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FULL REPORT

Evidence of Sexual Selection for Evening Orientation in Human Males: A Cross Cultural Study in Italy and Sri Lanka

K.G. Chandrika Gunawardane[1,*], Deborah M. Custance[1] and Davide Piffer[2]

[1]Department of Psychology, Goldsmiths College, London, UK
[2]Department of Anthropology, University of Durham, Durham, UK

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Author contribution: K.G.C.G. developed the research study by formulating the hypothesis, underlying theories and constructed the sexual behavior questionnaire, wrote the draft paper, did statistical analyses and collected the dataset; D.M.C. supervised the study and reviewed the draft paper; D.P. reviewed the final manuscript providing important feedback.

***Correspondence** and requests for materials should be addressed to K.G.C.G. (chandrikag@hotmail.co.uk).

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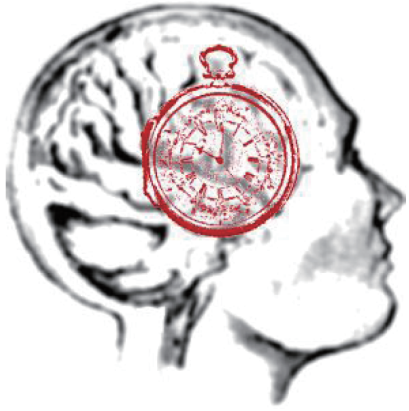
SYNOPSIS

Previous research has established the existence of individual differences with regards to individuals' optimum time of well-functioning; specifically in terms of being either morning or evening oriented. An association has also emerged between being more evening, as opposed to morning, oriented and having a greater number of sexual partners. The aim of the present study was to investigate whether "eveningness" in males is an evolved sexually dimorphic trait consistent across different cultures. A sample of 179 male Sri Lankan men residing in two different cultural and economic settings, Italy and Sri Lanka, were administered the Morningness-Eveningness Questionnaire (MEQ) followed by assessing their sexual behavior history. The results robustly portrayed a highly significant main effect of MEQ types highlighting the twofold sexual success enjoyed by the evening individuals in both regional locations. Morning oriented individuals, showed a stronger preference for going out and partying than evening-types, suggesting that the higher mating success of evening types is not due to their different lifestyles allowing more opportunities to encounter females. However, evening types exhibited a preference for flirtatious behaviors in the later part of the day. Shoulder-to-hip and handgrip strength, as measures of testosterone levels, were not significantly associated with eveningness. The results are discussed in terms of sexual selection and its interplay with human cultural variation.



Key Words: morning and evening types; western and non-western regions; sexually evolved trait; human mating; circadian typology; sexual selection

INTRODUCTION

The vast majority of social events and, hence, potential mate encounters occur during leisure times in the evening, such as, clubbing, concerts, gathering of friends for dinners or drinking at the pub[1]. In contrast, daily obligations in life, for instance, employment, education or grocery shopping occur before the sun sets. A striking illustration of this is provided by the increased liability of women to get involved in elevated nocturnal social events during their fertile conception phase (i.e., near ovulation) and indeed sexual infidelity has been found to be most prominent during this phase[2]. Thus, it follows that individuals who engage in more nighttime social activities may increase their probability of encountering a mate[1].

Further support for this notion can be derived from variations in sleep cycles especially emerging around the time of puberty when the body becomes reproductively viable[1]. Many studies have documented the shift from early rising to more later bedtimes during adolescence[3,4]. For instance, a large scale investigation by Kim et al.[5] among participants aged 8-16 years revealed a greater delayed evening adjustment around the age of 13. Similarly, in a Finnish survey the evening orientation for male children increased from 11% at 11 years to 30% when compared to adolescents aged 15 years[6]. Furthermore, a handful of studies exploiting large adult samples have established significant gender differences where women display a tendency to be morning oriented than men[7].

Previously, people have been categorised as either evening-types (or night owls) versus morning-types (or early birds). As the labels suggest night owls prefer to be active and are at the optimum level of functioning during the evening or nighttime, while early birds function best during the morning time[8]. Moreover, M-type and E-type profiles are not just differentiated based on self-report measures solely but are robustly supported by physiological and biological correlations, such as, bodily temperatures, melatonin production and heart pace[9,10].

