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Men's Bodily Attractiveness: Muscles as Fitness Indicators

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Abstract

Bodily attractiveness is an important component of mate value. Musculature—a crucial component of men's bodily attractiveness—provides women with probabilistic information regarding a potential mate's quality. Overall musculature is comprised of several muscle groups, each of which varies in information value; different muscles should be weighted differently by attractiveness-assessment adaptations as a result. In the current study, women and men ($N = 1,742$) reported size preferences for 14 major muscle groups. Women's reported preferences provided only partial support for our hypotheses that women will prefer muscles that most reliably differentiate between potential mates to be larger; men tended to prefer larger upper-body muscles. We discuss possible interpretations of these mixed findings. Ultimately, our findings suggest that attractiveness-assessment adaptations are sensitive to the information contained within specific muscle groups and they highlight the potential for additional research on the nuances of bodily attractiveness assessment.

Keywords

muscles, attractiveness assessment, evolved preferences, mate value

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Bodily attractiveness is one of the numerous variables processed by mate selection adaptations. Visual assessment of attractiveness, although seemingly effortless, is no trivial feat: Assessment mechanisms must be engineered to selectively identify, evaluate, and consolidate a myriad of individual elements to judge overall bodily attractiveness. Therefore, a complete account of attractiveness-assessment adaptations requires understanding the weights placed on the different inputs that inform holistic appraisals.

Existing evidence suggests that musculature—specifically, upper-body musculature—is a major component of men's bodily attractiveness (e.g., Dixson, Dixson, Bishop, & Parish, 2010; Gray & Frederick, 2012; Sell, Lukaszewski, & Townsely, 2017). However, a man's musculature is not a single unit but instead a collection of distinct muscles that can and do develop independently from one another. Each provides potentially unique, albeit correlated, bits of information. Systematic examination of the influence that different muscle groups have on men's bodily attractiveness has not yet been conducted, but it may reveal additional nuance in women's attractiveness-assessment adaptations. In this paper, we briefly review the selection pressures that shaped women's mate preferences, highlight the information men's musculature would have provided to ancestral women, and empirically examine the contributions of different muscle groups to men's bodily attractiveness.

Parental Investment and Women's Mate Preferences

Female reproductive potential in mammals is constrained by lower gamete production, as well as the costly investment of

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gestation, lactation, and often the bulk of child-rearing. In contrast, the reproductive potential of males is theoretically limited only by access to viable mates, and their obligatory investment is only the time needed to copulate. Over evolutionary time, this imbalance in parental investment selected for females, on average, to be more discriminatory in mate choice than males, and drove males to compete more for sexual access to females (Trivers, 1972).

In humans, women are adapted to choose men ultimately based on genetic quality and/or ability and willingness to invest in and protect the woman and her offspring (Buss & Schmitt, 1993). These ultimate goals underlie women's proximal decisions and conscious preferences: women desire and choose mates who exhibit traits associated with good genes and investment. The trade-offs of short- and long-term mating may shift preferences and choices towards one of these fundamental objectives, but regardless of the mating context, musculature would have provided ancestral women with cues to how well a given man fulfills each objective—and ultimately, the fitness consequences of mating with him.

Information Provided by Men's Musculature

Musculature is sexually dimorphic in humans. The sex difference in musculature is most clear in the upper body. On average, men have 60% greater total muscle mass and 80% more arm muscle than women (Abe, Kearns, & Fukunaga, 2003). Accordingly, men's upper-body strength is around 90% greater than women's and the average man is stronger than the vast majority of women (Hagen, & Rosenström, 2016; Lassek & Gaulin, 2009). These stark sex differences in muscularity—along with evidence of robust sex differences in aggression (Archer, 2009)—reflect the selection pressures imposed by physical conflict on men throughout human evolution (Puts, 2010; Sell, Hone, & Pound, 2012).

In the ancestral past, a man's musculature would have been probabilistically associated with a host of fitness-relevant factors. Musculature provides accurate and direct information about a man's strength (Sell et al., 2009), which indirectly predicts fighting ability (Muñoz-Reyes, Gil-Burmann, Fink, & Turiegano, 2012). Ancestral men who were better fighters would have been better able to co-opt the resources of others as well as defend their own resources, mates, and children from threats, exploitation, and usurpation (Sell et al., 2012). Men's upper-body musculature would have been particularly crucial in combat, where advantages in upper-body strength are converted into greater ability to inflict damage on an opponent.

A man's musculature would have also been an indicator of his ability to acquire resources, which is a crucial aspect of men's mate value across cultures (Buss, 1989). Anthropological evidence suggests that stronger ancestral men would have been better able to extract resources from the environment. For instance, Hadza men's upper-body strength is positively associated with hunting ability (Apicella, 2014), which is a major component of Hadza men's mate value (Marlowe, 2004). Similar patterns are found in modern societies, where fighting ability and physical strength are positively associated with mate value (e.g., Archer & Thanzami, 2009; Muñoz-Reyes, Fernandez, Flores-Prado, Guerra, & Turiégano, 2015).

Additionally, muscles are cues to men's overall condition. Because musculature requires a body that is able to allocate energy toward muscle growth and maintenance, musculature is an indirect honest indication of a man's health throughout development and his underlying disease resistance as well (Del Giudice, Gangestad, & Kaplan, 2016). Moreover, muscle development and maintenance requires large amounts of energy intake (Lassek & Gaulin, 2009), so muscularity could also function as an indication of a man's access to energy-providing resources (e.g., meat). Muscles help to increase the success in several survival-related tasks and therefore are great candidates to serve as honest, costly cues of mate quality.

