fructose to produce yeast. This yeast was used as a leavening agent to make leavened bread by the production of carbon dioxide. They also employed their knowledge of producing yeast and bread-making to brew an acidic beer beverage called (Boozah, Arabic: بوزة) from a lightly baked loaf of germinated grains [34]. Another method of brewing Ancient Egyptian beer was by amalgamating cooked and uncooked malt with water and the mixture was strained to free it from husk before inoculating it with yeast [35].

To produce flour for bread making, according to archaeological discoveries, ancient Egyptians employed a simple grain grinding quern, which is constructed from a granite stone mill for grinding emmer wheat and other grains. Typically, the quern was assembled from two circular or flat stones, the upper of which is manually rotated or rubbed against the lower saddle stone (Fig. 9). To bake bread, they placed it in an open-topped clay oven or inside fire-heated cylindrical-shaped bread clay molds. Archaeological artifacts showed that both men and women contributed to making bread; however, when men were engaged in performing other field tasks,

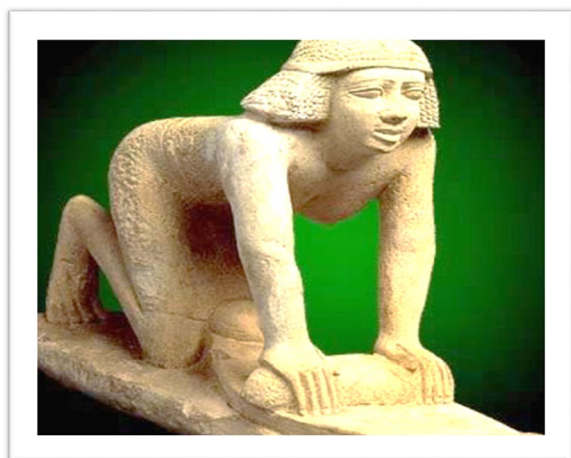


Fig. 9 Ancient Egyptian rotary saddle quern used to grind emmer wheat and barley to produce flour for baking bread. This image was retrieved from URL: <https://foodprocessinghistory.blogspot.com/2018/01/milling-in-ancient-egypt.html>

women customarily were the grain millers. Images of women milling grain have been discovered in the tombs of the later Old Kingdom (c.2575–2510 BC) to the ancient Middle Kingdom (c.2030–1640 BC) (Fig. 9) [36, 37]. As a demonstration of the important role that bread played in the social life of Ancient Egyptians, an archeological analysis of the Pharaonic settlement in the Amarna (Arabic: العمارنة; Al-Amanah) Workers Village that was founded around (1350 BC) at the directive of the Pharaoh Akhenaten showed that when they were provided with raw bread-making ingredients, the settlement households were mostly self-sufficient, and those households collaborated in the milling of wheat grains into flour and baking various types of bread for the settlement's consumption needs [38]. In present-day Egypt, bread continues to play a substantial role in the political, economic, and social life of all Egyptians. Egypt has become the foremost largest importer of wheat in the world to feed its nearly 105 million Egyptians. The importation and consumption of wheat grains to produce bread have been increasingly expanding to meet the corresponding demand of its population growth of nearly (2.6) million people annually. The outcome of this population growth led to a considerable rise in the amount of wheat consumed by (0.185) million tons per million people. Research findings suggested that the increase in wheat imports rose from (5.1) million tons in 1995 to (8.6) million tons in 2016 with an uptick of (3.5) million tons in nearly two decades. One of the key drivers of the 2011 "Tahrir Square" Egyptian revolution and the January 1977 "beard uprising," among other grievances, was bread availability, prices, and quality. The revolution's

chants were calling for "bread, freedom, social justice," especially the demand for a structural policy change regarding bread, the symbol of sustenance for tens of millions of Egyptians. However, the upsurge in the production of wheat flour, and the corresponding increase in bread consumption is rising at alarmingly higher rates, leading to an increase in Egyptian wheat imports, which is creating a heavy burden on Egypt's economy and trade balance deficient [39, 40].

