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Men's ratings of female attractiveness are influenced more by changes in female waist size compared with changes in hip size

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Abstract

Women's attractiveness has been found to be negatively correlated with waist-to-hip ratio (WHR) in many studies. Two components of this ratio can, however, carry different signals for a potential mate. Hip size indicates pelvic size and the amount of additional fat storage that can be used as a source of energy. Waist size conveys information such as current reproductive status or health status. To assess which of these two dimensions is more important for men's perception of female attractiveness, we used a series of photographs of a woman with WHR manipulated either by hip or waist changes. Attractiveness was correlated negatively with WHR, when WHR was manipulated by waist size. The relation was inverted-U shape when WHR was changed by hip size. We postulate that in westernized societies with no risk of seasonal lack of food, the waist, conveying information about fecundity and health status, will be more important than hip size for assessing a female's attractiveness.

Keywords: Waist-to-hip ratio; Woman attractiveness; Woman reproductive potentials

1. Introduction

Any of several important female morphological traits may be taken into consideration by men in the process of mate choice, namely face (Buss, 1999, Hassebrauck, 1998, Furnham et al., 2001, Perrett et al., 1999), weight (Singh, 1993a,b, 1994a), BMI (body mass index)

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(Tovée et al., 1999), height (Lynn and Shurgot, 1984; Pawlowski et al., 2000; Pawlowski and Koziel, 2002), breasts (Singh, 1995) and body shape which can be described by the waist-to-hip ratio (WHR) (Henss, 1995, 2000; Singh, 1993a,b, 1994a). The last trait has been scrutinized in many papers in the last decade, with sometimes conflicting results (e.g. Singh, 1993a,b, 1994a [or Streeter and McBurney, 2003] vs Tassinary and Hansen, 1998; Singh, 1993a,b, 1994a versus Tovée et al., 2000). Although Tovée et al. (1999, 2000) found that weight was more important than WHR in judgments of a woman's attractiveness, Streeter and McBurney (2003) showed that woman's WHR influences her attractiveness even when the effect of weight on attractiveness judgments was removed.

Since signals should be honest, traits that are considered attractive should be in some way related to general fitness or at least to the female's fecundity state (see review in Singh, 2002). It is known that female WHR is related to proportion of sex hormones (DeRidder et al., 1990) and to the female health (Björntorp, 1988; Folsom et al., 1993; Huang et al., 1999; Leibel et al., 1989; Misra and Vikram, 2003). WHR is the ratio based on the two body dimensions (measurements) waist and hip size. In clinical and anthropological studies, WHR is measured in three dimensions and represents the ratio of two circumferences. In most studies on male preferences for female WHR, however, the stimuli are two-dimensional, with WHR constructed on the ratio of the waist and hip width. Although WHR indicates general fat distribution (Singh, 1993a,b, 1994a) and sex hormone levels (DeRidder et al., 1990), it is notable that hip and waist can carry different signals. Hip size (particularly, in two dimensions presentation) may indicate female pelvic size and, therefore, the size of the reproductive canal, the amount of fat reserves which could constitute an additional energy source during seasonal lack of food (Cant, 1981; Huss-Ashmore, 1980). On the other hand, waist conveys information such as current reproductive status (waist size increases during pregnancy and in the post-reproductive period of a female's life) (Singh, 2002), female health status or the risk of morbidity in the future (e.g. Björntorp, 1988; Misra and Vikram, 2003), and also sex hormone levels (see Singh, 1993a,b, 1994a). The problem is, which component of the WHR is more important in assessment of attractiveness? It is possible that in different ecological and demographic situations men might pay more attention to signals conveyed by the female's waist or hip size. Some authors (Singh and Luis, 1995; Tassinary and Hansen, 1998) claim that hip size is more influential than waist size. In traditional societies, living in relatively harsh conditions where fat reserves in hip and thigh regions may be important as an energy source during pregnancy and lactation, one might expect a preference for large hips. In contrast, in modern societies where there is no risk of lack of food and where an elaborate social system provides poor mothers with basic resources, more important information for men might be conveyed by waist size, which indicates the state of fecundity and/or a woman's health.

Here, we would like to test whether in westernized society men's perception of female body shape attractiveness is influenced more by hip or by waist size (particularly, in relation to the diverse biological signals they carry). The main questions we address in this paper are:

(1) Do males have the same preferences for female WHR irrespective of whether WHR is changed by waist or hip size?

