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### LIFESPAN CHANGES: FROM LOWER PALEOLITHIC HUMANS TO ANATOMICALLY MODERN HUMAN

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#### Abstract

Lifespan, which can be defined as the process by which a living thing continues its life, gives information about human position in the evolutionary process and adaptation to changing conditions. Humanity has struggled with diseases since the past and striving to improve conditions, delay aging, prolong healthy lifespan. In ancient hunter-gatherer communities, who slept in tree branches or lived in caves, and faced various dangers every day, mortality at a young age was common.

Societies struggling with famine, war and epidemics for many years had a very short lifespan, the difference between birth rate and death rate was small. The human being was less exposed to danger with the shift from the hunter-gatherer lifestyles to settled agricultural societies. Lifespan has gradually increased, thanks to the improving health and hygiene conditions, developments in technology and medicine.

The species lifespan contributes to comprehending their role within the taxonomic classification. For this reason, in this study, the impact of changing conditions on life expectancy has been examined, by comparing the diets, illnesses, and medical facilities of societies lived in prehistoric and historic periods with those of today's

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societies. Whether the human life has a maximum limit has been explained, and it is aimed to interpret the estimated lifespan that awaits us in the future.

**Keywords:** Hominin, Homo Sapiens, Life Expectancy, Maximum Lifespan

## 1. Introduction

Human is the longest-lived species in the Hominidae family. The maximum life expectancy is 58,7 years in orangutans, 54 years in gorillas, 50 years in bonobos, 53.4 years in chimpanzees and 85+ years in modern humans.<sup>1</sup> The reason why humans live longer than other primates is the slow growth rate, the longer fertility period than the primates,<sup>2</sup> the large brain size<sup>3</sup> and the ability to adapt to changing conditions.

Paleolithic Period is the prehistoric age characterized by tool production. Tools made of stone, bone and horn were first produced in this period. It mostly hunted mammals and large game animals to meet human nutritional needs, and migrated frequently to be close to water and food sources. The population growth rate is slow due to reasons such as predators and wild animals being a threat factor, weaning children late, and injuries resulting in death.<sup>4</sup> For the first time in this period, pictures were drawn on rocks and caves, and ornaments were made from seashells and beads.<sup>5</sup> Stone tools (especially hand axes) were made in the Lower Paleolithic Period,<sup>6</sup> tools were made from the core in the Middle Paleolithic Period, and bow and arrow were invented in the Upper Paleolithic Period.<sup>7</sup>

The genus *Homo* first appeared in the Paleolithic Age.<sup>8</sup> *Homo habilis*, *Homo rudolfensis*, *Homo georgicus*, *Homo erectus*, *Homo antecessor*, *Homo heidelbergensis* in the Lower Paleolithic Period; *Homo neanderthalensis* in the Middle Paleolithic Period; *Homo floresiensis*, *Homo luzonensis* and *Homo sapiens* lived in the Upper Paleolithic Period.

*Homo habilis*, the first example of the genus *Homo*, lived in Africa 2.4 my ago. Endocranial capacity was 500 - 800 cm<sup>3</sup>.<sup>9</sup> He had long arms, deep rib cage, strong grip muscles in the hands. He could stand upright and make stone tools.<sup>10</sup> He ate hard shell fruit and plant roots. The enlargement of the brain box and the shrinkage of the facial box as a result of the enlargement of the cerebrum and parietooccipital region and the first time observation of Broca and Wernicke areas was the most obvious change what makes him different from the hominids that lived before him.<sup>11</sup> His life span was 52-56 years.<sup>3</sup> In the evolutionary process, it gave its place to *Homo erectus*.

*Homo erectus* had a broad face, strong jaw muscles, and a large jaw. He could stand upright and walk.<sup>10</sup> He had distinctive features that set it apart from other hominins: the occlusal areas in his teeth were narrow, third molars were small, his occipital squa was short, the glenoid fossa was large and his arms were as long as those of *Australopithecus*.<sup>12</sup> Due to climate change in Africa, especially the decrease in the survival rate of infants and the

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<sup>1</sup> Robson – Wood 2005, 394-425.

<sup>2</sup> Caspari – Lee 2004, 895-900.

<sup>3</sup> Judge- Carey 2004, B201-B209.

<sup>4</sup> McClellan – Dorn, 2015, 19-32.

<sup>5</sup> Tripp et al 2014, 529-538.

<sup>6</sup> Yaman 2019, 45-69.

