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Neanderthal Extinction, Early Modern Humans and Diet

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Abstract: The use in this work of a diet model differentiated between Neanderthals and early modern humans, based on the need for a diet rich in protein to maintain robust morphology and muscle hypertrophy in elite weightlifting and throwing athletes, with anatomical adaptations similar to Neanderthals, allows establishing an increase of 81.92% of the population of modern humans with respect to Neanderthals. This must have played an essential role in the extinction of the latter, due to the competition to obtain a greater amount of daily protein (121.89 gr/day for each Neanderthal versus 67 gr/day for each modern human) to maintain 30% more muscle mass (Boyd et Silk, 2001, Arsuaga et al., 2015, Carretero et al., 2018, García-Martínez et al., 2018).

Introduction

Fossils suggest that Neanderthals were more robust and muscular than the anatomical modern humans (MH) (Boyd et Silk, 2001, Arsuaga et al., 2015, Carretero et al., 2018, García-Martínez et al., 2018). The Venus of Hohle Fels –40-35 ky cal BP (Conard, 2009), a period in which the dates for the end of the Middle Paleolithic and the beginning of the Aurignacian coincide (table 1 Conard, 2009)– and the Venus of Chauvet, of more than 33 ky cal BP, also suggest this duality: the first one is the image of a woman with a robust morphology, almost superhuman (Conard et Wolf, 2010), with broad pelvis, shoulders and thorax and a short and compact trunk (perhaps, a Neanderthal woman or hybrid specimen), compared to the second one and the Gravettians that represent MH women of graceful typology, but obese.

These morphologies and a differentiated diet model between Neanderthals and early modern humans, based on the need for a protein-enriched diet to maintain a robust morphology and muscle hypertrophy in current athletes (Stark, 2012), allow us to support the hypothesis that Neanderthals became extinct due to competition with invasive MH populations, as they needed a greater daily amount of protein to maintain their hypertrophied muscles.

The replacement period in Europe (RP) of Neanderthals by MHs began in ~ 44 ky BP and lasted several millennia. During the coldest states the steppe, taiga (or boreal forest) and tundra landscapes advanced in Europe while in the milder states they retreated at the expense of the temperate forest (Staubwasser, 2018). The biome was not a limitation for Neanderthals because hunting of a great variety of animals has been documented in some of their sites (Bocherens, 2011, Weyrich et al., 2017, Zilhäo et al. 2020, Yravedra et Cobo-Sánchez, 2015, Gómez-Olivencia et al., 2018, Finlayson et al., 2019), depending on availability, need and, sometimes, taste.

After the RP, ~33 ka cal BP (Petzinger et Nowell, 2014), the biome did not change substantially, as Chauvet's paintings indicate (Chauvet et al., 1996, Clottes, 2001). The images and their location suggest that they symbolize the Spirit of Nature because of the numen they give off, in front of which shamanic, totemic, propitiatory, of initiation, magical or other rituals would be performed in which man merged with his biome.

Method and Results

Faced with the impossibility of knowing the morphology of the first MH of Europe during the RP due to the scarcity of fossils, we estimate the Body Mass Index (BMI) of the MH of the Mediterranean Levant (MHML) before their departure to Eurasia, and we compare it to that of Neanderthals.

For this we will consider:

1) The BMI of 21.28 to find the optimal weight of Neanderthals because this value is obtained from the height and weight of MHML.
2) The estimate of a body weight of 30% higher than Neanderthals in BMI compared to MH (Boyd et Silk, 2001).
3) The WHO recommendation to consume between 0.8gr and 1.0gr of protein for each kilogram of body weight per day (gr / kg / d) in healthy people. Here we take for the MH 1.0gr.

4) The recommendation of the ISSN (2017) to consume between 1.4 and 2.0 gr / kg / d of protein in people whose objective is to build or maintain muscle mass. Here we choose for the Neanderthals, of great body mass, the average, 1.7gr.