(2) Is there a positive correlation between attractiveness judgments about a woman's WHR viewed from front and back, when WHR is manipulated by both hip and waist width?
(3) How sensitive are men to small changes in WHR, for example: 0.05, as a function of manipulation of WHR by hip or waist size?

The original studies by Singh (1993a,b, 1994a,b, 1995) and several later ones (e.g. by Tassinary and Hansen, 1998; Furnham et al., 1997, 2002; Tovée et al., 2000) were based on line drawings. Underlining some drawbacks of this method, Henss (2000) used more natural stimuli, i.e. color photographs. In our studies, we used a similar method as the one used by Henss (2000) or Streeter and McBurney (2003), but with black and white photographs. The conclusions drawn by Henss (2000) were based only on WHRs manipulated by waist size.

2. Materials and methods

Stimuli were created electronically from two black and white photographs of one woman. In one of the original pictures the woman was presented from the front, and in other one from the back. The real waist-to-hip ratio (WHR) of the woman was 0.65. For both the front and back photographs, four new pictures with WHRs of 0.6; 0.7; 0.75 and 0.8, respectively, were created by morphing techniques. We used only WHRs lower than 0.85, i.e. in the range for healthy and pre-menopausal women (Singh, 1993a,b; Singh, 1994a,b,c; Henss, 1995, 2000). In fact, the range we used covers ca. 95% of WHR variation for young women (19–25-years old), e.g. in Pawlowski and Grabarczyk (2003) sample, the mean WHR was 0.72 and S.D. = 0.034. If waist and hip are important signals, one should expect that in the real population of young women the range of variation should be relatively small (Zahavi and Zahavi, 1997). Therefore, showing the difference in men's perceptual sensitivity to a woman's waist and hip change in this range of WHR should be the best proof of the importance of signaling function of these morphological traits.

We used a small (0.05) step change between consecutive WHRs to assess male sensitivity to small differences for both front and back series for WHR changed either by waist or hip width.

Two different series of stimuli were used. In the first series (Series I), WHR was altered by changing waist width; in the second series (Series II), WHR was altered by changing hip width. Each series contained five front and five back photographs of the model. The photographs in each series were sequenced randomly and differently for front and back photographs (Fig. 1 shows back photographs from two series).

A total of 340 men participated; 170 judged Series I, and 170 judged Series II, with every participant looking at only one series. The age range of participants was between 18 and 70-years old (mean = 36.4; S.D. = 14.3) for Series I participants, and between 17 and 71-years old (mean = 31.2; S.D. = 14.4) for Series II participants. Educational backgrounds were diverse (80 and 86.4% of men with either high or university education level, respectively, for Series I and II and the complementary percentages for men with no more than vocational education) and participants were naïve to the role of waist-to-hip ratio in the perception of physical attractiveness.

