Possible steatopygia in prehistoric central Japan: evidence from clay figurines

Mark J. Hudson*, Mami Aoyama, Takamune Kawashima, Takayuki Gunji

1 Division of Occupational Therapy, Department of Rehabilitation Sciences, Nishi Kyushu University, Kanzaki 842-8585, Japan
2 Institute of History and Anthropology, University of Tsukuba, Tsukuba 305-8571, Japan
3 Master’s Program in Education, University of Tsukuba, Tsukuba 305-8571, Japan

Received 17 March 2006; accepted 27 June 2007

Abstract It is proposed that the so-called ‘protruding buttock’ figurines from Middle Jomon central Japan may be representations of steatopygia. The distribution of these figurines is associated with archaeological evidence for high population densities and possible intensive use of wild yams (Dioscorea japonica). Given the low fat content of these yams, it is suggested that nutritional stress in the diet of Middle Jomon hunter-gatherers of the Chubu highlands may be consistent with the fat accumulation on the buttocks apparently represented in the ‘protruding buttock’ figurines.

Key words: Jomon, steatopygia, nutritional stress, clay figurines

Introduction

Steatopygia refers to large but localized accumulations of fat on the buttocks (Figure 1). In historic populations, this condition is known from herding Khoi and hunter-gatherer San groups of southern Africa and from Onge Andaman Islanders (Saller, 1930; Tobias, 1961; Molnar, 1983). Of these populations, the Khoikhoi, or ‘Hottentots’, had been known to Europeans from the end of the 15th century and were widely seen as one of the most primitive groups encountered during the European colonial expansion (Fagan, 1998). The display of the so-called ‘Hottentot Venus’, a woman with steatopygia who was brought to London from South Africa in 1810, was extremely influential in spreading knowledge—much of it prejudicial—about this condition in the early 19th century (Gould, 1982; Lindfors, 1996; Conkey, 1997; Quershi, 2004). In the 19th century, steatopygia came to be seen as a primitive trait that symbolized not just blackness and sexuality but a whole earlier stage of human evolution between animals and modern Europeans (Gilman, 1985; Lindfors, 1996). Nicholas Hudson (2004) notes that while steatopygia was almost never reported before the 19th century, from that time it became strongly associated with racist ideas about the primitive nature of Africans.

The perceived link between steatopygia and primitiveness that developed in the 19th century meant that discussions of whether or not steatopygia was present on figurines and other prehistoric art became common as the archaeological record expanded in the early 20th century (e.g. Myres, 1900; Johnston, 1913; Zammit and Singer, 1924; Breuil, 1930; Gautier, 1935; Barrow, 1956; Cooke, 1965; Smith, 1968). Steatopygia was one element used to make direct links between Upper Paleolithic Europeans and recent southern African hunter-gatherers (e.g. Boule, 1923: pp. 306–307). Misuse of the idea that steatopygia was a ‘primitive’ trait reached its apogee in Nazi Germany where Heinrich Himmler suggested a connection between Paleolithic ‘Venus’ figurines and African steatopygia in an attempt to prove the racial superiority of the German people (McCann, 1990).

Against this background, the topic of this present paper may seem like a clichéd throwback to an earlier, racist archaeology. In reality, however, so little is actually known about steatopygia that it would be premature to dismiss its importance. Much of the earlier literature on steatopygia does indeed incorporate what would now be seen as racist ideas, yet many scholars simply describe the presence of what appear to be depictions of steatopygia in ancient art. The fact that there seems little doubt that steatopygia was geographically more widespread in prehistory than at present raises the question of the role of steatopygia as an evolutionary adaptation in human history.

This paper is part of a broader project that attempts to examine the representation of physical features on Jomon figurines from prehistoric Japan using evolutionary theory. In previous work we have analyzed the waist-to-hip ratios of these figurines (Hudson and Aoyama, 2007). Here we focus on the buttocks of one type of figurine from Middle Jomon central Honshu and suggest that the exaggerated buttocks of these figurines may be representations of steatopygia. We argue that the limited distribution of this type of figurine may reflect dietary conditions that are consistent with earlier research on the causes of steatopygia.