The results are shown in Table 1. They are comparable with the Neanderthal weight estimate of 72.1 kg (Arsuaga et al., 2015) and 72.6 kg obtained by the mean of the data from Trinkaus et Ruff (2012). The MHML's BMI of 21.28 is remarkably close to the average of 21.7 recommended for modern humans, demonstrating that the general morphology of those was identical to what is now considered healthy.

Discussion

The MHML was graceful and stylized by reason of the relationship between height and body weight, unlike Neanderthals, and protein requirements to maintain muscle were lower. Thus, when they began their emigration to Europe, they had an evolutionary advantage that increased the population by 81.92% compared to Neanderthals in the same biomes. This was a migratory engine for the MHML to Europe and the main cause of the extinction of Neanderthals.

Neanderthals extinction, adaptations and diet

The competition to obtain a greater amount of daily protein (121.89 gr for each Neanderthal versus 67 gr for each MHLM), mainly of animal origin (Bocherens, 2011, Weyrich et al., 2017, Zilhäo et al. 2020, Yravedra et Cobo-Sánchez, 2015, Gómez-Olivencia et al., 2018), because it contains all the essential amino acids necessary to stimulate muscle protein synthesis, especially the amino acid leucine (Stark et al., 2012), must have been the force that selected the graceful morphology of MH over the robust one of Neanderthals, as it was more advantageous for the survival and reproduction.

Referring to the recent debate on the need to consume carbohydrates in Neanderthals, we must say that Hardy et al. (2022) compare Neanderthals to endurance or team sports athletes, whose main, or important, energy substrate during activity is glucose catabolized by cellular respiration (with sufficient O_2 in the muscle), but Neanderthals, due to their muscular hypertrophy and robust morphology (Boyd et Silk, 2001, Arsuaga et al., 2015, Carretero et al., 2018, García-Martínez et al., 2018), not measured by BMI, should be compared with elite weightlifting and throwing athletes, who practice disciplines in which glucose is catabolized by glycolysis (with high O_2 deficit in the muscle), and the creatine phosphate, CP, is catabolized without O_2, because the anatomical adaptations of these correspond more to those of Neanderthals. An image of this morphology is shown by the Venus of Hohle Fels, as mentioned above, a small sculpture that was used for several generations (Conard, 2009), therefore, the artists predate its last bearers, which leads us to doubt even more who its author is.

As javelins from 400 ky ago have been documented (Thieme, 1997), we can imagine Neanderthals, more robust and muscular than MH, safely hunting large animals with accurate long-distance throws, for those who were more specialized due to their morphology, preceded by some powerful previous steps, similar to how athletes throw the javelin today in Olympic competitions, and transporting large pieces of meat to the base camp.

Consequently, since a daily increase in carbohydrate intake up to a total of 4-7 g/kg of weight is necessary in elite weightlifting and throwing athletes (Slater and Phillips, 2011) to maintain activity and energetic processes of protein synthesis in their hypertrophied muscles, this suggests that the consumption of this macronutrient should have been similar, at least, in Neanderthals, further raising caloric needs compared to MH.

Neanderthals undoubtedly adapted to the trophic conditions of their biomes with versatility (Klement, 2022), just like current or historical hunter-gatherer populations in the northern hemisphere, from the temperate forest, with the Iroquois, in which products of vegetable origin are combined with those of animal origin, to the arctic, with the Taremiut, who feed almost exclusively on meat, including marine mammals (Campbell, 1983), as also documented at Neanderthal sites (Zilhäo et al., 2020). The problem for the Neanderthals, and also for the Paleolithic MH, would have been to adapt to a strictly vegetarian diet, due to the difficulty in obtaining essential amino acids for protein synthesis.

In short, the greater need for protein and calories in the diet of Neanderthals led to their extinction in the competition for limited food resources.