Given that musculature and strength provided such crucial information to women about potential mates, modern women should be able to accurately assess men's physical strength, and evidence suggests that this is the case (Durkee, Goetz, & Lukaszewski, 2018; Sell et al., 2009). These assessments would allow women to indirectly gauge a man's ability to invest and protect. Moreover, physical strength and muscularity are moderately heritable (Silventoinen, Magnusson, Tynelius, Kaprio, & Rasmussen, 2008; Thomis et al., 1998), so assessments of strength would have allowed women to identify men who could contribute genes associated with physical strength to offspring—making male offspring more attractive as a mate to subsequent generations of women, and ultimately, increasing fitness across generations.

Muscles develop at different rates (Erikson, 1980) and some muscles are more energetically costly to develop than others (Stini, 1981). Differences in the size and definition of different muscle groups, therefore, provide unique fitness-relevant information over and above general musculature or body size—especially in ancestral populations where men would not waste precious energy targeting the growth of specific muscles through resistance training (Petersen & Dawes, 2017). However, women's mate selection adaptations have not evolved to take resistance training into account as a cause of muscle size and definition. The inferences that arise from women's assessments of bodily attractiveness must be informed by the factors that drove muscle development in the ancestral past, so differences in muscle development should still be interpreted as a reliable cue to mate value.

The Current Study

These considerations suggest that the costs of building and maintaining muscle mass could be translated by women's mate assessment adaptations into appraisals of some components of mate value. These cues would have honed women's mate selection adaptations to be sensitive to the nuances of men's musculature. However, no prior studies have systematically examined women's preferences for different muscle groups. In the current study, we test predictions derived from the assumptions that some muscles contain more fitness-relevant information than others and that attractiveness assessment adaptations weight them accordingly.

Theoretical and empirical evidence suggest that upper-body strength was pertinent to men's resource acquisition and defense ability in the ancestral past (Sell et al., 2009; Sell, Hone, & Pound, 2012). Women's attractiveness assessment adaptations should therefore place greater weight on upper-body musculature, relative to lower-body musculature. We predict that (*P1*) muscles in the upper body will be rated as more important for a man's attractiveness by women than muscles in the lower body. Insofar, as men's body image and expectations about what women find attractive is partly shaped by women's preferences, (*P2*) men should also rate upper-body muscles as more important to men's attractiveness.

Because some muscles are more difficult to build than others, differences in muscle size and development provide fitness-relevant information. Of course, in modern environments, people can increase the growth of specific muscles through resistance training, but it is unlikely that women's evolved psychology would take this into account—differences in musculature should be interpreted as differences in mate quality, rather than simple differences in time and effort expended at the gym. We take advantage of this evolutionary mismatch to examine whether some muscles that are harder to build are weighted more heavily by women's attractiveness assessment adaptions. If women's mate preferences are attuned to differences in muscle development between men, we should find that (*P3*) women will prefer muscles that are more difficult to build to be more developed than muscles that are easier to build, as these muscles would allow for more reliable discrimination between potential mates. Consequently, (*P4*) men should also prefer such muscles to be more developed in themselves.

In the current study, we also aim to explore individual differences in muscle-size preferences. Because attractive individuals can place higher expectations on potential mates (Arnocky, Woodruff, & Schmitt, 2016; Buss & Shackelford, 2008), we expect that (*P5*) women's self-perceived attractiveness will be positively correlated with preferences for muscle size. However, because less attractive women would also benefit from coupling their genes with high-quality mates, it may be that these conflicting effects will cancel each other out. We test these competing hypotheses and examine whether the relationship between men's self-perceived attractiveness and muscle-size preferences mirrors the relationship between women's preferences.

Method

Participants

To test these predictions, we recruited volunteers to rate the attractiveness of male muscles through an announcement during a public advice radio station program in Spain (Program: Tiempo de Juego. Station: Cadena Cope). The program is specialized in sports (particularly soccer), but includes a small science section conducted by one of the authors of the paper (M.P.) among many other entertainment sections, and has a large general audience. The radio audience was invited to participate in a study to evaluate "men's muscles and attractiveness" by clicking on a web link in the station website and social media. Once they clicked the link they were redirected to a Google Forms document where they could read the instructions and accept to collaborate. In total, 1,742 people over the age of 18 participated. In an effort to homogenize the sample with respect to mating pools, we only retained data from participants who reported being under the age of 46 years old and heterosexual. The final sample consists of 1,445 people, of which 503 were women (mean age $\pm$ $SD = 25.09 \pm 7.32$) and 942 were men (mean age $\pm$ $SD = 30.10 \pm 6.99$).

Materials and Procedure

The Ethics Committee of the Universidad Autónoma de Madrid (Spain) approved this research protocol. Participants completed the study in Spanish online as a Google Forms document (goo.gl/6iBq8L). All participants affirmed being at least 18 years old and their identity remained anonymous.

Participants first indicated their gender, age, sexual orientation, and nationality. Next, they rated size preferences for 14 muscles: trapezius, deltoids, pectoralis, biceps, abdominals, obliques, forearms, quadriceps, tibialis anterior, shoulders, latissimus dorsi, triceps, glutes, and calves. For participants to be able to identify the muscle, an arrow pointed to the specific muscle on a stylized drawing of a highly muscled man (see Supplementary Material). For each muscle, they answered the question, "How do you find the [MUSCLE] most attractive?" using a Likert-type scale (7 = *highly muscled* to 1 = *not muscled at all*). We indicated that the size of the muscle in the drawing was the anchor for the *highly muscled* choice on the rating scale. For each muscle, participants also answered "Yes" or "No" to the question, "Does this muscle affect men's attractiveness?". Next, participants answered the question, "How attractive do you consider yourself?" on a Likert-type scale (1 = *not at all attractive* to 7 = *very attractive*).