Steatopygia has often been explained as the storage of excess body energy on the buttocks instead of an evenly distributed fat layer that would reduce the dissipation of body heat in hot climates (Johnson, 1962; Molnar, 1983: p. 58; cf. Young, 1976). It is not clear if this necessarily rules out ste-
atrophy-like deposits in cold or temperate climates. Johnson (1962) suggested that, as well as fat, steatopygia may play a role in the storage of vitamins. More broadly, steatopygia can thus be seen as an adaptation to food shortage. Although Froment (2001: p. 244) writes that there is no convincing proof of that hypothesis, work amongst San women by Tobias (1961) enabled him to draw the conclusion “that steatopygia does diminish under conditions of impaired nutrition and water shortage, such as obtain in old age or severe drought, or even the annual dry season”, a change that had earlier been suggested by Drury and Drennan (1926). This finding suggested to Tobias that “steatopygia is an adaptive trait associated … with a hunter-gatherer economy, with its attendant periodic shortage of food, especially of fat and first-class protein”, although he also noted that the possible role of sexual selection cannot be dismissed (Tobias, 1961: p. 34; see also Tobias, 1957). Of course, sexual selection should not necessarily be seen as an alternative explanation to fat storage since men may be expected to select for women who have health/fertility advantages in a particular environment. The link between fat and fertility has been widely discussed in the anthropological literature (e.g. Huss-Ashmore, 1980) and several scholars have suggested that fat deposits on human female buttocks and breasts have been selected for over the course of human evolution (e.g. Cant, 1981; Marlowe, 1998). Krut and Singer (1963: p. 181) claimed that “among the Hottentots, … there is no preference on the part of the males for steatopygous women”, but we are unaware of any research that actually tests this claim.

Despite the frequency with which steatopygia appears in the anthropological literature, little actual research has been conducted on this condition due to its limited distribution and the difficulties of observation. Francis Galton (1889) was perhaps the first to acknowledge the practical difficulties in measuring steatopygia when he famously used a sextant to compute the size of a female Khoikhoi’s buttocks at a distance (cited in Tobias, 1985 and Hudson, 2004). In recent years research on steatopygia and prehistoric art has also been tainted by the associations with racism and gender stereotypes mentioned above. Much early work on figurine steatopygia also reproduced stereotypical views of gender that have been widespread in research on prehistoric art in general (Nelson, 1990; Conkey, 1997). Here we do not assume that all of the “protruding buttock” figurines are necessarily female, although we have not identified any examples that are clearly male. Rather, this paper is an attempt to examine to what extent certain Jomon depictions of buttocks on clay figurines may have been related to biological reality. Of course, as figurines are artistic/symbolic representations of the human body, it cannot necessarily be assumed that they are ideal materials for analyzing physiological conditions such as steatopygia. At the same time, however, figurines and other similar representations are the only available materials for much of prehistory. For this reason, we believe that the prehistoric clay figurines used here hold the potential to further our understanding of this important but poorly understood physiological condition.

As noted, steatopygia has been proposed for a range of Paleolithic figurines from Eurasia. In many cases, however, descriptions of these figurines were overly vague and obesity was often confused with true steatopygia (Nelson, 1990). Some authors, such as Passemard (1938) and Sacca-syn della Santa (1947), both cited by Nelson (1990), argued that most Paleolithic figurines do not represent steatopygia. However, Nelson (1990: p. 14) herself concluded that 13% of a sample of 24 figurines has steatopygic protruding buttocks. Gvozdover (1989: pp. 84–85) also argued that some West European figurines have projecting buttocks “vaguely reminiscent of the steatopygia found in Bushman women”. These studies show that care needs to be taken not to confuse steatomeria (broad hips) or general obesity with true steatopygia, but that the latter condition does seem to have existed in Paleolithic Europe.

One clear problem with these previous studies of prehistoric art is that there has been no attempt to explain why steatopygia should have been present at a particular time or place. In this paper, in contrast, we propose a possible link between steatopygia and dietary conditions in Middle Jomon Japan.

**Materials**

The figurines discussed here belong to the hunter-gatherer Jomon culture of the Japanese Islands and are of a type classified by Japanese archaeologists as dejiri dogu or ‘protruding buttock figurines’ (Kobayashi, 1990). As their name suggests, protruding buttocks are indeed the main characteristic of these figurines, which are usually not otherwise obese (Figure 2). These figurines are limited to the Middle
Jomon phase (ca. 3600–2550 cal BC). Their center of distribution is the Chubu highlands of central Honshu (Kobayashi, 1990). Figure 3 shows the distribution of Middle Jomon figurines in the Chubu highlands based on Okuyama (1984). Although we were unable to check the published reports for all of these sites, we confirmed that this map also corresponds to the main area of distribution of ‘protruding buttock’ figurines. Over 100 of these figurines were known by the end of the 1980s (Kobayashi, 1990) and the current total is likely to be significantly higher.