Ancient and present-day Egyptian halloumi cheese

Recent archaeological discoveries have revealed that Ancient Egyptians consumed a type of cheese called "halloumi" cheese (Fig. 3). Founded on recent conclusive archaeological evidence, ancient Egyptians engaged in the cheese-making process over 5,000 years ago during the rule of the first Egyptian Dynasty. The earliest evidence of cheese-making in Egypt was murals that depicted images of the manufacturing of cheese. Among this evidence, archeologists discovered two alabaster jars containing images of cheese at Saqqara, the first Capital City of ancient Egypt neighboring the modern-day Capital City of Egypt, Cairo [41, 42]. In addition, more recently, in 2018, a team of Egyptology archaeologists from the University of Catania, Sicily, Italy, and Cairo University, Egypt unearthed a broken jar containing a 3,200-year-old piece of halloumi cheese found in a high-ranking Egyptian official's tomb that dates back to the 26th and 27th Egyptian dynasties (664–404 BCE) (Fig. 3). Historically, there has been an argument that meat and cheese were consumed in ancient Egypt; however, this consumption was primarily by the Pharaohs, high priests, and upper-class wealthy Egyptians at the time [43–45].

The tradition of cheese making and consumption continued from ancient Egypt to modern-day Egypt. This continuity defines a notable aspect of Egypt's 5000 years of contextual food culture and history. The modern-day Egyptian cheese (Egyptian Arabic: جبنة "gebna") is usually milky white and has been an important staple of the Egyptian diet. The Egyptian white cheese is often served with breakfast. Cheese is also incorporated into making various traditional dishes and added to numerous ingredients in making a variety of pastries and desserts [41]. There are several types of white halloumi cheese chiefly among them the (Akkawi, Arabic: عكوي) cheese, which is generally popular in Egypt and the Levant. The modern-day halloumi cheese is comparable to feta cheese, which is traditionally made from pasteurized sheep, goat, buffalo, or cow's milk. It is usually soft-textured and salted in brine with a smooth, piquant flavor. It has a distinctly mild salty and milky taste (Fig. 10). Halloumi cheese is versatile and commonly eaten with fresh fruit, sliced fresh tomatoes and cucumber, and olive oil. It can also be



Fig. 10 Present-day Egyptian halloumi (a.k.a. akkawi) cheese. This image was retrieved from URL: <https://www.arabamerica.com/the-11-cheeses-of-the-arab-world/>

grilled and combined in a sandwich of pocket pita bread or sprinkled over salads. Halloumi cheese can also be combined with grilled mushrooms, avocado, or chunky salsa [46]. According to 2000 estimates, per capita, Egyptians consumed approximately (4.4) kilograms (9.7 lb.) of cheese. In 2002, it was projected that more than one-third of Egyptian milk yield was used in the production of the traditional white salt-brained feta cheese. Most of the cheese in Egypt is manufactured in the northern port city of Dumyat, which is recognized as the Egyptian capital city of feta cheese production [47, 48].

Another type of popular Egyptian cheese is kariesh cheese (Egyptian Arabic: جبنة قريش). It is one of the indigenous white soft cheese types that originated in ancient Egypt that is comparable to the texture and taste of cottage cheese. Karsh cheese is a low-fat and mild-tasted cheese made of acid-coagulated skimmed milk collected from cow's milk, buffalo milk, fermented buttermilk, or sour defatted milk. Traditionally, it is produced in Egyptian rural areas in dairy farmlands, especially in small farm communities operated by low-to-middle-income villagers who depend mostly on kariesh cheese for their diet as a nutritious source of high-value protein and low-fat at an affordable cost. Additional to its high protein content, kariesh cheese contains most of the skim milk properties, including a small amount of lactose, some water, soluble vitamins, calcium, and phosphorus. Because of the increased health awareness of the consumer, kariesh cheese has become quite popular owing to its manifold health benefits, as it is comparatively a defatted cheese consumed widely by most Egyptians. Kariesh cheese is often recommended for people who are suffering from heart disease, high LDL cholesterol, hyperlipidemia, and obesity. Its popularity can be ascribed to its freshness, distinct flavor, and relatively lower price.



Fig. 11 Present-day kariesh cheese originated in ancient Egypt between 3200 and 332 BC. This image was retrieved from URL: <https://spinneys-egypt.com/en/products/quraish-cheese#/>

Customarily, kariesh cheese is usually eaten with whole wheat pita bread, some olive oil, and slices of fresh tomato. Conventionally, kariesh cheese was produced by a rudimentary method of the random fermentation of milk that impaled its cream layer by applying rapid gravity force. Currently, however, it is produced through several modern manufacturing processes employing ultrafiltration skimmed milk, adding certain bacterial cultures (probiotic bacteria), and enzymatic coagulation. Similar to halloumi cheese, kariesh cheese can be traced back to the Pharaonic era spanning from 3200 BC to 332 BC, where the availability of certain pottery jars and pots facilitated making it, as well as a type of Nile River-grown reed that was commonly employed as mats for draining milk serum and shaping the fermented skimmed milk into kariesh cheese molds of different shapes and sizes (Fig. 11) [49–52].