Participants then indicated whether they had experience as sports trainers, and, if yes, what kind of experience or formal degree (these questions were free response). Participants who indicated having experience as sports trainers were then asked about the difficulty of building each of the 14 muscles (7 = *extremely difficult* to 1 = *not difficult at all*). Only participants with above 5 years of experience or an official degree were included in the trainers' sample of 76 (22 women, 54 men). Data were analyzed using IBM SPSS Statistics Version 20 and R Version 3.5.1 (http://cran.r-project.org).

Results

Muscle-Building Difficulty and Size Preferences

To test the first four predictions (P1–P4), we obtained information regarding each muscle's difficulty to be built from trainers, and its attractiveness to both women and men. Using

Table 1. Mean Ratings and Pairwise Comparisons for Each Muscle by Group and Rater-Type.

Muscle	Trainers' Ratings ($n = 76$)	Women's Ratings ($n = 503$)	Men's Ratings ($n = 942$)	Comparison of Women's and Men's Ratings
Obliques	5.33 ± 1.43 (1)	4.88 (1) ± 1.54	5.29 (2) ± 1.47	$t(1,433) = -4.90$, $p < .001$, $d = -.27$
Abdominals	5.32 ± 1.68 (2)	4.79 (3) ± 1.31	5.62 (1) ± 1.21	$t(1,434) = -12.21$, $p < .001$, $d = -.65$
Tibialis anterior	4.92 ± 1.40 (3)	3.88 (13) ± 1.31	4.18 (12) ± 1.32	$t(1,433) = -4.08$, $p < .001$, $d = -.23$
Calves	4.74 ± 1.78 (4)	4.26 (7) ± 1.29	4.55 (11) ± 1.32	$t(1,424) = -3.93$, $p < .001$, $d = -.22$
Glutes	4.66 ± 1.66 (5)	4.87 (2) ± 1.27	5.07 (4) ± 1.32	$t(1,428) = -2.70$, $p = .007$, $d = -.15$
Trapezius	4.62 ± 1.43 (6)	3.04 (14) ± 1.35	3.90 (14) ± 1.37	$t(1,436) = -11.41$, $p < .001$, $d = -.63$
Deltoids	4.50 ± 1.39 (7)	4.20 (8) ± 1.29	4.61 (9) ± 1.29	$t(1,437) = -5.67$, $p < .001$, $d = -.32$
Forearms	4.39 ± 1.52 (8)	3.95 (12) ± 1.43	4.16 (13) ± 1.32	$t(1,434) = -2.76$, $p = .007$, $d = -.15$
Shoulders	4.34 ± 1.39 (9)	4.66 (5) ± 1.29	4.86 (6) ± 1.29	$t(1,433) = -2.79$, $p = .005$, $d = -.15$
Latissimus dorsi	4.33 ± 1.58 (10)	4.11 (11) ± 1.41	4.65 (8) ± 1.34	$t(1,430) = -7.14$, $p < .001$, $d = -.39$
Quadriceps	4.17 ± 1.60 (11)	4.20 (9) ± 1.43	4.55 (10) ± 1.28	$t(1,434) = -5.07$, $p < .001$, $d = -.26$
Triceps	4.01 ± 1.64 (12)	4.26 (6) ± 1.33	4.69 (7) ± 1.31	$t(1,426) = -5.90$, $p < .001$, $d = -.33$
Pectoralis	3.97 ± 1.70 (13)	4.20 (10) ± 1.33	5.01 (5) ± 1.26	$t(1,434) = -11.47$, $p < .001$, $d = -.63$
Biceps	3.61 ± 1.43 (14)	4.67 (4) ± 1.17	5.16 (3) ± 1.15	$t(1,434) = -7.73$, $p < .001$, $d = -.42$

Note. For each studied muscle, the table shows building difficulty according to trainers, and size preferences as rated by women and men, as mean values from the 7-point Likert-type scale. The relative ordinal position of each muscle within the column is shown in parentheses. Gray shade indicates muscles within the same extracted factor reflecting trainers' ratings, from darker Factor 3 (hardest muscles to build) to lighter Factor 1 (easiest muscles to build). Cohen's *d* provided for effect size.

trainers' ratings of muscle-building difficulty, we calculated the mean values of the difficulty to build each of the 14 studied muscles (they appear in decreasing order of estimated difficulty in Table 1). Tests of variance components suggest that 32% of the variance in ratings of difficulty-to-build muscles were due to differences between trainers.

Participants' answers to the question "How do you find the [MUSCLE] most attractive on a man's body?" allowed us to estimate size preferences for each muscle (Table 1). We compared mean ratings by women and men and found statistically significant differences in all muscles; men rated bigger muscles as more attractive in all cases (Table 1). Given this result and theoretical reasons to expect sex differences, we considered female and male participants separately. Women reported preferring larger obliques, followed by glutes, abdominals, biceps, shoulders, triceps, calves, deltoids, quadriceps, pectoralis, latissimus dorsi, forearms, tibialis anterior, and trapezius. Men's ratings suggest preferences for larger abdominals, followed by obliques, biceps, glutes, pectoralis, shoulders, triceps, latissimus dorsi, deltoids, quadriceps, calves, tibialis anterior, forearms, and trapezius (ordinal rankings for each muscle are given in parentheses in Table 1).