Piffer[1] proposed that eveningness/morningness may be the product of sexual selection. He found that male night owls reported a fourfold higher degree of sexual success compared to male early birds. Hence, the study concluded that eveningness is an evolved dimorphic feature in males as a consequence of their elevated potential reproductive capacity[11]. Although women need to be available for this mating process to occur, multiple copulations are not as reproductively beneficial to them since they can only become pregnant by one man at a time and during pregnancy, and to a certain extent lactation, they do not reproductively benefit from extra copulations. Thus, eveningness is viewed as a sexually evolved trait in men allowing night owls to energetically participate in nighttime social activities when the majority of sexually charged interactions take place[1].

Piffer[1] also suggested that eveningness may constitute a typical Fisherian mechanism, whereby, this trait is associated with healthy or advantageous genes which are continuously being selected by females, hence, sustaining its transmission generation after generation. Gianotti et al.[12] associated precarious and harmful lifestyle with E-types including substance abuse especially cigarettes and liquor amalgamated with caffeine products to assist in wakefulness due to their frenetic lifestyles. As a result, a majority of individuals may suffer from sleep loss which in turn may cause a variety of detrimental outcomes constituting depressive symptoms, mood fluctuations, predisposition to schizophrenia and physiological disturbances[13]. Hence, risky behaviour in night owls may function as an honest advertisement for choosy females of high-grade beneficial genes in males for the subsequent production of "sexy sons".

This research area is in its infancy. A full and global empirical survey of E-types and M-types is needed. Most importantly, E-type is not necessarily equivalent to always going out at night and socializing; they might actually stay indoors and watch a movie or surf the net during their optimum time of day. Moreover, although not they might be at their peak physical or mental state during the night time hours, M-types may due to social pressures or intrasexual competition[14] still go and stay out as late as E-types.

The current study

The present experiment is an extension of Piffer's[1] study. The main aim was to investigate whether eveningness is a sexually selected trait present in different cultures. Hence, the methodology involved surveying participants from a non-western culture, Sri Lanka, and comparing them with Sri Lankan individuals who have emigrated and are presently living in a western culture, Italy.

Eveningness/morningness was also studied in relation to well established dimorphic testosterone-linked attributes. Shoulder-to-hip ratio (SHR) is strongly correlated with reported number of sexual partners, age of virginity loss and the number of clandestine or adulterous affairs[15]. Hand Grip Strength (HGS) is another reliable measure of these features as well as a fitness indicator for a long healthy life expectancy and muscular bodily physique[16-18]. Hence, if eveningness is indeed a sexually selected trait one might expect it be associated with higher SHR and HGS.

The present study focused exclusively on males. The following hypotheses were examined: a) a higher mating success would be displayed by E-type men compared to M-type men; b) E-type men will have significantly higher SHR and HGS than M-types men; c) E-type men will experience greater sexual success (both in terms of flirting and copulations) than M-types; d) different patterns of male behaviour and reported female pref-

erence will be evident in western versus non-western participants.

RESULTS

Categorization of M-type and E-type participants: After inspecting a histogram of the MEQ scores, it was clear that only a small proportion of the current sample fell into the extreme tail ends of the distribution for morning to evening orientation. Hence, a 49/50 split criterion was employed where higher scorers ≥ 50 were designated as morning oriented and scorers of ≤ 49 as evening inclined[19]. As a consequence, 55 participants were allocated to the M-type group and 60 to the E-type group from the Sri Lanka based sample. Thirty-one participants from Italy were qualified as M-types and 33 as E-types.

The dependent variables of lifetime number of sexual partners, total number of flirting partners per week, and the amount of time engaged in night time activities were each analyzed with 2 (country of current residence: Italy/Sri Lankia) × 2 (MEQ type : morning/ evening) ANOVAs (Table 1). All reported *P*-values are two-tailed unless otherwise stated.

Lifetime number of sexual partners: There was a significant main effect for MEQ type in terms of the reported lifetime number of sexual partners, F (1, 175) = 13.178, $P < 0.001$. E-type participants reported a greater number of sexual partners (M = 2.6) than M-types (M = 1.26). There was also a main effect of country of residence, F (1, 175) = 19.086, $P < 0.001$. The men living in Italy reported a great number of sexual partners (M = 2.74) in contrast to those living in Sri Lanka (M = 1.12). The interaction between country of residence and MEQ type was -not significant, F (1, 175) = 1.963, $P = 0.163$, as E-types reported a greater number of sexual partners compared to M-types in both Italy and Sri Lanka.

Weekly number of flirting partners: There was no main effect for MEQ types in terms of the number of women they tend to flirt with, F (1, 175) = 0.744, $P = 0.390$. However, there was a significant main effect for country of residence, F (1, 175) = 22.86, $P < 0.001$, where the non-westerners engage extensively in this activity (M = 8.25) in comparison to the western individuals (M = 1.75). There was no significant interaction between Country of Residence and MEQ types, F (1, 175) = 0.384, $P = 0.536$.

