Music and Testosterone

A New Hypothesis for the Origin and Function of Music

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INTRODUCTION

The origin and function of music have been discussed extensively,[1] but they remain a mystery. There have been numerous discussions about the close relationship between spatial ability and testosterone,[2] spatial ability and musical ability,[3] and testosterone and musical ability.[4] The reason that a sex hormone such as testosterone is closely related to music is still unknown despite the many reports that music affects the human endocrine system.[5] I reported findings that music suppressed testosterone in the male.[6] The current study investigates whether listening to music affects the testosterone level in females and whether any sex differences exist in the effect of listening to music on testosterone level. Finally, I propose a new hypothesis for the evolutionary function and origin of music.

METHODS

Seventy college students, all in good health and not taking any medication, were recruited and asked to sign a consent form. There were 35 males and 35 females, ranging in age from 19–25 years, the average age being 21. Forty were music majors and 30 were nonmusic majors. Only women claiming to have regular menstrual cycles were selected. Samples taken in the luteal and follicular phases were used for analysis.

In the experiment, subjects had six choices. They were given 30 minutes to listen to (1) their favorite music ($n = 10$: five men and five women each), (2) Gregorian chant ($n = 10$), (3) Mozart ($n = 10$), (4) jazz ($n = 10$), (5) popular music ($n = 10$), or (6) no music at all ($n = 20$). Males and females were separated, and a same-sex research assistant conducted each group. The experiment was carried out in a quiet laboratory room at a specific time (between 1400 and 1700 hours) because of the diurnal variation in testosterone secretion. Stimuli were presented by audio speakers. Subjects rested for 10 minutes and were given 30 minutes of music stimuli or si-

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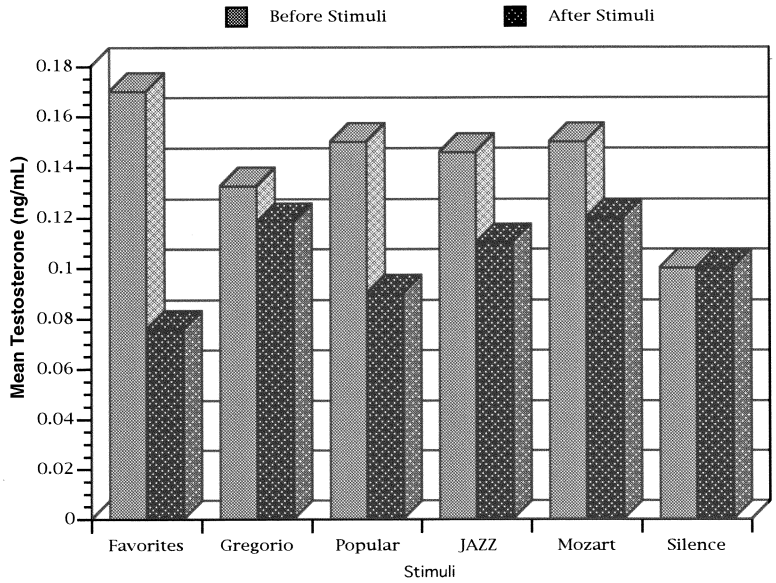

FIGURE 1. Testosterone levels of 35 male subjects sampled at 30-minute intervals. ANOVA revealed that the main effect of the stimuli was significant ($p < 0.0001$).

lence. They submitted 7-mL saliva samples before and after the stimuli. Because of individual differences in testosterone pulse, their order was randomized. Only free testosterone levels were assessed by radioimmunoassay, measured as described elsewhere.[7] Salivary testosterone concentrations are highly correlated with serum concentrations[8] and represent the free and biologically active steroid fraction. Taking a saliva sample is less invasive and less stressful than is drawing blood.

Music stimuli used for the experiments were (1) the subject's favorite music (chosen from Japanese pop music composed in the American-European pop style, American pop music, and jazz), (2) music chosen for the experiment, for example, Gregorian chant (Canto Gregoriano, EMI, TOCE-8374), Mozart (Sonata in D Major, K. 448, for Two Pianos, CBS/SONY, 32DC627), jazz (pieces from "100 Gold Fingers," ALLART, KICJ137), and (3) popular music (pieces from "The Swinging Star," EPIC/SONY, ESCB1350).