To explore the potential relationship between muscles' difficulty to be built and attractiveness, we considered different approaches. First, we analyzed the linear relationship between each group of muscles attractiveness and its difficulty. Secondly, we grouped muscles according to their morphological locations (e.g., upper and lower muscles; arms, chest, lower body, and torso). Finally, we compared attractiveness and difficulty based on factors reflecting trainers' ratings of difficulty.

Linear test. We conducted separate analyses to examine the simple linear association between muscles' difficulty to build and size preferences, as well as differences between logical groupings of the muscle groups. First, we examined the simple linear association between ratings of muscles' difficulty to build and their average size preferences using a mixed model. As shown in Figure 1, we found no statistically significant relationship between a muscle's difficulty to build and average size preferences ($b = .14$, $p = .608$), and the association was not moderated by sex of the participant giving the ratings. Some muscles that are relatively easy to build, such as the biceps, were preferred to be large. Others, such as the abdominals and obliques, were among muscles that are hard to build and are preferred to be largest (Figure 1).

Morphological groupings. We then examined size preferences between muscles in the upper body (i.e., muscles above the waist) and muscles in the lower body (i.e., muscles below the waist). As shown in Figure 2, we found that there was no difference in women's size preferences between upper- and lower-body muscles ($p = .361$); however, men preferred both sets of muscles to be larger than did women ($p < .001$) and preferred more developed upper-body muscles than lower-body muscles ($p < .001$).

For additional granularity, we also examined differences in size preferences between more specific groupings based on muscles in the arms (i.e., biceps, forearms, triceps, shoulders, trapezius, and deltoids), chest (i.e., pectoralis), lower body (i.e., glutes, calves, cuadriceps, and tibialisanterior), and torso (i.e., abdominals, obliques, and dorsals). As depicted in Figure 3, this analysis revealed statistically significant differences in women's size preferences across all muscles groups (p's $< .05$), except for the comparison of women's lower body preferences to chest preferences ($p = .051$) and chest size preferences to arm muscle preferences ($p = .206$). Men had statistically higher ratings than women across all

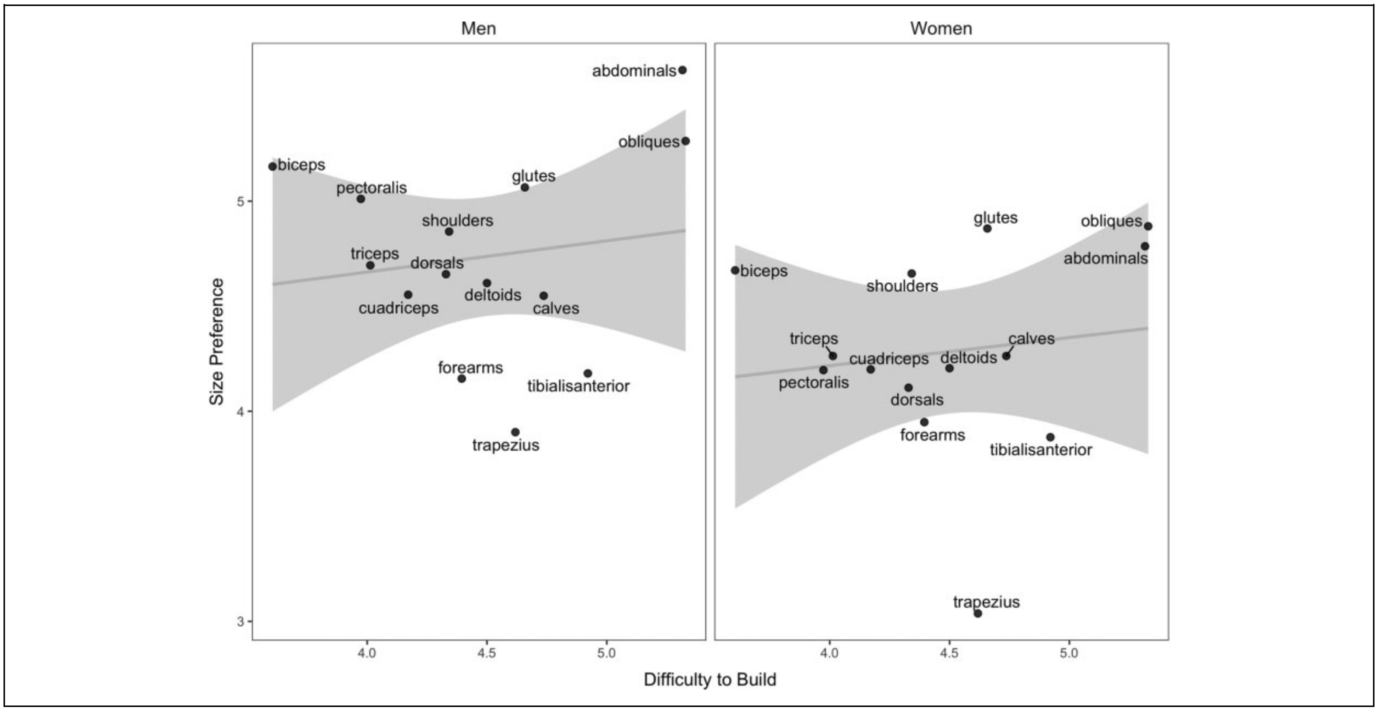

Figure 1. Sex-faceted plot depicting the nonsignificant relationship between ratings how difficult a muscle is to build and sex-specific size preferences for each muscle.