Night time hours out per week: There was no main effect of MEQ types in terms of the number of night time hours spent out of the home, F (1, 175) = 0.31, $P = 0.86$. However, there was a significant main effect for Country of Residence, F (1, 175) = 14.056, $P < 0.001$, revealing that those men living in Italy spent more time out at night (M = 11.22) than the Sri Lankan group (M = 5.25). There was no significant interaction between Country of Residence and MEQ type, F (1, 175) = 0.726, $P = 0.395$.

Age: Obviously, age is a potentially important contributing factor to the number of sexual partners men can expect to achieve during their lifetime. Indeed, there was a significant positive correlation between age and the number of sexual partners among the sample of men living in Sri Lanka (r = 0.204, $n = 115$, $P = 0.014$). No such positive correlation was found in the sample of men from Italy (r = -0.073, $n = 64$, $P = 0.283$). However, this age effect did not constitute a confounding factor in the present study, since there was no significant difference in the ages of the E- and M-types either from Sri Lanka, $t(113) = 0.551$, $P = 0.583$; E-type M = 22.56 years, SD = 1.72; M-types M = 22.75 years, SD = 1.89 or from Italy, $t(62) = 0.438$, $P = 0.663$; E-types M = 25.12, SD = 3.36; M-types M = 24.71, SD = 4.13.

HGS and SHR: There was no significant difference between either the left or right HGS of E- versus M-type men living in Italy [Left hand: $t(62) = 0.589$, $P = 0.558$; M-types M = 39.39, SD = 8.71; E-types M = 40.55, SD = 6.99; Right hand: $t(62) = 0.579$, $P = 0.565$; M-type M = 41.00, SD = 9.10; E-type M = 42.18, SD = 7.17]. Nevertheless, there was a significant difference between the mean SHRs in the sample living in Sri Lanka, $t(113) = 2.21$, $P = 0.029$. On average the E-type men (M = 1.27, SD = 0.15) had higher SHRs than the M-types (M = 1.21, SD = 0.10). However, a comparable significant pattern was not found in the sample from Italy, $t(62) = 0.794$, $P = 0.43$ since both M-types (M = 1.25, SD = 0.19) and E-types (M = 1.29, SD = 0.22) from Italy displayed very similar means.

Tables 2 and 3 show the correlations between the morning and evening profiles of the western population with the testosterone linked attributes of SHR, HGS (left and right) and age of virginity loss. Interestingly, there was a significant and negative association between left hand grip strength and virginity loss

Table 1. Mean number of sexual partners, flirting partners and night time hours out for both M/E types in relation to their regional locations (SD in parentheses)

	Regional location			
	Western ($n = 64$)		Non-western ($n = 115$)	
	M-types ($n = 31$)	E-types ($n = 33$)	M-types ($n = 55$)	E-types ($n = 60$)
Sexual partners	1.81 (2.33)	3.67 (2.59)	0.71 (1.79)	1.53 (2.70)
Flirting partners	1.42 (1.36)	1.76 (1.35)	7.22 (10.77)	9.28 (11.34)
Night hours out	12.03 (10.98)	10.40 (9.19)	4.71 (8.91)	5.78 (11.35)

Table 2. Pearson correlations (r) for western population morning types between SHR, HGS and virginity loss age

	SHR	Virginity loss age	HGS (left)
SHR	-		
Virginity loss age	- 0.166 (25)	-	
HGS (left)	- 0.121 (31)	0.175 (25)	-
HGS (right)	- 0.176 (31)	0.130 (25)	0.827* (31)

*$P < 0.01$ (two-tailed)

Table 3. Pearson correlations (*n*) for western population evening types between SHR, HGS and virginity loss age

	SHR	Virginity loss age	HGS (left)
SHR	-		
Virginity loss age	0.103 (30)	-	
HGS (left)	- 0.071 (33)	-0.587** (30)	-
HGS (right)	- 0.156 (33)	-0.393* (30)	0.651** (33)

*$P < 0.05$ (two-tailed)
**$P < 0.01$ (two-tailed)

Table 4. The counts for the peak time in flirtatious behaviours regarding both typologies in their regional locations (percentages in parentheses)