<sup>7</sup> Bar-Yosef 2002, 262-292.

<sup>8</sup> Owen-Smith 1987, 351-362.

<sup>9</sup> Wood – Richmond 2000, 39-41.

<sup>10</sup> Özbek 2007, 130-133.

<sup>11</sup> Tobias 1988, 741-761.

<sup>12</sup> Antón 2012, S278-S298.

increase in human brain size caused the shortening of the lifespan of *Homo erectus*.<sup>13</sup> His life span was 60-63 years.<sup>3</sup>

*Homo neanderthalensis* lived in Europe, Eurasia and Asia until about 40 thousand years ago. His zygomatic arch was thin, foramen magnum was oval and narrow, and nasal fossa was wide.<sup>14</sup> He had a short, stocky body and a large nose as a result of adaptation to the cold climate he lived in. He ate on plant roots, grains, legumes, roasted nuts, and meat.<sup>15</sup> His average life expectancy was 29.4 years.<sup>16</sup> It is thought to be extinct due to harsh climatic conditions and competition with *Homo sapiens*.<sup>17</sup>

*Homo Sapiens* is the only living species of the genus *Homo*. *Homo Sapiens* lived at the same period as *Homo neandertalis*. The elderly population is five times that of Neanderthals. Young deaths are uncommon in modern human societies as in hunter-gatherer societies, on the contrary, most of those who die are older adults.<sup>18</sup>

The Mesolithic Age follows the Paleolithic Age when hand tools were used consciously for the first time. As the temperature increased in the early period of the Mesolithic Age, the glaciers melted, the sea level rose, and the settlements were submerged. This situation has led people to look for more livable areas. Seafood consumption has become widespread as people settled on the shores of the sea and lakes. From flint tools, microliths, horns and bones harpoons and fishing lines were invented. Deer, wild boars, mountain goats, rabbits and roe deer were often hunted. The coats of animals such as beaver, sable, marten, lynx and wolf were used for clothing.<sup>19</sup> Pottery pots were produced. Large animals were hunted with bow and arrow to meet their nutritional needs. The estimated life expectancy during this period is 25-35 years.<sup>20</sup>

Neolithic Age is the transition period from hunter-gatherer life to settled life. Population and division of labor increased in this period. Animals are domesticated. The spreading rate of infectious diseases has increased.<sup>21</sup> The estimated life expectancy of Neolithic people is 20-33 years.<sup>20, 22</sup> The life span is different from each other of the Neolithic societies that lived in Anatolia varies. Life expectancy in the Çatal Höyük community is 30 years for women, 33 years for men, and 31.5 years for both sexes.<sup>23</sup> Child deaths between the ages of 0-5 are common in Çayönü society, which has become the symbol of the transition to agriculture, and the estimated life expectancy is 29-30 years.<sup>24</sup>

In the Chalcolithic Age, mines such as gold, silver, bronze, copper, iron were started to be processed for the purpose of use in different areas. The first metal processed is copper. Bronze was obtained by adding tin to copper in the Bronze Age. The Hittites invented steel during this period.<sup>25</sup> Average life expectancy in the Chalcolithic Age is 30-35 years.<sup>20</sup> Among the Anatolian societies that lived in the Chalcolithic and Bronze Age, the only society with a

<sup>13</sup> Tobias 2006, 1-15.

<sup>14</sup> Tattersall 2006, 269-274.

<sup>15</sup> Hardy et al 2012, 617-626.

<sup>16</sup> Başoğlu 2010, 149-164.

<sup>17</sup> Sullivan et al 2017, 62-71.

<sup>18</sup> Hawkes – Connell, 2005, 650-653.

<sup>19</sup> Milisauskas, 2011, 405-460.

<sup>20</sup> Galor-Moav 2005, 1-36.

<sup>21</sup> Fuchs 2019, 1545.

<sup>22</sup> Angel 1984, 51-73.

<sup>23</sup> Angel 1971, 77-98.

<sup>24</sup> Özbek 1989, 161-172.