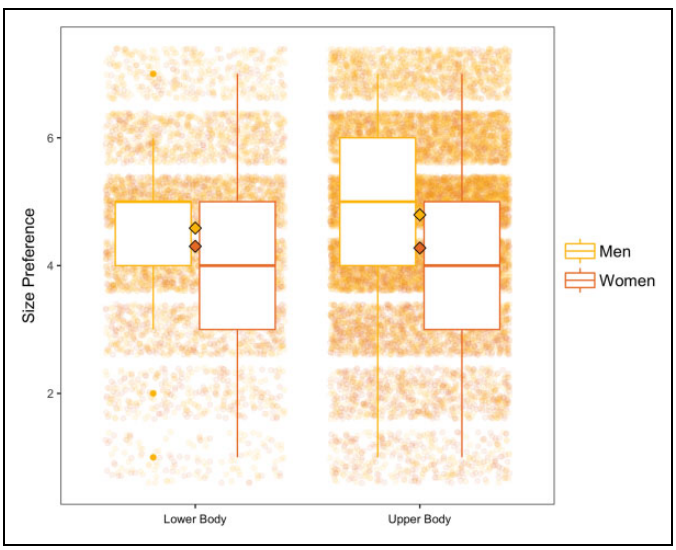

Figure 2. Box-plots depicting sex-specific differences in size preferences for muscles aggregated across the lower and upper body, separately. Sex-specific mean ratings are represented by diamonds.

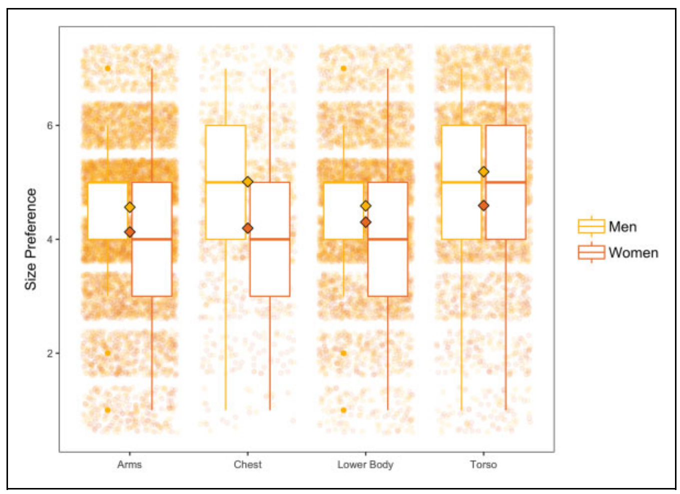

Figure 3. Box-plots depicting sex-specific differences in size preferences for muscles separately aggregated across the arms, chest, lower body, and torso. Sex-specific mean ratings are represented by diamonds.

muscle groups (p's < .001) and all differences between men's mean preferences across muscle groups were statistically significant after Bonferroni correction (p's < .001), except the comparison between men's arm muscle and lower-body muscle-size preferences ($p = .279$).

Difficulty-to-build groupings. To analyze a possible relation between muscle-size preferences and difficulty-to-build muscles with empirically derived groups, we first performed a factor analysis on the 14 muscles. We rotated (varimax) and extracted three factors, which accounted for 65.55% of the variation. Factor 1 included obliques (.913) and abdominals (.845); Factor 2 contained tibialis anterior (.844), calves (.785), forearms (.714), and glutes (.655); and Factor 3 included the rest of the muscles: pectoralis (.798), triceps (.787), deltoids (.727), latissimus dorsi (.726), biceps (.691), shoulders (.642), trapezius (.636), and quadriceps (.622).

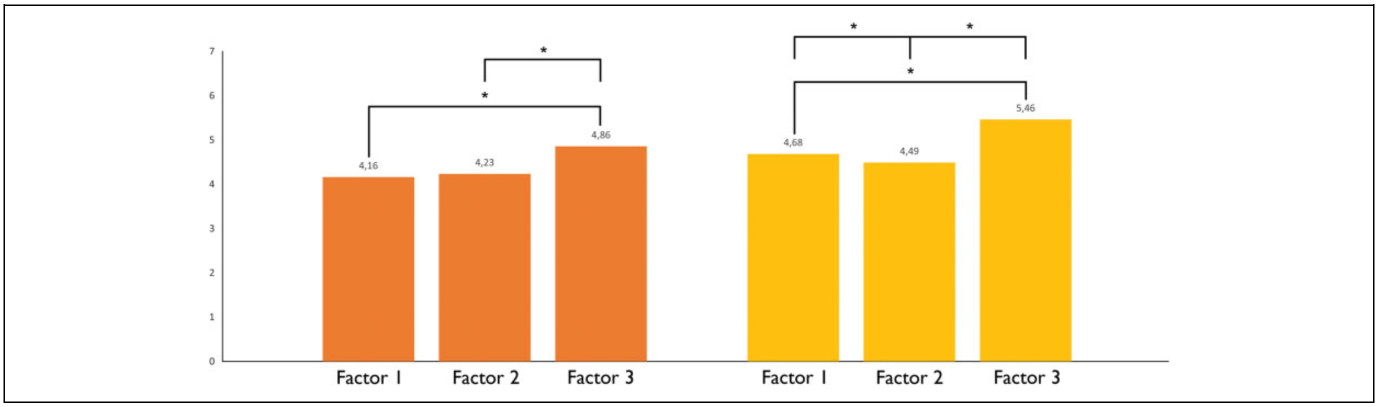

Figure 4. Mean ratings of attractiveness of the muscles within the three previously defined factors. Left columns: Women ratings of Factors 1, 2, and 3. Right columns: Men ratings of Factors 1, 2, and 3. Statistically significant differences are marked with an asterisk (*).