	Peak time in flirtatious behaviours			
	Non-western typology			
	Morning (*n* = 41)	Afternoon (*n* = 19)	Evening (*n* = 23)	Night (*n* = 29)
E-types	18 (44%)	8 (42%)	18 (78%)	15 (52%)
M-types	23 (56%)	11 (58%)	5 (22%)	14 (48%)
	Western typology			
	Morning (*n* = 6)	Afternoon (*n* = 5)	Evening (*n* = 26)	Night (*n* = 25)
E-types	2 (33%)	5 (100%)	13 (50%)	13 (52%)
M-types	4 (67%)	0 (0%)	13 (50%)	12 (48%)

(r = -0.59, $n = 30$, $P = 0.001$) and right hand grip strength and virginity loss age (r = -0.39, $n = 30$, $P = 0.032$) for the E-type men. On the other hand, no significant correlations for any measures were obtained for the M-type males. There was, however, a positive correlation between SHR and age of virginity loss in both E-type (Pearson, r = 0.50, $n = 24$, $P = 0.012$) and M-types men (r = -0.59, $n = 13$, $P = 0.035$, Figure 5).

Additional Pearson correlations for the non-western sample assessing the relationship between SHR and age of first sex depicted a positive significant association between the two for the evening oriented individuals (r = 0.50, $n = 24$, $P = 0.012$, Figure 1). And, still significant but a negative correlation characterizing for the morning ones (r = -0.59, $n = 13$, $P = 0.035$, Figure 2).

Flirting and going out: Phi correlations were also conducted in order to determine the peak time of flirtatious behaviours engaged by the M-types and E-types as well as evaluating their preferred activity throughout the night hours. As shown in Table 4, 78% of the non-western E-type males reported a preference for flirting during the evening period, whereas the M-type men tended to prefer flirting during the afternoon (58%) and morning (56%) times (r = 0.270, $n = 112$, $P = 0.043$). Surprisingly, (Table 5) E-type individuals opted to spend more time at home after the sun sets (60%) compared to the M-types (40%), and indeed the latter seemed to display a more party predilection (52%), yet these results failed to yield a statistically significant difference (r = -0.114, $n = 115$, $P = 0.220$).

Comparably, the E-type western residents exhbited a slight tendency to opt for staying indoors (54%) compared to the M-type individuals (47%). Furthermore, a great disparity was not observed among the M-individuals and E-typologies and their party environment preferences (49% and 51%, respectively). Similarly, the evening inclined also described the afternoon as their most flirtatious phase, whilst for the early risers it was during the morning (67%). Yet these results were not statistically significant (Table 6).

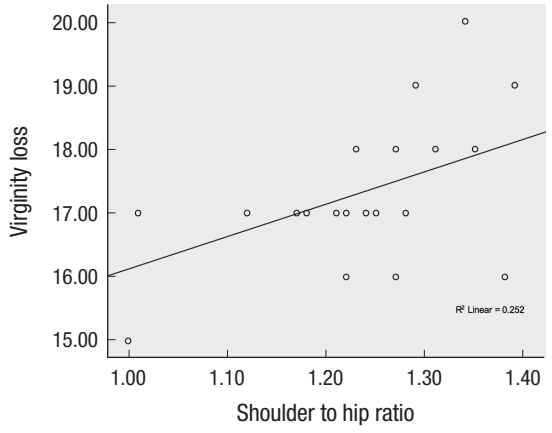


Figure 1. Positive correlations between SHR and age of virginity loss for E-types in non-western region.

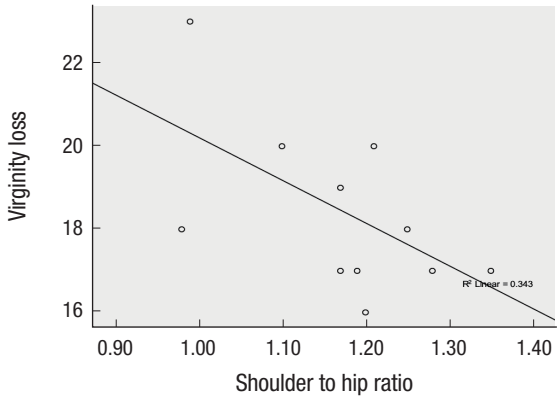


Figure 2. Negative correlation between SHR and age of virginity loss for M-types in non-western region.