<sup>25</sup> Başak 2008, 15-33.

significantly higher life span is the İkiztepe society with 40-45 years. It is followed by Çavlum society, Gordion society, Birecik Dam society and Küçük Höyük society with a life span of 35-40 years. The estimated life expectancy in Kuriki Höyük, Karataş, Küçük Höyük, Woman and Troy societies is 25-30 years. The estimated life expectancy of individuals living in the Early Bronze Age is 25-30 years, and the life expectancy of individuals living in the Middle Bronze Age is 30-35 years in the Oylum Höyük societies.<sup>26</sup>

Tools and weapons were produced from iron in the Iron Age following the Bronze Age. Plow, scythe, hammer, tong, nail, shovel, age and strainer were invented. Pottery has become widespread in Europe. Wheat, barley, millet, rye, oats, lentils and peas were grown. The meat of deer, roe deer, rabbit and quail; both meat and milk of cattle, sheep and goats were benefited.<sup>19</sup>

The Iron Age is followed by Classical Greek, Classical Rome (Ancient Rome), Medieval and Ottoman Period. The average age of death is 41.14 in the Hellenistic Period, 28.16 in Classical Rome, and 39.22 in the Middle Ages.<sup>16</sup> Death was common between the ages of 35-50 during the Ottoman Period.<sup>27</sup> In the following years, radical changes in the way of life of human beings made the life expectancy longer. The estimated life span of modern humans reached 28.5 years in 1800s, 31 years in 1900s and 48 years in 1950. After World War I, life expectancy increased each year and became 66 years in the 21st century.<sup>28,29,30</sup>

## 2. Factors Affecting the Change in Life Expectancy

### 2.a. Abandonment of Hunter-gatherer Life

Humans lived a hunter-gatherer life for many years and settled down about 10 thousand years ago. This change has had both advantages and disadvantage. In hunter-gatherers, the fight against predators and infections caused by injuries caused young deaths. These dangers have decreased with the transition to settled life, but the incidence of diseases such as leprosy, arthritis and the risk of external death has increased.<sup>20, 29,30,31</sup> Close contact with animals has revealed the risk of disease transmission from them. Being in the same environment with humans own feces and animal faeces has adversely affected his health.<sup>21</sup> At the same time, with the domestication of cattle, lactose tolerance has appeared in societies.<sup>30</sup> The shift to agriculture has facilitated mosquito breeding, and made it easy malaria to spread.

### 2.b. Change of Diet

Diet is directly related to longevity and quality of life. It is thought that the early hominins fed on fruit, plant roots, seeds, leaves, hunted animals, and animal residues left behind by predators. Poultry and milk joined human life with the domestication of animals in the Neolithic period. In this way, the diet of the human has become an animal-based diet. Cooking meat has prevented diseases caused by bacteria from harming the human body.

The foods consumed has diversified with the shift to agriculture. The ratio of sodium, fibers, protein, calcium, carbohydrate, fat, and vitamin consumed from daily food differ in pre-agricultural societies and agricultural societies. After the transition to agriculture, diet of *Homo Sapiens* was enriched in sugar, sodium, chloride but has become poor in fiber, potassium, and magnesium. After the 18th century, refined grains began to be consumed.

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<sup>26</sup> Usta 2019, 65-78.

<sup>27</sup> Aytek 2020, 93-115.

<sup>28</sup> Riley 2005, 537-543.

<sup>29</sup> Gowdy 2019, 1-27.

<sup>30</sup> Gurven – Kaplan, 321-365.

<sup>31</sup> Gluckman et all 2009, 97-127.

Until 20,000 years ago, white meat and fish were not included in diet of human, and there was no grain until 15,000 years ago.<sup>32</sup> These changes have been led up to the creation of diseases like diabetes, osteoporosis, and hypertension, which nowadays we call "civilization diseases."<sup>33</sup>

### **2.c. Decrease in Infant and Child Mortality**

Infection, bleeding, breech birth and congenital defects were the most prevalent causes of child deaths in ancient societies. The malnutrition or early weaning of her baby by the mother prompted the babies to have a weakened immune system and become vulnerable to diseases.

Between the 17th and 20th centuries, births of disabled babies were common. The most common cause of this condition was rickets. Rickets caused deformity in the pelvis, making it difficult for the baby to exit. The use of non-sterilized instruments during delivery and the mother's not paying attention to hygiene conditions caused damage to maternal tissues and puerperal sepsis deaths.<sup>34</sup> Since the 19th century, infant and child deaths started to decrease with the improvement of health conditions.<sup>29</sup> Especially after 1980, the increase in literacy rates of women enabled them to make progress in child care, and was a factor in preventing infant deaths.<sup>21</sup>