The Middle Jomon ‘protruding buttock’ figurines are unusual amongst Jomon period clay figurines for their representation of the buttocks. Although most decorated figurines have decoration on the rear as well as the front, in many cases emphasis appears to have been placed on the front surface. Matsumoto (2004) argues that, in general, emphasis was placed on the face and body ornaments (including clothing) of Jomon figurines rather than on breasts, genitals, or buttocks. Matsumoto’s Figure 1 plots changes in the physical attributes of figurines over the Jomon period, but she does not even consider buttocks as a variable (Matsumoto, 2004: p. 156). Figurines with large or realistic buttocks appear to be mainly confined to the Middle Jomon phase and, as its name suggests, the ‘protruding buttock’ type discussed in this paper has the largest, most attenuated buttocks of all Jomon figurines. The large buttocks of Middle Jomon figurines were noted by Kidder (1968) some 40 years ago, yet no research appears to have been conducted on the meaning or implications of this specific feature. We cannot, of course, prove that these figurines do represent steatopygia. As discussed below, however, we believe that this interpretation is strengthened by the cultural context of these figurines.

Interpretation and Discussion

Archaeologically, the Middle Jomon of the Chubu highlands was marked by several phenomena that may support the interpretation of steatopygia in the ‘protruding buttock’ figurines. A massive spike in excavated pit dwellings suggests a rapid population increase followed by an equally rapid crash in both the Chubu and neighboring Kanto regions (Imamura, 1996: p. 96, 1997). Koyama (1984) estimated the population density of the Chubu region in the Middle Jomon at 2.4 persons per km², a figure that is
matched ethnographically only by some Northwest Coast and Californian groups. It is widely agreed that this high population density was supported by intensive utilization of plant resources (Kidder, 1993; Imamura, 1996). An analysis of dental caries by Turner (1979) found levels indicating high carbohydrate consumption in central Japan in the Middle to Late Jomon phases, although unfortunately Turner does not describe exactly which site samples he used. Work by Imamura (1989, 1996: pp. 104–109) has shown that, whereas the Middle Jomon in the eastern Kanto region was marked by widespread storage pits typically used for nuts, such mass use of storage pits was rare in the same phase in the western Kanto and Chubu highlands; instead, chipped stone axes were common in the latter regions (Figure 4). Imamura argues that these axes were used for digging the wild yam Dioscorea japonica, whose underground tubers can reach over a meter in length (Figure 5). Imamura (1996: p. 108) may be correct that the storage of yams in underground pits would have been unnecessary but various types of tuber storage techniques are known ethnographically from Japan (Matthews, 2002). Leaving aside the question of whether or not yams were stored, the high estimated population densities for both the Chubu and Kanto regions at this time suggest that yams and nuts were exploited and managed very intensively in their respective regions.

Dioscorea japonica produces fast-growing tubers that would have been well suited to intensive use by Jomon populations. Nishida (1983) argued that many economically useful plants would have favored the open, disturbed habitats found around Jomon settlements. That this pattern also holds for D. japonica was confirmed by recent research by one of the present authors (T.G.). A walking survey of the central Tennodai campus of the University of Tsukuba in the autumn and winter of 2006 found that D. japonica was significantly more common in open than in closed, forest habitats. As many as 2354 individual D. japonica plants were counted in a survey of three open-habitat locations with a combined area of 10,077.5 m$^2$. On the University of Tsukuba campus, the yams were most common along the boundary zone between forested and open areas, but the open areas are used as walkways, lawns, sports fields, and so on, and are maintained by the university department of buildings and grounds. Without such maintenance it is likely that D. japonica would be even more common right across the open, disturbed habitats, although Alexander and Coursey (1969) suggest that the presence of some vegetation for the yam vines to twine upon increases yields. From interviews with local farmers in Tsukuba it was determined that if the tuber stem is replanted, the yam will grow back to its maximum size in about four years. If a typical Jomon settlement utilized an immediate catchment area of 1–2 hectares as proposed by Nishida (1981), then the results of our survey suggest that as many as 2500–5000 D. japonica tubers would have been annually available to that settlement. This yam has to be a strong candidate for one plant resource.

![Figure 4](image)

Figure 4. Central Honshu in the Middle Jomon showing mutually exclusive distributions of frequent finds of chipped stone axes (black circles) and storage pits (open circles). The main area of distribution of ‘protruding buttock’ figurines is also shown. Modified from Imamura (1996).

![Figure 5](image)

Figure 5. Dioscorea japonica tubers dug in Tsukuba in 2006. Length of longest tuber is 110 cm.
that supported the high population densities of the Middle Jomon of the Chubu highlands.