DISCUSSION

The current study revealed significantly superior mating success in E-type men over M-type in both western (Italian) and non-western (Sri Lankan) societies. E-type mating superiority was more prominent in Italy than Sri Lanka. Due to less liberal sexual attitudes in Sri Lanka casual mating opportunities are much reduced compared to Italy. The men living in Sri Lanka seemed to somewhat compensate for their limited sexual access by flirting with women to a significantly greater extent than

Table 5. The counts for the preferred activity during the night time regarding both typologies in their regional locations (percentages in parentheses)

	Going out preference			
	Western typology		Non-western typology	
	Home ($n = 13$)	Party ($n = 51$)	Home ($n = 40$)	Party ($n = 75$)
E-types	7 (54%)	26 (51%)	24 (60%)	36 (48%)
M-types	6 (46%)	25 (49%)	16 (40%)	39 (52%)

Table 6. The counts for the peak time in flirtatious behaviors and preferred activity during the night time regarding both typologies in their regional locations (percentages in parentheses)

	Regional location			
	Western ($n = 64$)		Non-western ($n = 115$)	
	M-types ($n = 29$)	E-types ($n = 33$)	M-types ($n = 53$)	E-types ($n = 59$)
Morning	4 (14%)	2 (6%)	23 (56%)	18 (44%)
Afternoon	0 (0%)	5 (100%)	11 (58%)	8 (42%)
Evening	13 (45%)	13 (50%)	5 (22%)	18 (78%)
Night	12 (41%)	13 (52%)	14 (48%)	15 (52%)
	M-types ($n = 31$)	E-types ($n = 33$)	M-types ($n = 53$)	E-types ($n = 59$)
Home	6 (46%)	7 (53%)	16 (40%)	24 (60%)
Party	25 (49%)	26 (51%)	39 (52%)	36 (48%)

their Italian-based counterparts. Although not significant, there was a tendency for evening oriented men to flirt with more women than M-type men. Also, as one might expect, the men living in Italy went out at night more than the men from Sri Lanka. However, perhaps the most surprising finding was that M-type men from both cultures went out at night slightly more than E-types. Furthermore, the associations among the dimorphic traits and the evening typology did not fully coincide with the predicted hypothesis. Nevertheless, the relationship of HGS with the age of virginity loss in the western sample were in line with previous research[16]. While, the results obtained for the SHR in the Sri Lankan region can be explained via a cultural imposition.

The elevated sexual prowess of male Sri Lankan night owls compared to morning birds corroborates Piffer's[1] empirical findings with Italian natives. This study shows its occurrence and persistence among the same ethnic population but living in diverse cultural environments. E-types reported having twice as many sexual partners as M-types in both the western and non-western settings. Furthermore, this effect seemed independent of age since there was no significant difference between the ages of night owls and early birds in either sample.

Nevertheless, overall the western sample enjoyed elevated mating levels compared to the non-western participants. This was expected since Sri Lanka is a traditional society governed by the influence of culturally constructed taboos related to premarital relations whereby a bride's virginity is both expected and highly valued[20].

It is important to note that even though an individual might rate their optimum activity level as being during the evening, it does not automatically follow that they prefer to spend these hours going out to public venues, such as going to pubs, clubs, and bars[1]. Indeed, the present study found no significant difference between night-owls or early-birds from either country in terms of the degree they preferred to stay at home or go out after dark. Interestingly, it was the early-birds who rated themselves as more party inclined. Although the present study found that the western sample in comparison to the non-western reported going out more after dark, there was no significant main effect of MEQ type. This could be a product of intrasexual competition[14]. Although the evening hours may not be when early-birds function at their best, knowing that night time is the most important for courtship, they may strive to engage in as many social activities as possible in an attempt to compensate for their lower rate of sexual conquest compared to night-owls. As a direct consequence this clearly confirms that females actively choose to mate with evening men excluding any doubt that the E-type males sexual success is not just a by product of their possibility of being more out in the critical period and socializing with more women. This particular line of approach yields more reliable data than directly questioning females of their preference between the two typologies. This is due to research[21] which has shown that females' attraction for different male prototypes is governed by hormonal variations occurring throughout the menstrual cycle.

It has been suggested that women are attracted to men who possess a greater capacity for creative abstract thinking coupled with a more outgoing independent personality. Indeed, these traits have been linked to night-owls more than early-birds[22]. Nettle et al.[23] found a twofold increase in the sexual success of creative inspirational people compared to more conventional monotonous individuals. Night-owls are likely to provide a more favourable impression when socialising in the evening since this is their optimum period of alertness, creativity and positive mood. Moreover, they also have the opportunity to advertise their pool of good genes since they are able to maintain a costly feature like eveningness which is associated in the majority of cases with proneness to depression, schizophrenia, and even physiological disturbances[13]. Eveningness may function as an honest indicator of a robust immune system, which would be an advantageous to pass on to one's offspring[14,24].

