

Across all cultures, puberty marks an important milestone in human development. Specifically, the character of puberty as the prelude to reproductive capability signals the transition from childhood into adulthood. As such, its analysis has withstood the test of time and has inspired both religious and scientific discourse for centuries. The variability and determinants of pubertal age have been of particular interest to Chazal and scientists alike.

According to rabbinic thought, the anticipated ages of sexual maturity are 12 and 13 for girls and boys, respectively, as the ages of *bar* and *bat mitzva* signify adulthood in Judaic law. This assumption is apparent in the discussion in *Kiddushin* 16b regarding the ramifications of pubic growth in a boy below the age of 13 as an indication of sexual maturity. The rabbis of the *Gemara* unanimously accepted the pubic growth of a boy aged 13 or older as a sign of maturity. However, if the growth manifested above the age of 9 and remained until he was over 12, then the rabbis were divided on whether it was considered an indication of puberty (*Kiddushin* 16b). The discussion in the *Gemara* hints to the rabbi's nuanced understanding of the variability of pubertal age. They recognized that there is a standard age for the expectation of sexual maturation, as indicated by their unanimous acceptance of the growth as pubertal onset above the age of 13. However, their divergence of opinion on the child over the age of 9 demonstrates their understanding that pubertal onset is actually variable by person.

In fact, this subjective variability beckons further analysis throughout rabbinic literature. Chazal identified a number of factors that may be contributing influences on the age at which puberty first begins to occur. Some of these factors include whether a woman is from the town or the village. The *Gemara* claims that the upper signs of puberty manifest sooner in village-women, because they perform more physical labor (*Niddah* 48b). Wealth and impoverishment are identified as considerations as well in alternative pubertal development. The *Mishnah* suggests that for breast development, the right side develops sooner in wealthy women, because of the scarves that they wear, while the left side develops sooner in poorer women, because of the water jugs that they carry (*Leviticus Rabbah* 2:4). Additionally, the *Gemara* recognizes body weight as a pubertal determinant. When people approached Rav Hiyya seeking to initiate the onset of puberty, he advised them to either gain or lose weight depending on their physiques (*Niddah* 47b). Interestingly, many of the factors that the rabbis identified in the *Gemara* are reflected in modern scientific texts as well.

Rav Hiyya's assessment on body weight correlates with one of the more well-established determinants of sexual

maturation. Researchers have found that weight, height, and body mass index may influence pubertal age. An elevated level of subcutaneous fat, as well as a higher BMI in girls aged 5 through 9 is associated with an increased likelihood of earlier menarche, which is a girl's first menstruation [1]. Conversely, in a longitudinal prospective study of a population of U.S. boys, obesity was found to be associated with delayed puberty in males [2]. Thus, when Rav Hiyya advised those struggling with delayed puberty to either gain or lose weight, he was significantly ahead of his times. His advice came hundreds of years before modern science exposed that the relationship between body weight and age of sexual maturation was directly proportional for females and inversely proportional for males.

Furthermore, modern science has corroborated the rabbis' identification of locale and socioeconomic status as influencers of pubertal age in girls. Chazal recognized that potential differences in sexual maturation may exist in girls from cities as opposed to villages as well as in girls from wealthy as opposed to impoverished means (*Niddah* 48b, *Leviticus Rabbah* 2:4). Although the particular cause and effects cited in the *Gemara* and the *Mishnah* for these trends are not scientifically founded, the rabbis astutely made the associations between these environmental factors and pubertal onset. Research has shown that girls from families with relatively higher socioeconomic statuses tended to experience menarche at younger ages [1]. Some researchers have gone so far as to say that menarche is so sensitive to socioeconomic factors that menarcheal age may be useful in the estimation of the socioeconomic backgrounds of historical populations [3]. Additionally, many studies have found that girls from urban areas tended to experience earlier menarche when compared to girls from rural areas [4]. However, it is important to understand that factors like socioeconomic and locations act as umbrellas that contain many sub-factors, such as nutritional intake, access to healthcare, and overall general health, all of which play contributing roles as determinants of pubertal age.

Furthermore, the Sages and the scientists are both interested in the incidence of puberty at an unusually young age, and it is discussed in both rabbinic and scientific literature. Both contend with the plausibility of conception in early childhood. In *Sanhedrin* 69b, after much back and forth, the rabbis concluded that it was possible for an eight-year-old boy to father children. They cited the line of descent from Caleb to Bezalel as proof. The rabbis were able to calculate that Caleb must have been 26 years old when Bezalel, his great grandson, was born. Given that 3 generations descended from Caleb by the time he was 26, the *Gemara* reasons that each father must have been 8 years old when his child was born. The discussion there

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also mentioned that Bathsheba gave birth to a child at the age of 6. In his analysis of the topic, Dr. Jeremy Brown concluded that the nature of this pregnancy was indeed scientifically possible. He cited a report from *La Presse Medicale* from 1939 documenting the story of a girl who successfully birthed a healthy child at the age of 5 [5]. Because conception is related to ovulation, it is possible for a girl to get pregnant before menarche, as girls may begin to ovulate before their first menstruation [6]. Although ovulation before menarche is not guaranteed, the ovulation may proceed menarche in conjunction with the normal menstrual cycle, which is generally not regulated in pre-adolescent girls. Conversely, according to both the *Gemara* and modern science, a boy must first experience the outward signs of puberty in order to father a child (*Sanhedrin* 69a). Thus, when the rabbis in *Sanhedrin* 69b referred to the plausibility of an eight-year old boy fathering children, they likely intended to assert that boys may experience puberty before the age of eight.

Indeed, the determinants of pubertal onset have been covered extensively within modern scientific literature. Yet,

scientists are still unable to conclusively predict how the variety of determining factors will interact to impact puberty. At this point, they have primarily identified determinants after analyzing trends across different populations, and then retroactively provided explanations for them. Interestingly, many of these trends have been identified centuries earlier in rabbinic literature. Although the rabbis may not have correctly identified the origins of the patterns that they observed, they managed to intuit some of the important environmental factors that influence pubertal onset.

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