Muscles grouped in the same factor appear the same shade in Table 1, with muscles that are hardest to build in the darkest shading and those easiest to build in the lightest shading. A repeated measures general linear model, which controlled for interindividual variation between raters, revealed an overall statistically significant difference in ratings of muscle-building difficulty between the three factors, $F(2,150) = 22.87$, $p < .001$. Post hoc pairwise comparisons with Bonferroni correction showed that muscles included in Factor 3 ($M = 5.32$, $SD = 1.43$) were rated as harder to build by trainers than muscles included in Factor 2 ($M = 4.68$, $SD = 1.25$; mean differences $\pm$ $SE = 0.645 \pm 0.197$, $p = .005$, $d = .48$) and Factor 1 ($M = 4.19$, $SD = 1.14$;1.128 ± 0.162, $p < .001$, $d = .88$). Additionally, muscles included in Factor 2 were rated as harder to build than muscles included in Factor 1 (0.484 ± 0.138, $p = .002$, $d = .41$). These factors, therefore, serve as a proxies representing the difficulties of building the muscles in the factor, where Factor 3 is hardest to build, followed by Factor 2 and then Factor 1 (see Table 1).

Subsequently, we compared participants' muscle-size preferences with the muscles grouped on each of the three previously identified factors that reflect muscle-building difficulty.

Women's muscle-size preferences. The repeated measures general linear model indicated overall significant differences in women's preferences among the three factors, $F(2, 964) = 141.76$, $p < .001$. The sphericity assumption did not hold ($W = .72$, $p < .001$), but the results did not change after the application of a Huynh–Feldt correction, $F(1.57, 757.11) = 141.76$, $p < .001$. Bonferroni-corrected post hoc pairwise comparisons (Figure 4) showed that women preferred muscles included in Factor 3 ($M = 4.86$, $SD = .58$) to be larger than muscles included in Factor 2 ($M = 4.23$, $SD = .48$; 0.622 ± 0.051, $p < .001$, $d = .53$) and Factor 1 ($M = 4.16$, $SD = .45$; 0.694 ± 0.051, $p < .001$, $d = .61$). However, size preferences for muscles included in Factors 2 and 1 were not significantly different (0.071 ± 0.031, $p = .067$, $d = .07$). Thus, we supported the prediction that women prefer hard-to-build muscles to be larger than muscles that are easier to build.

Men's muscle-size preferences. Results from the repeated measures general linear model indicated significant differences in men's muscle-size preferences among the three factors, $F(2, 1842) = 588.84$, $p < .001$. Bonferroni-corrected post hoc pairwise comparisons (Figure 4) showed that muscles included in Factor 3 ($M = 5.46$, $SD = .40$) were rated as more attractive than muscles included in Factor 2 ($M = 4.49$, $SD = .34$; 0.973 ± 0.036, $p < .001$, $d = .86$) and Factor 1 ($M = 4.68$, $SD = .32$; 0.779 ± 0.030, $p < .001$, $d = .70$). Interestingly, men preferred muscles included in Factor 2 to be smaller than muscles included in Factor 1 (-0.195 ± 0.023, $p < .001$, $d = .19$), but this difference is trivially small.

General attractiveness impacts. Participants' also answered an additional "yes/no" question for each muscle: "Does this muscle affect men's attractiveness?" Figure 5 shows the percentage of *yes* responses for each muscle, revealing eight muscles over the 50% of *yes* for both sexes (obliques, abdominals, glutes, deltoids, shoulders, triceps, pectoralis, and biceps) and one also for male participants (latissimus dorsi). Additionally, five muscles showed significant differences in the percentages of yes/no between women and men, obliques $\chi^2(1, n = 1{,}192) = 6.59$, $p = .01$; abdominals $\chi^2(1, n = 1{,}196) = 30.83$, $p < .001$; trapezius $\chi^2(1, n = 1{,}198) = 26.65$, $p < .001$; latissimus dorsi $\chi^2(1, n = 1{,}189) = 23.50$, $p < .001$; and pectoralis $\chi^2(1, n = 1{,}196) = 16.55$, $p < .001$). In all of these cases, men were more likely than women to indicate that a muscle affected men's attractiveness (Figure 5). With the exception of the glutes, all the muscles that were deemed to be important for men's attractiveness were in the upper body.

Self-perceived attractiveness and preferences. To test Prediction 5, we examined whether participants' self-perceived attractiveness (SPA) is associated with preferences for muscle size to explore the relation between women's attractiveness and muscle-size preferences and to examine if men's preferences parallel women's. Women's SPA ($M = 3.92$, $SD = 1.16$) did not differ significantly from that of men ($M = 4.02$, $SD = 1.20$), $t(1{,}169) < .001$, $p = .229$.