RESULTS

FIGURES 1 and 2 illustrate the saliva testosterone pulse profiles. Testosterone decreased under music conditions compared with silence, but not significantly. However, significant sex differences were noted in the effects of music. Testosterone *decreased* in males under all conditions ($p < 0.0001$), whereas testosterone *increased* in females under all conditions ($p = 0.0007$). ANOVA revealed that in both sexes the main effects of stimuli were significant ($F = 23.224$, $p < 0.0001$ and $F = 8.429$,

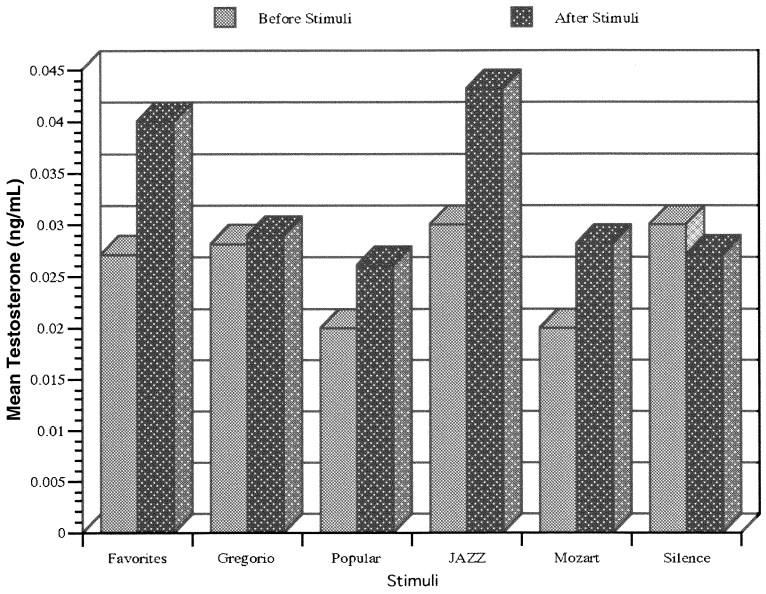

FIGURE 2. Testosterone levels of 35 female subjects sampled at 30-minute invervals. ANOVA shows that the main effect for stimuli was significant ($p < 0.0001$).

$p < 0.0001$, respectively). Post-hoc testing revealed that favorite-music conditions significantly differed from other stimuli in males and from Gregorian chant and silence in females. There were no significant effects from testosterone due to subject major and menstrual cycle, and neither was there any noticeable difference between music liked and that disliked by the subjects and between music offered and music of the subject's own choice.

DISCUSSION

This study revealed that music affects the testosterone level in both sexes. It is known that the interaction of testosterone with behavior is bidirectional: testosterone can influence behavior and behavior can alter testosterone levels. Yet, the evolutionary function of testosterone changes is unknown. Testosterone has been related to libido, activity level, sensation seeking, and dominance in animals and human beings,[9] and it also plays a part in aggressiveness.[10] Taken together with this evidence, I propose that music has a biological and evolutionary function. However, it not only developed as a signal of courtship, as Darwin remarked,[11] but it also evolved to control human love in a complicated way.

During evolution, the early humans adopted such new reproductive strategies as monogamy, mother–father families, and group living. However, group living intensified all kinds of competition for the resources of reproduction, including food and

mates. Human beings needed a system to control these states, which stemmed from sexual, aggressive, and dominant behavior due to excessive testosterone. I suggest that music originated from that need, with its function to control sexual and aggressive behavior. Because testosterone responses to libido differed according to sex, men with lower testosterone levels had low libido,[12] whereas women with higher testosterone levels had higher libidinal capacity, yet they had lower rates of intercourse.[13] Therefore, decreased testosterone levels in males would avoid confrontation, and increased testosterone levels in females suppress sexual behavior.

This theory is convincing if we recall that in music throughout the world, and even in animal sounds (monogamous birds), music and certain sounds function to ease tension or strain, strengthen social bonds, bring pleasure or ecstasy, and bring cohesiveness among people. Music is used empirically and universally in various social situations where stress, tension, and anxiety exist, such as ceremonies, funerals, war, and even banquets.

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