### **2.d Development of Medicines and Control of Epidemics**

The history of epidemics is as old as human history. In the Neolithic era, the rapid increase of the population, the transition to settled life, the change in hygiene and housing conditions have facilitated the spread of infectious diseases.<sup>35</sup> Human have struggled with many infectious diseases such as plague, tuberculosis, typhoid, smallpox, syphilis, leprosy and flu from past the present. Neanderthals struggled with adonevirus, HPV, flavivirus, diseases caused by polyomavirus and Hepatitis A in the Pleistocene period with Hepatitis B, Hepatitis C, HIV, influenza, meningitis, measles and mumps in the Holocene period.<sup>36</sup>

Plague has caused epidemics that negatively affect the physical and mental health of societies since ancient times. The plague epidemic in Athens between 426-430 BC caused the death of many people. The first epidemic A.D. which is known to affect societies, is the Justinian plague that emerged in the 6th century. It first started in Egypt, it caused the deaths of thousands of people by being transported by sea to Athens, China, Southeast Asia, India and Anatolia (especially Istanbul).<sup>37</sup> It was followed by the Black Death plague, It is thought to have spread across continents due to trade in the 14th century. This disease lasted 7 years. The first global epidemic was the flu epidemic in Russia in the 19th century. Spanish flu, Asian flu and Hong Kong flu, which swept the world in the 20th century, were followed by H1N1, Ebola, SARS, MERS in the 21st century.<sup>38</sup> The Covid-19 outbreak that started in 2019 is continuing.

The vaccine was discovered by Edward Jenner in 1796.<sup>39</sup> The implementation of plague vaccine in the 19th century and tuberculosis, pertussis, cholera, diphtheria, influenza, measles, mumps, chickenpox vaccines in the 20th century played a role in the prevention of

<sup>32</sup> Sebastian et al 2002, 1308-1316.

<sup>33</sup> Wells 1976, 1235-1249.

<sup>34</sup> Husain 2002, 161-165.

<sup>35</sup> Houldcroft – Underdown, 2016, 381.

<sup>36</sup> Kömürcü 2019, 5-11.

<sup>37</sup> Chakraborty 2015, 1-13.

<sup>38</sup> Stern-Markel 2005, 612.

<sup>39</sup> Plotkin 2014, 12283–12287.

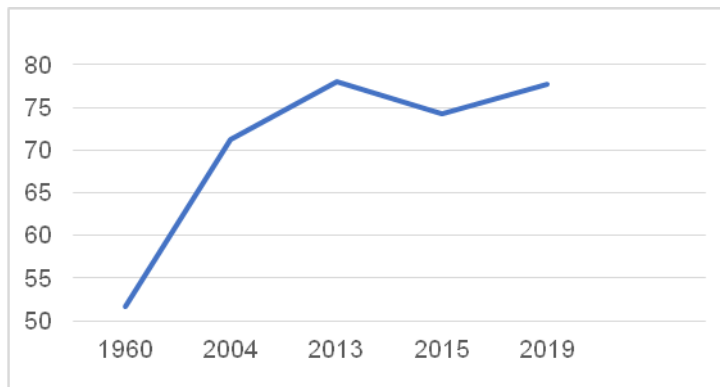
epidemics.<sup>40</sup> At the same time, Alexander Fleming's discovery of penicillin in 1928<sup>41</sup> prevented deaths caused by bacterial infection. These improvements in the health sector have reduced the risk of death by controlling the spread of diseases. Early detection of diseases has become possible thanks to the ever-increasing medical imaging methods.

### 3. Maximum Lifespan and Upper Limit of Human Lifespan

Maximum lifespan is the highest age at death observed in individuals of a population.<sup>13</sup> Today, scientists discuss whether there is an upper limit of human life. According to one view, the upper limit of human life is 122 years. Maximum lifespan extended until the 1990s, possible extension in the future, but there is a fixed upper limit.<sup>42</sup>

### 4. Life Expectancy in the Future

Diseases resolved with the drugs and vaccines developed, technological developments, and healthy nutrition will determine the future of lifespan. Mortality levels an average life expectancy of countries is different. The life expectancy of 80 years in today's developed societies is about 60 years due to the insufficiency of medical facilities and nutrients, the problem of providing clean water, unhealthy pregnancies and the prevalence of AIDS in South African societies. The countries with the longest life expectancy are Hong Kong (84.9), Japan (84.6), Switzerland (83.6), Spain (83.6) and Singapore (83.6); the shortest life expectancy are Central African Republic (53.3), Chad (54.2), Lesotho (54.3), Nigeria (54.7) and Sierra Leone (54.7) in 2019.<sup>43</sup> The average life expectancy that 51.7 years in the 1960s in Turkey<sup>43</sup> has reached 71.2 years in 2004,<sup>44</sup> 78 years in 2013,<sup>45</sup> 74.2 years in 2015,<sup>46</sup> 77.7 in 2019.<sup>47</sup> (Figure 1).