Discussion

Throughout human history, food has been the only source of nutrition and life sustainability. It provides indispensable physiological, biochemical, psychological, and sociological functions that are essential to maintaining good health and salubrious longevity. Over the past 5000 years, the Egyptian traditional food system provided a nutritionally balanced diet and largely uninterrupted food security [53]. Ancient Egypt's traditional food culture reflected Egypt's food diversity, contribution to developing civilization, religious beliefs, and natural resources such as the Nile River. Food was fundamental to ancient Egyptians' mythological concept of the after-life and preparation for ensuring a successful transition into eternal life. Modern elemental isotopic analysis informed of the type of diet that ancient Egyptians consumed [8]. Juxtaposing the results of this isotopic analysis with the present-day Egyptians' diet, cognate findings

corroborated that many of the food ingredients that were consumed during the Pharaonic era have transitioned into contemporary Egyptian food culture. Findings from the present study suggested that staple food items that were consumed by ancient Egyptians, illustrated in tombs, and engraved on temple murals are still being consumed—albeit with present-day modifications by present-day Egyptians. Chiefly among some of the traditional foods that transitioned from ancient Egypt to contemporary Egypt are koshary, molokhia, whole wheat bread, halloumi cheese, and kariesh cheese (Figs. 3, 5, 6, 8, 10, 11). Further, findings from the present research demonstrated that nearly all the food consumed by ancient Egyptians, especially the proletariat, was plant-based, suggesting that, unlike present-day Egyptians, ancient Egyptians mainly adopted a vegetarian diet. Archaeological evidence discovered “grave goods” found in temples and tombs, which showed that meat consumption was limited and is a relatively recent phenomenon. In ancient Egypt, animal meat, domesticated fowl, game bird meat, and fish had then considered luxury food items that were consumed primarily by the Pharaohs, nobility class, high priests, and wealthy Egyptians (Figs. 1, 4).

Vegetarianism was a widely common dietary practice in most ancient cultures, except in nomadic populations, where hunting and fishing were a way of life to secure food sources for subsistence. Archaeological evidence revealed that agriculture and irrigation channels existed from an early stage in Egypt’s history. Cereal foods, fruits, and vegetables constituted the staple foods that ancient Egyptians subsisted on from the pre-dynastic period up to the present time. Even for wealthy people, this staple food means having a bounty and variety of different pieces of bread, various kinds of vegetables, and exotic types of fruits consumed more frequently with other ingredients amalgamated. In the Old Kingdom (ca. 2649–2130 B.C.), the diet was mainly based on bread, vegetables, fruit, milk, cheese, and fish. However, some tangible images of the slaughtering of animals and hunting for game birds were found depicted in tombs and temples (Fig. 1) [54–56]. Whereas most of the proletarian class of ancient Egyptians consumed a mainly vegetarian-based diet [8–10], recent tomographic imaging (CT) analyses of mummies revealed that was not the case for the Pharaonic royalty and high priests, as well as and their family members whose daily food intake would have included high levels of animal-based saturated fat, which contributed to elevated rates of incidence of moderate-to-severe cases of atherosclerosis found in the 58 examined mummies in three cognate studies, including a 30-year-old princess. These findings represent the earliest evidence of coronary atherosclerosis found in humankind [57–59]. Religiously, one of the fundamental functions

of food in ancient Egypt was to employ it in performing sacrificial rituals and festivities. Sacrifices had been performed by ancient Egyptian and other ancient cultures by using food, humans, animals, or material objects as a necessary spiritual practice to bridge the hierarchical and physical distance between humanity and divine beings or “gods,” as well as to preserve ancient Egyptian beliefs and food cultural heritage in the afterlife. In ancient religions such as polytheism in Egypt, in religious terms, to make a sacrifice translates into “to make sacred” to move closer toward a divine power or “god” [60–62]. Ancient Egyptians sacrificed food and animals to “make them sacred” to be offered to a divine being as a demonstration of their devotion and commitment to their “gods.” This was particularly of significant importance in preparing for the fabled journey into entering the afterlife, where favorite food and mummified pets were buried alongside the deceased Pharaohs and privileged members of the nobility class in their tombs.