Neanderthals extinction, fossils and genetics

The generally accepted RP Neanderthal fossils, dated between ~ 44-40 ky cal BP (Semal et al., 2009, Hublin et al., 2012, Welker et al. 2016), were found at sites of transitional cultures between the Middle Paleolithic and Upper Paleolithic at Saint-Césaire and Spy showing modern behavior, with a lithic laminar advanced technology and the presence of artistic manifestations. It is not ruled out that Neanderthals or hybrid specimens sculpted the Venus of Hohle Fels showing with great realism the movement of shoulders and bilateral asymmetries and passed down for generations.

On the other hand, the genetic studies of the European fossils of MH of the RP allow us to establish a complex process of occupation in several waves. Probably, in the Mediterranean Levant or in Eurasia, ~ 60-50 ky ago, a hybridization took place between Neanderthals and the first MH (Yang et Fu, 2018, Hublin et al., 2020). A descendant of this mixed population is the only complete Aurignacian MH skeleton found. It was found in Kostenki 14, ~ 38 ky cal BP, (Marom et al., 2012). Its genome contains a higher percentage of Neanderthal DNA than that of modern humans (Seguin-Orlando et al., 2014), as it is to be expected from the proximity to the hybridization. We can consider this specimen, with which current Europeans are related, closer to Neanderthals.

In Bacho Kiro, ~ 46 ky cal BP (Fewlass et al., 2020), another population lived which was originally assigned to MH by morphological analyses of a tooth and of the mtDNA of various bone remains (Hublin et al., 2020), but a later study (Hajdinjak et al. 2021) shows that the nuclear DNA of these specimens contains hybridizations between four and seven previous generations with Neanderthals. It is the oldest European MH population that we have evidence of.

In di Fumane, an MH tooth, according to the mtDNA analysis (Benazzi et al., 2015), is the oldest fossil remains of this hominid found in Western Europe (~ 41 ky cal BP), but as in Bacho Kiro we cannot rule out Neanderthal ancestry or a mixture of characters in the rest of the skeleton.

In Peştera cu Oase (~ 40 ky cal BP), a third population of which we have cranial remains lived. They show a mixture of characteristics between MH and Neanderthals, indicating that hybridization occurred (Trinkaus, 2007). This was confirmed by genetic studies for a specimen in a period of between four and six ascending generations (Fu et al., 2015, Yang et Fu, 2018), so that it probably occurred in Europe.

On the other hand, a study has been published (Zwir et al., 2021) that addresses the genetics of creativity, showing that the genomes of MH, Neanderthals and chimpanzees differ from each other regarding said ability. However, the analysis did not consider the genomes of MHML and Eurasia, closer to those of Neanderthals than that of current MH, therefore, the results cannot be extrapolated to the RP. Furthermore, the genes related to creativity shared by current MH with Neanderthals, 42%, are dismissed as an adequate indicator, which represents a bias because these genes can demonstrate the creative capacity of Neanderthals. Genetic differences in brain and facial development between both species are also argued (Pinson et al. 2022, Stringer et Crété, 2022), but in no case do these variations imply, to our knowledge, psychological differences that improve cognitive habilyties.

Conclusions

The importance of this work lies that it establishes a model in which it is not necessary to resort to a supposed genetic or psychological superiority of one species over another. Simply, the differences in morphology, protein intake in the diet and the number of offspring are enough to explain the extinction of the Neanderthals.

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TABLES

Table 1: Estimation of MHML and Neanderthals morphology

	SIZE (cm)	WEIGHT (kg)	BMI[4]	gr/p/d[6]	POPULATION INCREASE %
MHML	177.4[1]	67[3]	21.28	67	81.92
NEANDERTHAL	161[2]	71.7	21.28 (+30%)[5]	121.89	-

[1]Data obtained from Arsuaga et al., 2015.
[2]Data obtained from Urbano, 2020.
[3]Mean of data obtained from Trinkaus et Ruff, 2012.
[4]Body Mass Index.
[5]30% body weight increase in Neanderthals (Boyd et Silk, 2001).
[6]Mean consumption of grams of protein per day per specimen.