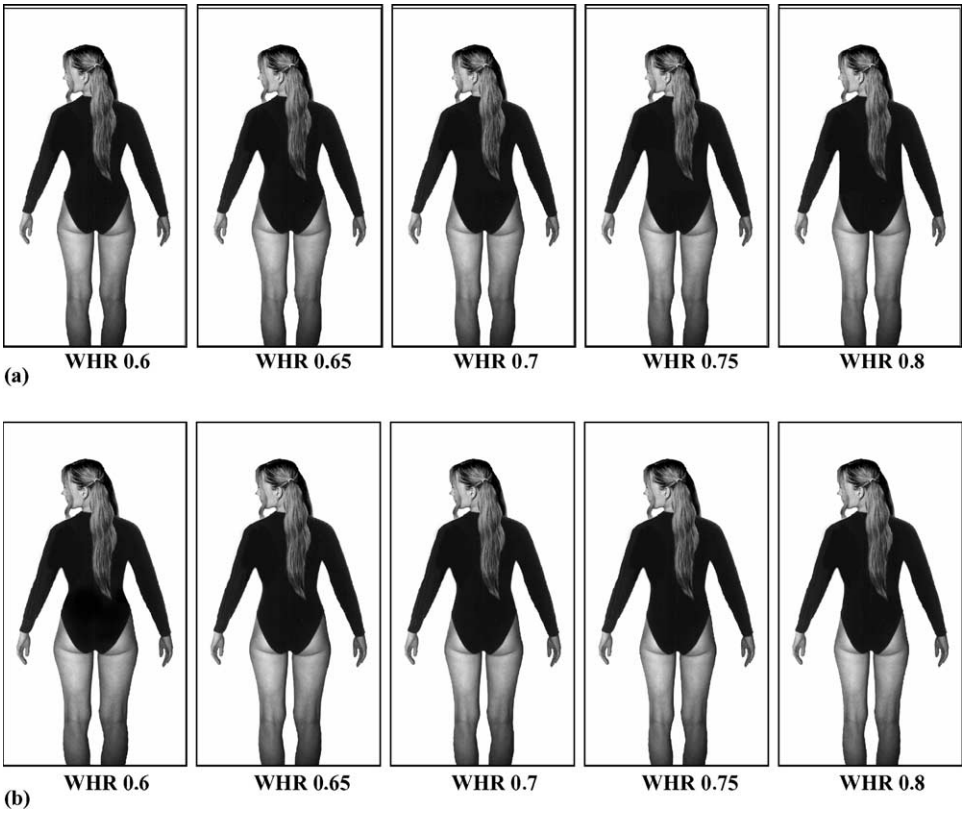

Fig. 1. The photographs showing the backs of the models with: (a) WHR altered by changing waist width; (b) WHR altered by changing hip width.

3. Rating criteria and procedure

The participants were tested both in group settings and individually. All participants were given a booklet containing questions about their age, height, weight, education level, place of residence, and the pictures of the model. The participants rated the model's attractiveness for 10 photographs (for either Series I or II) on a five-point bipolar scale, (1 = non attractive, 5 = very attractive). All participants were also asked which of the five stimuli (in each series) was the slimmest one and which one was the heaviest.

The statistical significance of variation between mean attractiveness ratings for the model with different WHRs within a series was assessed using the non-parametric Kruskal–Wallis test (since the ratings had no normal distribution and were not measured we could not used any parametric tests). Differences between means for each pair of WHRs within a series were tested using the Wald–Wolfowitz test. To test for agreement of ratings between the front and back series of photographs we used the Spearman rank correlation. All analyses were carried out using STATISTICA 5.5 A PL (StatSoft, 2000).

Table 1
Means and standard deviations for attractiveness ratings given to the "front" and "back" series with different WHRs created by changes to waist ($N = 170$)

WHR	Front		Back	
	Mean	S.D.	Mean	S.D.
0.60	4.14	1.03	4.09	1.05
0.65	3.69	0.92	3.77	0.89
0.70	3.11	0.92	3.25	0.81
0.75	2.37	0.96	2.36	0.99
0.80	1.97	1.00	1.80	1.08

4. Results

Table 1 shows the mean attractiveness ratings for different WHRs changed by waist width, both for the front and back series. We found that the most attractive was WHR = 0.60 and the least attractive 0.80. There was a statistically significant decrease (according to the Kruskal–Wallis test) in attractiveness with WHR increases both for the front ($H_{(4,850)} = 350.8$, $P < 0.001$) and back ($H_{(4,850)} = 372.8$, $P < 0.001$) series. There was a positive correlation between the front and back series assessments (Spearman *r*-range for different WHR was between 0.23 and 0.63). The Wald–Wolfowitz tests between all pairs of WHR revealed no statistical difference only for two comparisons (between 0.65 and 0.70, and 0.75 and 0.80) for the front series, and for only one (between 0.60 and 0.65) for the back series.

Table 2 shows the mean attractiveness ratings for different WHRs changed by hip width, both for the front and back series. The most attractive was WHR = 0.70 and the least attractive was WHR = 0.60. Although the overall variability in both series was significant ($H_{(4,850)} = 124.4$, $P < 0.001$ for front; $H_{(4,850)} = 101.5$, $P < 0.001$ for back) when Wald–Wolfowitz test for the pairs of WHR was used, only four differences (between 0.6 and 0.65, 0.7, 0.75, and 0.7 and 0.8) for the front series and five differences (the same as for the front series, plus 0.6 versus 0.8) for the back series were significant. We observed an inverted-U shape relationship in which the least attractive was WHR = 0.6 (it was even significantly less attractive than 0.8 in the back series). There was also a positive

Table 2
Means and standard deviations for attractiveness ratings given to the "front" and "back" series with different WHRs created by changes to hip ($N = 170$).