The night-owls from Sri Lanka had significantly higher SHRs than the early-birds. SHR has been found to be positively correlated with the level of androgen circulating in the body, and testosterone is known to lower the maximum potential functioning of the immune system[14,15]. However, a similar positive correlation was not evident in the participants from Italy. A cer-

tain degree of similarity could be expected, since although the settings were different, both samples originated from the same Sri Lankan population. Likewise, there was no positive correlation between the right or left HGS and degree of eveningnes in the western sample. A variety of reasons may be contemplated for this arisen division commencing with the probable higher levels of stress or depression experienced by these individuals in having departed from loved ones and integrating into a new environment. Furthermore, the superior socio-economic status in the Italian country may lead this sample to engage in more alcohol beverages, smoking and consumption of fast food diets than their natives back home and all these factors are known to repress testosterone production affecting the person's body build[25].

Despite the slightly mixed pattern of SHR and HGS results, the fact that they were found to positively correlate with age of virginity loss supports previous research[16]. For instance, in the present westernized sample, the right and left HGS of E-types was negatively correlated with the age of first sexual intercourse. Moreover, the morning inclined individuals displayed no such significant correlation. Furthermore, the overall HGS means among the two typologies were similar suggesting it is the eveningness trait per se that drives a strong attractive basis. However, the expected pattern of relationship was reversed when examining the non-western location. Although, a significant correlation did emerge for the evening men between their SHRs and age of virginity loss but it was a positive one; so that as the SHR increased so did the age of first having sex. The M-types illustrated the exact pattern but in the reverse direction. These findings directly contradict the study hypothesis that E-type men with large SHRs will have sexual experiences at a significantly earlier age. Yet, these results should not be entirely dismissed as the man made cultural norms maybe exerting an upper hand influence. The age of first sex in the Sri Lankan population has been estimated to be around 15 years[26] which coincides with the high school period. The education timetable in this country starts fairly early from 8 am lasting until lunch break. As a consequence E-types are more likely to be favoured since being more energetic and vibrant during their optimum time of day and coupled with their prominent SHRs are more attractive to the choosy females. However, these females are limited in their judgement as after they have obliged to the schooling schedule they are exasperatingly escorted by an elderly of the family prohibiting any form of interaction with the male species[20]. Nevertheless, in the long run due to the progression of jobs and higher level education fields this pressurized chaperoning is diminished and limited[26]. This endows the opportunity to experience the E-types as well, and the net result being of the E-types having more sexual partners than morning individuals. This also provides an explanation why even possessing an attractive high SHR their age of first sex comes much later. An alternative explanation of the reason subsisting behind the earlier sex reported by the night owls with low SHRs may lie in their physically visible dimorphic trait not fully matured at around the mean age of 15. This support the rationale that the sole eveningness dimorphic trait per se is sufficient to drive the female's mating criteria.

Limitations and future work

The reversal of the predicted trend in the HGS measures of the non-westernized sample and age of first sexual encounter is difficult to explain. However, it should be noted that SHR and HGS are indirect measures of androgen levels. Future research might benefit from incorporating more direct measures of testosterone serum levels, such as from blood or saliva samples.

Numerous investigations[27,28] have established female's trade-off mating strategies; where dominant masculine men are favoured for short-term liaisons and more feminine docile men are preferred for long-term stable relationships. Female preference could be investigated in relation to male eveningness. Male participants could be directly questioned about the nature of their sexual partners' involvement with them; whether their relationships tend to be either short or long term. One could even test women directly by asking them to rate the physical attractiveness of male night-owls versus early-birds in photographic stimuli depending on speculated relationship duration. One could also investigate the facial features characterizing each type (e.g. proneness of E-types having more symmetry, averageness, dominant features) as a person's face has been shown to be a fundamental contributing factor when selecting a mate[27]. It would be particularly interesting to test not only young men or women from each location but also their parents' ratings of the most suitable spouse for their daughters since in Sri Lanka parents traditionally arrange marriages.

CONCLUSION

Overall, it can be ascertained that eveningness is an evolved sexually selected trait in males, emerging during puberty and clearly manifested in the adjustments to more delayed circadian sleep patterns[4]. This study proclaimed the "eveningness" trait as a principal attractive feature consistent among different cultures. The findings of this research also help to elucidate why social gathering practices favouring mate encounters are prominent during the night time. Individuals are not just merely conforming to social norms but actively constructing their environments driven by a genetic predisposition rooted in the evolutionary goal of reproduction and survival of the species.