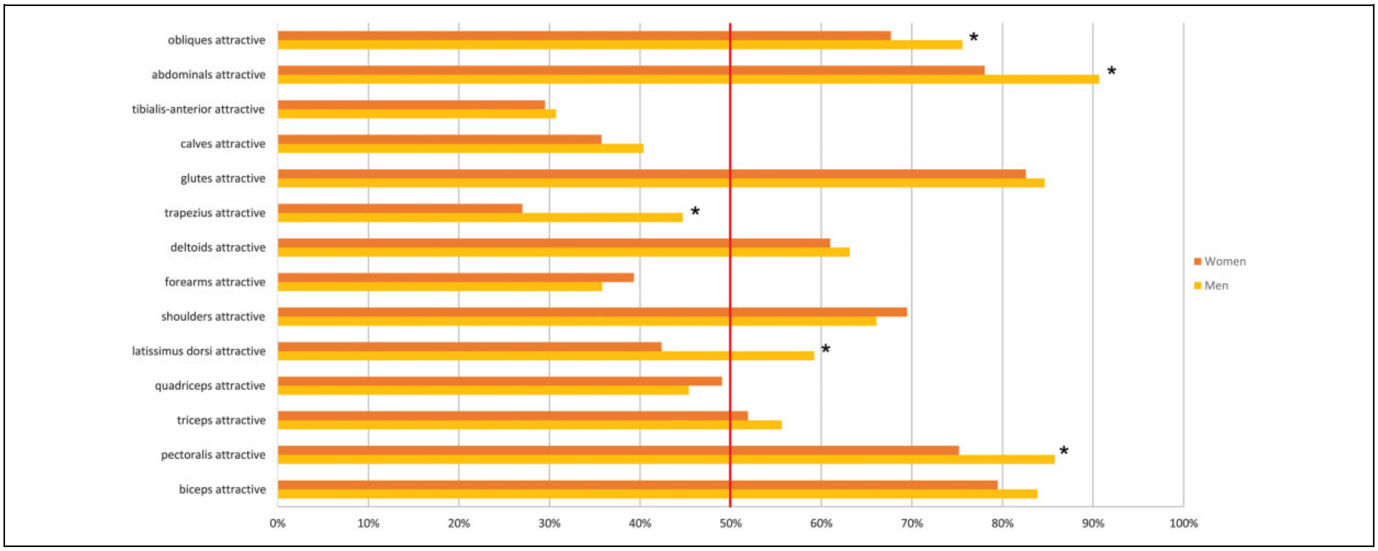

Figure 5. Percentage of participants of each sex (women in orange, men in yellow) answering "Yes" for each particular muscle. Red line signals 50% of approval. Muscles revealing statistical differences between women and men are marked with an asterisk (*).

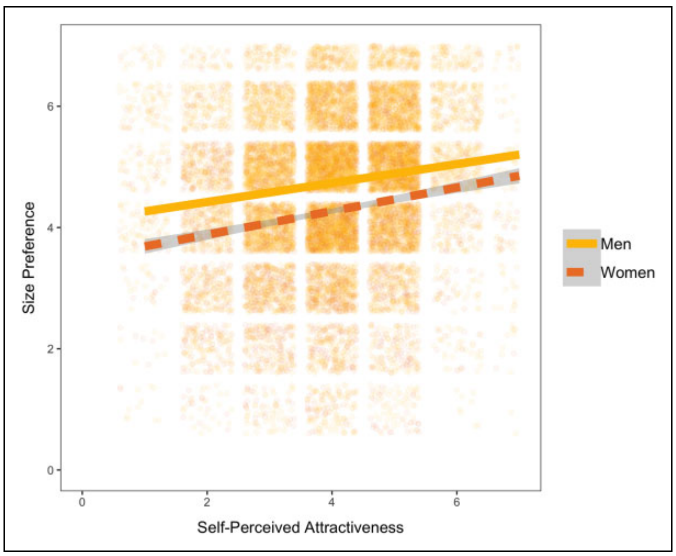

Figure 6. Relationship between men's and women's self-perceived attractiveness and overall muscle-size preferences.

Table 2. Sex-Specific Correlations Between Muscle-Size Preferences and Self-Perceived Attractiveness.

	Men's SPA		Women's SPA	
Muscle	*r*	*p*	*r*	*p*
Abdominals	.115	.002	.118	.228
Biceps	.150	.000	.211	.007
Calves	.143	.000	.233	.002
Quadriceps	.159	.000	.116	.228
Deltoids	.126	.001	.165	.038
Latissimus dorsi	.186	.000	.180	.024
Forearms	.116	.002	.203	.009
Glutes	.161	.000	.098	.228
Obliques	.192	.000	.086	.228
Pectoralis	.145	.000	.204	.009
Shoulders	.148	.000	.257	.000
Tibialis anterior	.099	.002	.200	.009
Trapezius	.114	.002	.169	.038
Triceps	.145	.000	.212	.007

Note. SPA = self-perceived attractiveness. After Bonferroni correcting for multiple tests (28), correlations are statistically significant if $p < .0017$.

To test a relation between SPA and the size preference for any group of muscles, we examined the simple linear association between muscle-size preferences and self-perceived attractiveness as well as for each muscle group separately. We conducted a mixed model to examine the overall simple linear relationship and found a statistically significant positive association between muscle-size preferences and women's SPA ($b = .21$, $p < .001$) as well as men's SPA ($b = .18$, $p < .001$); Figure 6 depicts this relationship. We present the muscle-specific correlations between size preferences and SPA in Table 2.