WHR	Front		Back	
	Mean	S.D.	Mean	S.D.
0.60	2.30	1.23	2.15	1.20
0.65	3.30	1.11	3.19	1.20
0.70	3.62	1.13	3.44	1.19
0.75	3.48	1.16	3.27	1.19
0.80	2.73	1.30	3.13	1.34

correlation between the front and back series ratings (Spearman *r*-range for different WHRs was between 0.42 and 0.64).

The men from Series I were on average 5.2-years older than men from Series II. To check whether this difference could have influenced the results we ran the same analysis for 144 men from Series I who were younger than 55-years old. The mean age for them was 31.9 and did not differ significantly from the mean age of men from Series II ($t_{312} = 0.46$, $P = 0.65$). The results for such selected group of men were similar as for the 170 men from this series. Moreover, there was no significant difference for the ratings of the picture with WHR = 0.65 (which was the same for Series I and II) when assessed by these two groups of men both in front ($z = -0.54$) and in back ($z = -0.98$). These two analyses indicate that there is no reason to think that these two groups were different with respect to the attractiveness criteria they used.

Tassinary and Hansen (1998) found that when WHR was manipulated by hip size the most preferred was WHR = 0.9, but their subjects were very young (with the mean age of 18 years). In our study the mean age of men was over 30 years. To check whether the age of subjects influenced WHR attractiveness ratings (when manipulated by hip size) we studied 30 men aged 20–21. For this sample we obtained results similar to those of Tassinary and Hansen (1998). The young men judged the model with WHR = 0.8 (the highest WHR presented) as the most attractive.

We found also that when WHR was changed by hip size, the majority of subjects (92%) considered that the woman with the lowest WHR (0.6) was the heaviest one. This result did not depend on the assessed woman's body view (front or back). The picture of the woman with WHR = 0.80 was judged to be the slimmest. In contrast, when waist was changed, 90% of participants considered that the woman with the lowest WHR (0.6) was the slimmest one.

5. Discussion

As in many earlier studies (Furnham et al., 1997; Furnham et al., 2001; Furnham et al., 2002; Henss, 1995, 2000; Marlowe and Wetsman, 2001; Singh, 1993a,b, 1994a,b,c, 1995) men's perception of model attractiveness with different WHRs altered by waist width manipulation was negatively correlated with WHR. There was also a strong positive correlation between attractiveness of the female body viewed front and back, confirming the results obtained by Thornhill and Grammer (1999). We found that men are sensitive to rather small changes in WHR but only if WHR was altered by waist size. Although Henss (2000) used pictures of models in which WHR sometimes differed by smaller steps (e.g. 0.03) than in the present study, he manipulated WHR only by means of waist change. Furthermore, in Henss (2000), the differences in attractiveness between three WHRs (differing only slightly) were very low (on the 1–6 scale he obtained means of 4.16, 4.06, and 3.95). Our results indicate that men are very sensitive to WHR differences based on waist change and are much less sensitive to WHR differences based on hip changes. We postulate that when assessing female attractiveness based on WHR, men are more influenced by waist than by hip change. How can this be explained from an evolutionary point of view? Although additional fat storage in the hip region can be a good signal of energy storage (Cant,

1981; Huss-Ashmore, 1980) and a lower relative center of body mass (Pawlowski, 2001; Pawlowski and Grabarczyk, 2003), in westernized societies where there is no risk of seasonal lack of food, the waist may carry more important information. First, since waist size increases during pregnancy and in the post-reproductive period, it indicates the fecundity status of a woman. Second, the waist can better indicate a woman's health. Visceral fat in the waist region can be a signal of higher morbidity risk (Björntorp, 1988; Folsom et al., 1993; Huang et al., 1999; Lin et al., 2002; Misra and Vikram, 2003). Thirdly, the waist is a good indicator of sex hormones profiles (review in Singh, 2002). Women with polycystic ovaries usually have lower levels of estrogens and higher levels of testosterone and therefore a higher WHR (Mather et al., 2000; Remsberg et al., 2002; Velazquez et al., 2000). Our hypothesis is supported by the different attractiveness ratings for the series with waist- and hip-changed WHRs. Decreases in waist size were related to increased attractiveness of the model. When waist size was unaltered and hip size changed, there was no significant difference in attractiveness ratings between four different WHRs (0.65, 0.70, 0.75 and 0.80).