METHODS

Participants

A sample of 197 male participants was recruited from two separate countries, Italy and Sri Lanka. 127 Sri Lankan participants with an age range between 20 and 31 (mean age = 22.7 years, SD = 1.8) came from vast and extended geographical regions of the Sri Lankan population and territory (e.g. Anuradhapura, Kandy, Colombo, Kurunegala, Polonnaruwa and Galle). Twelve participants were excluded from the final data analysis because they did not fully complete the sexual behavior questionnaire.

Seventy 18 to 32 year old (mean age = 24.8, SD = 3.9) participants came from Rome, Italy. They were actually originally Sri Lankan individuals who had been resident in Italy for at least 2 years. Six of these participants failed to complete all parts of the questionnaire, and as a consequence their data was excluded.

Selection of locations

A large proportion of the inhabitants in the island of Sri Lanka are Sinhalese (74%) with primary mother tongue language being Sinhala and the main religion being Buddhism (70%)[20]. There is a strong cultural taboo with regards to sexual unions before marriage and to the practice of extra-marital affairs. Moreover, strong parental imposition on their offspring's mating choices is prevalent[20]. Yet, premarital intimate relationships are not uncommon and a large scale study provided evidence by highlighting the elevated percentage of individuals between 10-19 years declaring to have had sexual unions, commencing at an earlier age for females (around age 14) than males (about 15 years)[26]. Therefore, the Sri Lankan inhabitants provide an optimum and apposite sample to investigate sexual behaviors in a non-western and traditional country.

Italy is a typical prosperous westernized country with more tolerant and open-minded views than those typically found in Sri Lanka, especially with regards to sexual behavior[20]. By directly comparing indigenous Sri Lankan males with Sri Lankan individuals residing in Italy, we could investigate the effect immediate surrounding cultural norms have on sexual attitudes and behavior.

Materials

Morningness – Eveningness Questionnaire (MEQ): For the purposes of the present study the standard MEQ was translated into Sinhalese by a professional native translator and subsequently a back translation was executed by an additional different interpreter which aided in validating the questionnaire. An Italian validated version of the MEQ[29] was also used (refer to Appendix 1 for sample copies).

Sexual Behavior Questionnaire (SBQ): This questionnaire, comprising of 16 questions, assesses an individuals' behavioral history with the opposite sex and was an extension of the questionnaire orginally developed by Piffer[1]. Examples of the questions were as follows, "How many sexual partners of the opposite sex have you had so far (excluding prostitutes)?", "At what age did you loose your virginity?", "How many times during the week do you tend to go out at night (after the sun sets)?"

The SBQ was translated into Sinhalese and Italian using the identical methodology applied to the MEQ (for complete questionnaire versions Appendix 2).

Physical measures

A Preston Hand Dynanometer provided a muscular grip force measure for each of the participants' hands. A sewing tape measuring strip was used to measure the shoulders and hips of each participant.

Procedure

Participants were tested individually thereby providing all the privacy required.

Shoulder and hip measurements were obtained using the sewing tape, following Gallup's procedure[15,16].

The grip strength values of each hand were achieved by first ensuring that the needle pointer of the gauge was resting at the 0 kg mark. The participants were then guided to hold the device with their left or right hand and given the option of resting their arm, but not their hand, on a table before being instructed to squeeze as strongly as possible. The strength rate was directly read from the gauge. The reset button was then pushed and after 3 minutes had elapsed the analogous steps were executed for the other hand. Each hand was measured twice to the nearest 1 kg value and the highest left and right hand records were utilized in the final analysis[16]. The SHR and HGS data were all recorded and placed within the participant's individually assigned sealed envelope. Upon completion of testing all envelopes were placed in a common box.

REFERENCES

1. Piffer, D. (2010). Sleep patterns and sexual selection: an evolutionary approach. *Mankind Q* 50, 361-375.
2. Gangestad, S.W., Thornhill, R., and Garver, C.E. (2002). Changes in women's sexual interests and their partners' mate-retention tactics across the menstrual cycle: evidence for shifting conflicts of interest. *Proc R Soc Lond B* 269, 975-982.
3. Cofer, L.F., Grice, J. W., Sethre-Hofstad, L., Radi, C. J., Zimmermann, L.K., Palmer-Seal, D., and Santa-Maria, G. (1999). Developmental perspectives on morningness-eveningness and social interactions. *Hum Dev* 42, 169-198.
4. Diaz-Morales, J.F., and Gutierrez Sorroche, M. (2008). Morningness-eveningness in adolescents. *Span J Psychol* 11, 201-206.
5. Kim, S., Dueker, G.L., Hasher, L., and Goldstein, D. (2002). Children's

time of day preference: age, gender and ethnic differences. *Pers Individ Dif* 33, 1083-1090.