Conclusion

Egypt has formerly been described as “the breadbasket of Rome.” During the Roman Empire era, Egypt produced an estimated surplus of nearly equivalent to 26 million metric tons of wheat that were exported to Rome and other regions of the Mediterranean Sea as one of their main grain suppliers. Currently, Egypt has become the largest wheat grain importer country in the world. During the past two decades, Egypt’s agricultural sector and food sufficiency, particularly producing staple grain crops, have been encountering multiple challenges triggered by water shortage and climate change issues, including declining grain yields per acre and a reduction in financial returns. This significant shift is associated with the current issues of the anthropogenic impact of global climate change and the impact of global warming coupled with the damming of rivers on the sociodemographic structure, as well as food and water security. Research findings suggest that prospective staple food availability causes major concerns. Global climate change and the construction of mega hydrological projects along the Nile River, namely the Aswan High Dam in southern Egypt and the Renaissance Dam in northern Ethiopia estimated to cause adverse effects on the vital agricultural sector, food security, and adequate staple food supplies, especially wheat, barley, and corn grains, which are essential for the production of flour for making bread for the increasingly growing Egyptian population.

The dwindling food subsidy allocation in Egypt, especially the heavily subsidized bread prices, has been the most intractable challenge. Findings from an empirical analysis reported that Egypt’s vulnerable food security is particularly dependent on food imports, especially grains

which constitute over (50%) of food product demands. Leading subsidies are provided for rationed sugar and cooking oil (23%) and unrationed bread and grain flour (77%). Whereas these subsidies improve food security for low and moderate-income Egyptians, they are not targeted to benefit the disadvantaged groups and are exposed to considerable marketplace manipulation. To manage the projected global climate changes, including the diminishing water resources from the overstressed Nile River, there should be a long-term strategy to deal with global climate change and implement water insufficiency adaptation interventions. Recent research maintains that Egypt would benefit from adopting and implementing effective adaptation strategies to mitigate the negative impact on several staple food crops that are imperative dietary sources to the sizable food-insecure Egyptian population. In response to the potential impact of food insecurity, an analysis of climate change risks for securing staple crops in the most affected food-insecure regions in Egypt was conducted to identify several adaptation priorities based on statistical crop models and climate change projections for 2030. Results of the analysis suggest that Egypt, without necessary adaptation measures, will probably experience long-term adverse effects on several staple food crops that are essential nutritional sources for tens of millions of Egyptians [63–70].

The present study has presented evidence that Egypt has 5000 years of well-recorded, tangible, and iconographical history of food culture, corroborated by numerous archaeological discoveries such as monuments, colorfully engraved murals, and paintings portraying the dietary behavior of ancient Egyptians. Most of this evidence was found in temples, and the food items stockpiled in tombs in preparation for entering the afterlife (Figs. 1, 2, 3, 4). Further, the present study underscored the close association between food and religious rituals, especially as a sacrifice for the “gods” and nourishment for the soul of the deceased on their transition into the afterlife, which was especially of spiritual significance in ancient Egypt. This historical patrimony highlights the considerable role and influence that food played in the life of ancient Egyptians not only for its physiological nutritive functions to sustain life, but also for its pivotal role in the polytheistic beliefs and mythological rituals to prepare the deceased Pharaohs to transition successfully into immortalization in the afterlife. This was done to ensure that they have adequate sustenance and belongings they will need for their journey into immortality. The present study further illustrated the significant influence that the ancient Egyptian food culture has on the present-day Egyptian food culture as various food ingredients consumed during the Pharaonic period are still being consumed in contemporary times as well. One of

the significant findings concerning the key role of food culture in ancient Egypt is that bread was monetized as a currency in exchange for services and was tendered to remunerate wages to the construction workers who built the Great Pyramids of Giza. In closing, it is reasonable to conclude that because of the existence of the Nile River flowing carrying fertile silt through the mainly barren desert, Egypt has benefited considerably from the Nile’s fresh water, long-standing agriculture, and diverse food resources better than other comparable ancient civilizations. This eonian history of food culture has contributed to the development of an enduring 5000-year civilization.

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Author contributions

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