In western societies women are not in danger from seasonal lack of food and there is no necessity to continue working until immediately before parturition. Therefore, additional fat storage in the hip and thigh region is not as important as in societies living in highly seasonal and ecologically harsh conditions. With improved living conditions one should expect that smaller hip size and higher WHR can be preferred. This trend was shown using Playboy centrefold models from the last 50 years by Voracek and Fisher (2002). It is, therefore, possible that the results obtained in the present study would diverge from those obtained in societies faced with marked ecological-economic constraints. Furthermore, as Marlowe and Wetsman (2001) suggest, the greater importance of female waist size in western societies can be also attributed to low total fertility rate (TFR). If TFR is low (e.g. two children) it could be very costly to be attracted to a woman with a relatively large waist (a large waist can signal pregnancy), because there is a high risk that she may conceive only one more child. In traditional societies, where TFR sometimes exceeds 6, if a woman is pregnant, she may nevertheless conceive at least a few more children, thereby securing reproductive success for a man who was attracted to her when she was pregnant. However, we would also suggest that even in societies where the TFR is relatively high, male preferences should depend on the woman's age (or on her Fisherian reproductive potential). They should be more willing to accept a larger waist if the woman is young than if she is in her mid or late reproductive period of life.

The fact that the increased hip size (from WHR = 0.65 to 0.60) caused a decrease in attractiveness can be explained either by the effect of BMI increase, as shown by Tovée et al. (2000) or by the possibly wrong proportion between hip width and other than waist width dimensions (e.g. not studied in details, shoulder width). The former can be confirmed by the fact that over 90% of participants perceived the model with a bigger hip size as the heaviest one. These results clearly imply that Tovée et al.'s (2000) objection concerning the perception of female BMI based on WHR changes is legitimate. And the latter can be confirmed by the fact that the most attractive woman had WHR = 0.7 and not 0.8 (as would be expected if the only criteria of attractiveness would be the woman's perceived BMI).

Tassinary and Hansen (1998) also found that when WHR was manipulated by hip size the most preferred was WHR = 0.9, though Streeter and McBurney (2003) obtained different results. In our study even the photographs showing WHR = 0.8 were less attractive than

those showing WHR = 0.7. However, in Tassinary and Hansen (1998) the participants were very young (mean age: 18 years) and such young men could have been attracted to a very high WHR as reflecting youthfulness in a woman. We have confirmed that for the sample of 30 young men. As further evidence that preferences may depend on participants' age, in a study using personal advertisements, Bereczkei et al. (1997) found a relatively high preference for female plumpness, but the mean age of the male participants was over 38 years. This age dependent relationship can be attributed to higher value of woman's reproductive potential (length of time which will be available for reproduction) for very young men and woman's current fecundity for older men (Pawlowski, 2000). The former is related to the body shape which is typical for very young women (slim and with relatively higher WHR due to the smaller hip width) and the latter with more gynecoidal body shape (low WHR with fat deposits on hips and thighs) for women being in their most fecund period of life (e.g. in their mid to late 20s'). Studying male preferences in personal advertisements, Pawlowski and Dunbar (1999) also found that for men with the mean age above mid-30s' (with the range between 20–59-years old) it was fecundity which explained more variance in female market value than reproductive potential.

We have studied only men's preferences in relation to woman's body shape differences and therefore we cannot draw any implications from our results on the development of eating disorders which might be related to self-body fat perception. However, the fact that girls and young women overestimate first of all their waist width and only in the second place their hip and thighs width (Bergstrom et al., 2000) confirms in some way our results. Their perceptual bias reflects male's criteria in judging women's body shape attractiveness. It should be also noted that female figures rated by women as most attractive are thinner than the figures preferred by males (Shih and Kubo, 2002).

To sum up, apart from confirming previous findings that when the waist is changed it is the lowest woman's WHR (here, 0.6) which is the most attractive, we have shown that: (1) women with the same WHR but manipulated either by waist or hip size are perceived differently by men; (2) men's ratings are more sensitive to change when WHR is altered by waist size and this indicates that in western society waist size can be more important for men's perception of a woman's body shape attractiveness than her hip size; (3) there is no difference in assessing woman's body shape attractiveness from the front or the back; (4) men's age should be taken into consideration in studies on woman's body shape attractiveness.

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