In the Middle Jomon phase, the main area of distribution of 'protruding buttock' figurines falls into the chipped stone axe zone described by Imamura (Figure 4). If Imamura is correct about the association of chipped stone axes and yams, then that in turn would imply a very different nutritional pattern between the mountain yam zone and the eastern Kanto nut zone shown in Figure 4. The Dioscorea yams assumed to have been exploited by the Chubu highland Jomon people have very low fat contents when compared with nuts—and indeed the fish and shellfish that would also have been available to coastal groups in the southern and eastern Kanto. The fat content of D. japonica is listed in modern food tables as 0.1% (Kagaku Gijutsu Cho, 1980). This yam has the lowest fat content of any of the Jomon foodstuffs listed by Suzuki (1985). Deer and wild boar were hunted in both regions but if, as proposed by Imamura, yams were largely responsible for the large population densities of the Chubu Middle Jomon, the low fat content of those yams may have been a significant limiting factor in the nutrition of highland groups.

Seasonal shortfalls in dietary carbohydrates and especially fat are a widespread constraint on foraging economies (Speth and Spielman, 1983), and the storage of large quantities of body fat to compensate for serious seasonal variations in food availability and nutritional content is common amongst hunter-gatherers (Jenike, 2001). Huss-Ashmore (1980) proposed that selection for the bodily storage of fat would have been greatest in sedentary groups living in seasonal environments. The importance of sedentism in the Jomon period has been widely discussed and most archaeologists would probably agree that the Middle Jomon cultures of central Honshu were relatively sedentary societies. As argued by Habu (2004), this “relative sedentism”—or “logistic mobility” in the sense of Binford (1980)—is associated with seasonal variations in resource availability. While the Jomon is popularly seen as extremely ‘affluent’, it is likely that seasonality was linked with resource stress of the type known from many other hunter-gatherer groups (cf. Yesner, 1994).

As can be seen in Figure 4, the main distribution of the ‘protruding buttock’ figurines does not overlap completely with Imamura’s chipped stone axe zone. In particular, these figurines are rare in eastern Tokyo and Kanagawa Prefectures even though Imamura’s reconstruction suggests yams were widely consumed there. Fish and shellfish would have been more easily obtained near to the coast and a resulting greater dependence on Dioscorea yams in the Chubu highlands may be a possible explanation.

As noted above, in modern populations steatopygia tends to be most pronounced in females. Many Japanese archaeologists have argued that Jomon clay figurines predominantly represent women (e.g. Yamagata, 1992). Although such a generalization is unwarranted, many of the ‘protruding buttock’ figurines have breasts and some have vulva (Figure 2: 3). While we believe the buttocks of these figurines are realistic representations, it is not necessary for the whole figure to be realistically ‘male’ or ‘female’. Given that the faces of these ‘protruding buttock’ figurines are rarely realistically human, it is possible that they represent a mixture of female and ‘other’, perhaps even mythological, elements. That such a mixture of elements would not necessarily detract from the interpretation put forward here is a point discussed in more detail in Hudson and Aoyama (2007).

Finally, Tobias (1961) has mentioned the possible role of sexual selection in favoring steatopygia and this possibility cannot be dismissed for the Jomon materials discussed here. Sexual selection, however, should not necessarily be seen as an alternative to the nutritional/resource stress model proposed in this paper.

Conclusions

European archaeology has a long and controversial history of interpreting prehistoric, especially Paleolithic, female figurines in terms of the presence of steatopygia (Conkey, 1997). Unlike many of the European examples, it has been suggested here that the Middle Jomon ‘protruding buttock’ figurines from Central Honshu do appear to represent true steatopygia. It was further argued that the presence of steatopygia in this phase is consistent with Imamura’s (1989, 1996) reconstruction of the subsistence system of the Middle Jomon Chubu highlands where chipped stone axes were probably used for digging the wild yam Dioscorea japonica. This yam may have underwritten a significant population increase in the Chubu highlands in the Middle Jomon phase, but the low fat levels of D. japonica would have led to nutritional problems if there was excessive consumption of this plant. Steatopygia may, therefore, have been an adaptation to this nutritional regime. The argument here relies on circumstantial evidence, but that evidence is consistent with an interpretation of these ‘protruding buttock’ figurines as representing steatopygia. If correct, this interpretation would in turn support Tobias’ (1961) conclusion that steatopygia is an adaptive condition associated with food stress.

Acknowledgments

We thank Gen Suwa and the two anonymous reviewers for their comments on an earlier draft of this paper.

References


Cooke C.K. (1965) Evidence of human migrations from the rock