We also analyzed the correlation of SPA with the preferences for muscle size in the three previously established Factors 1, 2, and 3. In female participants, SPA was not significantly associated with Factor 3, $r(262) = .11$, $p = .07$, but there was a significant positive correlation with Factor 1, $r(258) = .26$, $p < .001$, and Factor 2, $r(260) = .24$, $p < .001$. In male participants, positive correlations were found between SPA and all three factors: Factor 3, $r(924) = .17$, $p < .001$; Factor 2, $r(920) = .17$, $p < .001$; and Factor 1, $r(921) = .20$, $p < .001$.

Discussion

In a relatively large sample of Spanish men and women, we found mixed support for predictions about nuances in women's bodily attractiveness assessment adaptations. We predicted that women would tend to prefer muscles that are harder to build to be proportionately larger than those that are easier to build, as they would have been more reliably discriminating cues to ancestral mate value. While muscles that were rated as hardest to build were indeed preferred to be proportionately larger (e.g., the abdominal and oblique muscles), there was no robust linear association between muscle-building difficulty and size preferences. The lack of a strong association is understandable since all muscles revealed a rating of attractiveness around the middle of the scale, a pattern which may be consistent with the inverted-U hypothesis of masculine traits (Frederick & Haselton, 2007). We also predicted preferences for more developed upper-body muscles due to the importance of upper-body strength for ancestral men (Sell et al., 2012). In our data, only men reliably preferred proportionately larger upper-body muscles to lower-body muscles; women did not consistently prefer muscles in the upper body to be more developed than those in the lower body.

However, some support for our hypotheses is provided by the dichotomous ratings of whether a given muscle affects men's attractiveness. In these dichotomous (yes/no) ratings, women and men consistently indicated that muscles in the upper body were important to men's attractiveness, whereas almost no muscles in the lower body were rated as important by more than 50% of the sample (with the exception of glutes). This offers at least partial support for the hypothesis that upper-body muscles contain more information relevant to mate value than the lower body. Further, this agrees with recent evidence that men's upper-body strength accounts for most variance in men's bodily attractiveness (Sell et al., 2017), as well as broader research showing that muscularity is an important component of men's attractiveness (e.g., Dixson et al., 2010; Gray & Frederick, 2012).

We expected that men's preferences for muscle development would tend to mirror women's preferences, but we found that ratings of size preferences were always higher than women's ratings across all muscles. This might reveal a bias driven by intersexual selection, whereby women's preferences pushed men's psychology to exaggerate the importance of muscles. In addition, the bias could also be due to the pressures of intrasexual competition, where larger muscles mean higher likelihood of success in aggressive conflict, making larger muscles more attractive in potential coalitional allies (Puts, 2010; Sell et al., 2012). Along with feeling healthier and being more successful in the intrasexual competition, men report the interest in being more attractive to women as one of the main reasons to build muscles (Frederick et al., 2007). Moreover, the fact that muscular men are represented as attractive and prestigious in popular media may further contribute to men's preferences for larger muscles (Frederick, Fessler, & Haselton, 2005).

Interestingly, we found that both men's and women's self-perceived attractiveness was positively associated with preferences for the muscles that are hardest to build. That attractive women generally preferred more developed muscles suggests that women who are higher in mate value are more discriminatory in assessments of bodily attractiveness—a finding that parallels attractive women's higher standards for a variety of potential mate qualities (Buss & Shackelford, 2008). However, the correlation between SPA and size preferences did not hold for each individual muscle. Women's self-perceived attractiveness was uncorrelated with size preferences for the obliques, abdominals, glutes, and cuadriceps. If replicable, this suggests that women's attractiveness does not influence preferences for these particular muscles; this finding could be examined more intentionally in future studies.

Limitations

Although these findings offer support for some of our predictions, the strength of our conclusions are limited by several limitations. Most notably, all participants rated their preferences in reference to one stylized drawing of a man who is highly muscular compared to the normal range of human males. This could create stimuli-dependent results, meaning that ratings may be driven by the anchoring effects of our particular stimuli, which may not reflect species-typical men. As a result, the magnitude of some preferences may be exaggerated or truncated. Future research should replicate these effects across a more representative range of male musculature.

Also, the novel use of trainers' ratings of muscle-building difficulty may have certain limitations and inaccuracies that we were not able to fully explore and address here.

Additionally, the sample consists entirely of individuals living in Spain who happened to listen to the radio advertisement for the study. This self-selected sample of predominantly soccer (football) fans may not accurately reflect the preferences of the general population. Although the radio program is more of a general entertainment station for a wide and general audience of all ages, occupations, and social class, it could be introducing a certain bias. Moreover, our culturally homogenous sample prevents us from examining the cultural specificity of preferences for muscle size. Future research could examine cultural differences in the weights placed on different muscle groups and explore ecological variables (e.g., pathogen prevalence, climate, gender equality, and sex ratio) that modulate women's musculature preferences.

Conclusion

To our knowledge, this study offers the first systematic examination of preferences for specific muscle groups. We found mixed support for the hypothesis that women's muscle-size preferences are calibrated to the information they reveal about specific components of men's mate value. Although far from conclusive, these mixed findings suggest that somewhat different information may be extracted from different muscles groups by attractiveness assessment adaptations. Strong biceps, for example, might reliably indicate fighting or hunting ability, whereas strong abdominal muscles are more indicative of health or diet. If so, the size preferences of different muscles may reflect different inferences—each of which may be the outputs of different assessment mechanisms which we did not consider in this simple preliminary study. The specific inferences potentially tied to different muscle groups remain to be examined. In sum, the current study offers novel insight into women's musculature preferences and highlights the need for additional research to better understand how women's attractiveness-assessment adaptations weight different muscles in the computation of overall bodily attractiveness.

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Supplemental Material

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