6. Tynjala, J., and Kannas, L. (1993). Sleeping habits of Finnish school children by sociodemographic background. *Health Promot Int* 8, 281-289.
7. Chelminsky, I., Ferraro, F.R., Petros, T., and Plaud, J.J. (1997). Horne and ostberg questionnaire: a score distribution in a large sample of young adults. *Pers Indiv Differ* 23, 647-652.
8. Kerkhof, G.A. (1998). The 24-hour variation of mood differs between morning- and evening-type individuals. *Percept Mot Skills* 86, 264-266.
9. Kerkhof, G.A. (1985). Inter-individual differences in the human circadian system: a review. *Biol Psychol* 20, 83-112.
10. Gibertini, M., Graham, C., and Cook, M.R. (1999). Self-report of circadian type reflects the phase of the melatonin rhythm. *Biol Psychol* 50, 19-33.
11. Clutton-Brock, T.H., and Vincent, A.C. (1991). Sexual selection and the potential reproductive rates of males and females. *Nature* 351, 58-60.
12. Giannotti, F., Cortesi, F., Sebastiani, T., and Ottaviano, S. (2002). Circadian preference, sleep and daytime behaviour in adolescence. *J Sleep Res* 11, 191-199.
13. Ong, J.C., Huang, J.S., Kuo, T.F., and Manber, R. (2007). Characteristics of insomniacs with self-reported morning and evening chronotypes. *J Clin Sleep Med* 3, 289-294.
14. Cartwright, J. (2008). Evolution and human behavior, 2nd Edition., (New York: Palgrave MacMillan).
15. Hughes, S.M., and Gallup, G.G. (2003). Sex differences in morphological predictors of sexual behavior shoulder to hip and waist to hip ratios. *Evol Hum Behav* 24, 173-178.
16. Gallup, A.C., White, D. D., and Gallup, G.G. (2007). Handgrip strength predicts sexual behaviour, body morphology, and aggression in male college students. *Evol Hum Behav* 28, 423-429.
17. Rantanen, T., Harris, T., Leveille, S.G., Visser, M., Foley, D., Masaki, K., and Guralnik, J.M. (2000). Muscle strength and body mass index as long-term predictors of mortality in initially healthy men. *J Gerontol A Biol Sci Med Sci* 55, 168-M173.
18. Shoup, M.L., and Gallup, G.G. (2008). Men's faces convey information about their body and their behaviour: what you see is what you get. *Evol Psychol* 6, 469-479.
19. Natale, V., and Cicogna, P. (2002). Morningness-eveningness dimension: is it really a continuum. *Pers Indiv Differ* 32, 809-816.
20. Francoeur, R.T. (2001). The international encyclopedia of sexuality. Retrieved from the Web 2/3/10. http://www2.hu-berlin.de/sexology/IES/index.html.
21. Gangestad, S.W., and Thornhill, R. (1998). Menstrual cycle variation in women's preferences for the scent of symmetrical men. *Proc R Soc Lond B* 265, 927-933.
22. Diaz-Morales, J.F. (2007). Morning and evening types: exploring their personality styles. *Pers Indiv Differ* 43, 769-778.
23. Nettle, D., and Clegg, H. (2005). Schizotpy, creativity and mating success in humans. *Proc Biol Sci* 273, 611-615.
24. Frederick, D.A., and Haselton, M.G. (2007). Why is muscularity sexy? Tests of the fitness indicator hypothesis. *Pers Soc Psychol Bull* 33, 1167-1183.
25. Bryant, T. (2009). Decrease in testosterone- causes of low testosterone in men. Retrieved from the Web 20/3/10. http://www.articlesbase.com/mens-healtharticles/decrease-in-testosterone-causes-of-low-testosterone-in-men-1638069.html.
26. World Health Organization (2006). Sri Lanka Fact Sheet. Retrieved from the Web 10/3/10. http://www.searo.who.int/LinkFiles/Fact_Sheets_Srilanka_FS.pdf.
27. Little, A.C., Jones, B.C., and DeBruine, L.M. (2008). Preferences for variation in masculinity in real male faces change across the menstrual cycle. *Pers Indiv Differ* 45, 478-782.
28. Penton-Voak, I.S., and Perrett, D.I. (2000). Female preferences for male faces changes cyclically: further evidence. *Evol Hum Behav* 21, 39-48.
29. Mecacci, L., and Zani, A. (1983). Morningness-eveningness preferences and sleep-waking dairy data of morning and evening types in student and worker samples. *Ergonomics* 26, 1147-1153.