**Figure 1.** Change of Life Expectancy in Turkey

<sup>40</sup> Dong et al 2016, 257–259.

<sup>41</sup> Tan -Tatsumura 2015, 366-367.

<sup>42</sup> United Nations 2017, 1-46.

<sup>43</sup> Grosse-Perry 1982, 275-304.

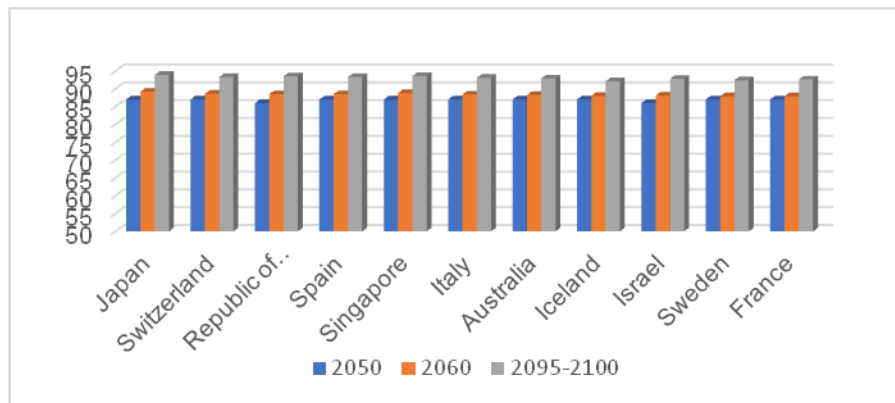
<sup>44</sup> Halicioğlu 2011, 2075-2082.

<sup>45</sup> Özmete, et al 2016, 1-5.

<sup>46</sup> OECD 2016, 51.

<sup>47</sup> United Nations 2019, 1-24.

Human lifespan will be prolonged with human effort in the coming years. There are estimates about the values that human life expectancy will reach in the future around the world and based on countries.<sup>42,48,49</sup> (Figure 2.)



**Figure 2.** Life Expectancy in Developed Countries in the Coming Years<sup>42, 49</sup>

## 5. Conclusion

There has been a significant increase in lifespan of human from the past to the present. The harsh weather conditions, predator attacks and competition with other animals in search of food caused young deaths in Paleolithic. The life expectancy of human has been extended thanks to the end of the fight against predators, the construction of shelters, the discovery of fire, the ability of humans to adapt to changing conditions, increasing water consumption due to easier access to water resources, improvement of hygiene conditions, diversification of nutrients, the treatment of diseases with the development of medicine, the discovery of antibiotics and vaccines, the declining of birth rate, the declining of child and infant and the development of technology.

In the Paleolithic period, despite the difficult conditions, the life span is higher than the Neolithic. Health problems in the Neolithic period caused a shortening of human life span. Human life started to prolong in the Chalcolithic Period and remained constant at the same levels in the Bronze Age. Human life span, which we expect to increase rapidly with the improvement of living conditions after the Iron Age, reached higher values compared to its contemporaries only in the Hellenistic Period. Due to the very poor hygiene conditions in Ancient Rome and frequent raids to the city from outside, the life span is equivalent to the Neolithic. The human life span, which extended only 3.5 years in 18.-19<sup>th</sup> century, by the middle of the 20th century, it extended by 17 years and reached 48 years. World War I caused premature deaths, leading to a decrease in both the population and life expectancy. After World War I, the life expectancy has increased exponentially ever year and reached its present rate. In the future, human lifespan will continue to extend within limits with the improving health conditions getting better than today and the treatment of incurable diseases.

<sup>48</sup> Christenson et all 2002, 49-67.

<sup>49</sup> Medina et all 2020, 25-1145.

### References

- Angel J.L. 1971, "Early Neolithic Skeletons from Çatal Höyük Demography and Parhology", *Anatolian Studies*, 21, 77-98.
- Angel J.L. 1984, "Health as a Crucial Factor in the Changes from Hunting to Developed Farming in the Eastern Mediterranean", M.N. Cohen – G.J. Armelagos (eds.), *Paleopathology at the Origins of Agriculture*, New York, 51-73.
- Antón S.C. 2012, "Human Biology and the Origins of Homo. Early Homo: Who, When, and Where", *Current Anthropology*, 53/S6, S278–S298.
- Aytek, A.İ. 2020, "Paleodemography of Anatolian Populations from Neolithic Period to Ottoman Period. In: Current Studies in Social Sciences II", A. Balcıoğulları and M.C. Sahin (eds.), *Anatolian Paleodemography*, Ankara, 93-115.
- Bar-Yosef, O. 2002, "The Upper Paleolithic Revolution", *Annual Review of Anthropology*, 31/1, 363–393.
- Başak O. 2008, "Taş Çağı'ndan Tunç Çağı'na Maden Sanatının Gelişimi ve Kullanımı", *Güzel Sanatlar Enstitüsü, Dergisi*, 21, 15-33.
- Başoğlu O. 2010, "Hitit Dönemi İskelet Topluluklarının Antropolojik Analizi", *Ç.Ü. Sosyal Bilimler Enstitüsü Dergisi*, 19/3, 149-164.
- Caspari R., Lee S.H. 2004, "Older Age Becomes Common Late in Human Evolution", *Proceedings of the National Academy Sciences of the United States of America*, 27:101/30, 895-900.
- Chakraborty R. 2015, "Epidemics", H.A.M.J. ten Have (eds.) *Encyclopedia of Global Bioethics*. Pittsburg, 1-13.
- Christenson M., McDevitt T., Stanecki K.A. 2004, "Global Population Profile: 2002", Washington, 9-67.
- Dong, X., Milholland, B., Vijg, J. 2016, "Evidence for a Limit to Human LifeSpan" *Nature*, 538/7624, 257–259.
- Fuchs K., Rinne C., Drummer C., Immel A., Kyora B., Nebel A. 2019, "Infectious Diseases and Neolithic Transformations: Evaluating Biological and Archaeological Proxies in the German Loess Zone between 5500 and 2500 BCE", *The Holocene*, 29/10, 1545.
- Galor O., Moav O. 2005, "Natural Selection and the Evolution of Life Expectancy", *SSRN Electronic Journal*, 5373, 1-36.
- Gluckman P., Beedle A., Hanson M. Buklijas T., Low F., Hanson M. 2009, "The Human Life Story". *Principles of Evolutionary Medicine*. New York, 97-127.
- Gowdy J. 2019, "Our Hunter-Gatherer Future: Climate Change, Agriculture and Uncivilization", *Futures*, 115, 1-27.
- Grosse, R. N., Perry, B. H. 1982, "Correlates of Life Epectancy in Less Developed Countries", *Health Policy and Education*, 2/3-4, 275–304.



- Gurven M., Kaplan H. 2007, "Longevity Among Hunter-Gatherers: A Cross-Cultural Examination", *Population and Development Review*, 33/2, 321- 365.
- Halıcıoğlu F. 2011, "Modeling Life Expectancy in Turkey", *Economic Modelling*, 28, 2075-2082.
- Hardy, K., Buckley, S., Collins, M.J., Estalrriich, A., Brothwell, D., Copeland, L., Rosas, A. 2012, "Neanderthal Medics? Evidence for Food, Cooking, and Medicinal Plants Entrapped in Dental Calculus", *Naturwissenschaften*, 99/8, 617-626.
- Hawkes K, Connell J.F.O. 2005, "How Old is Human Longevity?", *Journal of Human Evolution*, 49, 650-653.
- Houldcroft, C.J., Underdown, S. J. 2016, "Neanderthal Genomics Suggests a Pleistocene Time Frame 511 Ort he First Epidemiologic Transition", *American Journal of Physical Anthropology*, 160/3, 381.
- Husain AR. 2002, "Life Expectancy in Developing Countries: A Cross-Section Analysis" *The Bangladesh Development Studies*, 23/1, 161-165.
- Judge D.S., Carey J.R. 2000, "Postreproductive Life Predicted by Primate Patterns", *The Journal of Gerontology: Serias A*, 55/4, B201–B209.
- Kömürcü A. 2019, *Hitit Krallığı'nda Veba Salgını ve Etkileri (M.Ö. II. Binyılın Yarıısı)*. Afyon Kocatepe Üniversitesi, Sosyal Bilimler Enstitüsü, Arkeoloji Anabilim Dalı, (Yayınlanmış Yüksek Lisans Tezi), Afyonkarahisar.
- McClellan J.E, Dorn H. 2015, *Science and Technology in World History: An Introduction. Maryland.*
- Medina L., Sabo S., Vespa J. 2020, "Living Longer: Historical and Projected Life Expectancy in the United States, 1960 to 2060", *Maryland*, 25-1145.
- Milisauskas, S., 2011, "The Iron Age", S. Milisauskas (eds.), *European Prehistory, A Survey*, New York, 405–460.
- OECD. 2016, "Assessing Regional Competitiveness in Turkey", *Boosting Regional Competitiveness in Turkey*, 51.
- Owen-Smith N. 1987, "Pleistocene Extinctions: The Pivotal Role of Megaherbivores", *Paleobiology*, 13/3, 351-362.
- Özbek M. 1989, "Son Dönem Buuntuların Işığında Çayönü Neolitik İnsanları", *V. Archaeometry Results Meeting*, Ankara, 18-23, 161-172.
- Özbek M. 2007, *Dünden Bugüne İnsan*, Ankara.
- Özmete, E., Gürboğa, C., Tamkoç, B. 2016, "National Ageing Situation: Ageing and Elderly Care Services in Turkey", Country Report Republic of Turkey, *UNECE*. 1-5.

- Plotkin S. 2014, "History of Vaccination", *Proceedings of the National Academy of Sciences*, 111/34, 12283–12287.
- Riley J.C. 2005, "Estimates of Regional and Global Life Expectancy 1800–2001, *Population and Development Review*", 31/3, 537–543.
- Robson S.L, Wood B. 2008, "Hominin Life History: Reconstruction and Evolution", *Journal of Anatomy*, 212/4, 394-425.
- Sebastian, A., Frassetto, L. A., Sellmeyer, D. E., Merriam, R. L., & Morris, R. C. 2002, "Estimation of the Net Acid Load of the Diet of Ancestral Preagricultural Homo Sapiens and their Hominid Ancestors", *The American Journal of Clinical Nutrition*, 76/6, 1308–1316.
- Stern AM, Markel H. 2005, "The History Of Vaccines And Immunization: Familiar Patterns, New Challenges", *Health Affairs*, 24/3, 612.
- Sullivan A.P., Marc M., Marques-Bonet T., Perry G.H. 2017, "An Evolutionary Medicine Perspective on Neandertal Extinction. *Journal of Human Evolution*, 108, 62–71.
- Tan S.Y. Tatsumura Y. 2015, "Alexander Fleming (1881–1955): Discoverer of Penicillin", *Singapore Medical Journal*, 56/7, 366-367.
- Tattersall I. 2006, "Neanderthal Skeletal Structure and the place of *Homo neanderthalensis*. European Hominid Phylogeny", *Human Evolution*, 21/3-4, 269–274.
- Tobias P.V. 1988, "The brain of Homo Habilis: A New Level of Organization in Cerebral Evolution", *Journal of Human Evolution*, 16/7-8, 741–761.
- Tobias PV. 2006, "Longevity, Death and Encephalisation among Plio-Pleistocene Hominins. *International Congress Series*, 1296, 1-15.
- Tripp, A.J, Cook A., Petzinger G.V. 2014, "Art, Paleolithic", C. Smith (eds.), *Encyclopedia of Global Archaeology*, New York, 529-538.
- United Nations. 2017, "World Population Prospects", New York, 1-46.
- United Nations. 2019, "World Mortality 2019, New York, 1-24.
- Usta N.D.Y. 2019, "Kadıni Mağarası Geç Kalkolitik/ Erken Tunç Çağı İskelet Topluluğunun Demografik Analizi", *Journal of Anthropology*, 38: 65-78.
- Wells C. 1976, "Ancient Obstetric Hazards and Female Mortality". *The Bulletin of the New York Academy of Medicine*, 51/11, 1235-1249.
- Wood, B.; Richmond, B. G. 2000, "Human Evolution: Taxonomy and Paleobiology. *Journal of Anatomy*", 197, 39–41.
- Yaman İ.D. 2019, "Paleolitik Çağ'da Yontmataş Alet Üretim", O. Dumankaya (eds.), *Çağlar Boyunca Üretim ve Ticaret: Prehistorya'dan Bizans Dönemi'ne*, Ankara, 45-69.