Human Nature ***17****(4): 405-418*

Height and reproductive success: how a Gambian population compares to the West

by

Rebecca Sear

Department of Social Policy
London School of Economics
Houghton St
London WC2A 2AE, UK

Tel: +44 (0) 20 7955 7348
Fax: +44 (0) 20 7955 7415
Email: r.sear@lse.ac.uk

Key words: height, reproductive success, Gambia

Short title: height and reproductive success

Bio:
Rebecca Sear is a Lecturer in Population Studies at the London School of Economics. She has degrees in Zoology and Biological Anthropology, and received her PhD from University College London in 2001.

ABSTRACT

In Western societies, height is positively correlated with reproductive success (RS) for men but negatively correlated with RS for women. These relationships have been attributed to sexual selection: women prefer tall men, and men prefer short women. It is this success in the marriage market which leads to higher RS for tall men and short women. We have already shown that the relationship between height and RS for women is quite different in a non-Western context. In a subsistence farming community in rural Gambia, height is *positively* correlated with reproductive success for women, largely due to the higher survival of the children of tall women. Here, the relationship between height and reproductive success is analysed for men in the same community. For these Gambian men, there is no significant relationship between height and the number of children they produce, although tall men do contract more marriages than shorter men. We conclude that environmental context needs to be taken into account when analysing human reproductive behaviour.

INTRODUCTION

Women like tall men. This has been demonstrated by laboratory tests of mate preference (Shepperd and Strathman 1989), in studies of lonely hearts ads (Pawlowski and Koziel 2002) and by observing which men women actually marry (Murray 2000). Two studies have shown that this success in the marriage market leads to higher reproductive success (RS) for tall men, in that they are less likely to remain childless and have more children than shorter men (Mueller and Mazur 2001; Pawlowski et al. 2000). This preference for tall men has been suggested to be adaptive. Height correlates positively with health, wealth and socio-economic status (Cavelaars et al. 2000; Silventoinen 2003; Silventoinen et al. 1999; Turrell 2002). Women who choose tall men are therefore choosing healthy and successful fathers for their children.

Men, on the other hand, appear to prefer short women. This preference is not perhaps as strong as the preference women have for tall men, and may be driven, at least in part, by a desire for relationships in which the man is taller than the woman (Gillis and Avis 1980; Pierce 1996). Nevertheless, in laboratory studies of mate preference (Shepperd and Strathman 1989) and in studies of lonely hearts ads (Pawlowski and Koziel 2002), tall women do seem less preferred as potential mates than shorter women. A recent study found that men considered short women to be more 'nurturing' than taller women, suggesting that they may be seen as a better reproductive bet than taller women (Chu and Geary 2005). This lack of marital success for tall women has been found to lead to a negative relationship between height and RS for women (Nettle 2002b). Again, this finding was interpreted as the result of adaptive mate preferences. Men are presumed to be attracted to those physical attributes which indicate high reproductive potential in women, such as low waist-hip ratio and symmetrical features (Furnham et al. 1998; Hume and Montgomerie 2001; Perrett et al. 1999; Singh 1993; Streeter and McBurney 2003; Symons 1992). Since tall height was not assumed to be an indicator of reproductive potential in women, then there was no reason why men should show a preference for tall women. Instead men choose relatively short women, perhaps so that they can appear to be dominant in the relationship.

The studies described above have all been carried out in Western societies. Much less is known about relationships between height, marital success and reproductive success in non-Western societies. Western societies have unusual demographic patterns in that, compared to non-Western populations, marriage tends to be late, rates of non-marriage are high, and fertility and mortality are both low. This difference in demographic patterns means the determinants of reproductive success may be different in Western and non-Western contexts, particularly for women. While the ability to successfully obtain a mate(s) is likely to be a determinant of men's reproductive success in all ecologies, in traditional societies marriage tends to be early and universal for women. Successfully bearing and raising children to reproductive age may then be more important for determining a woman's RS than whether or not she can find a mate (Strassmann and Gillespie 2002). We have previously presented evidence that the relationship between height and RS for women in a non-Western context is indeed different to that seen in the West (Sear et al. 2004). In a subsistence farming community in rural Gambia, taller women have higher RS than shorter women. Taller women have later first births than shorter women, demonstrating a trade-off between growth and reproduction in this society (Allal et al. 2004). But taller women have slightly shorter birth intervals and, most importantly, significantly higher survival amongst their children, so that overall taller women have more children surviving to adulthood than shorter women. Here, we present a similar analysis of the relationship between height and reproductive outcomes among men in the same community, to determine whether the positive relationship seen for men in the West holds in a traditional society.

DATA & METHODS

Data

The data were collected from a population in rural Gambia which has been studied by the UK Medical Research Council (MRC) since 1950. Ian McGregor began research in the area in 1950 and continued to collect data from this population until 1980 (McGregor 1991; McGregor and Smith 1952). He set up a demographic surveillance system in which literate villagers recorded all births and deaths that occurred in four villages in this region. He also conducted surveys at least annually, during which he took anthropometric measurements, as well as collecting medical information. During his annual visits he took care to trace all villagers he had seen previously, and over 30 years built up a database that contained much additional information alongside basic birth, death and anthropometric data, such as information on migration and marriages. Marriages, however, were only recorded systematically for two of the four villages, so we have only been able to construct marriage histories for a sample of the population. In 1975, the MRC Dunn Nutrition Unit (DNU) began their own research programme in this area, which continues today. As part of their research station, the DNU set up a permanent medical clinic providing free contraception and medical care. This very rapidly reduced mortality rates in this population and also resulted in a decline in fertility, though fertility was much slower to change than mortality (Lamb et al. 1984;

Sear 2001; Weaver and Beckerleg 1993). We have restricted most of our analyses to the period between 1950 and 1974, when this was a natural fertility, natural mortality population.

During this period, the population depended largely on subsistence agriculture. No contraception and little medical care was available, and both mortality and fertility were high (Billewicz and McGregor 1981). Women gave birth to around 7 children on average, but almost half died before reaching adulthood. Marriage was universal and occurred early for women (mean age at first birth was 18 years), and women remarried rapidly after widowhood or divorce. Men married later (mean age at first birth was 31 years), and aspired to polygynous marriage. By the age of 45 half of all men had had at least 2 wives, and of those that survived into their 70s only a quarter had only been married once. These marriages were relatively unstable (Thompson 1965). Divorce and remarriage were not uncommon, and a high proportion of marriages (~30%) ended without producing children (suggesting they were of brief duration). Choice of marital partner, particularly for women and particularly for first marriages, may have been relatively limited. Women were traditionally betrothed at a very young age, before puberty, and their husbands would have been chosen by parents or guardians, although they would have had more control over their subsequent marriages. The highly polygynous nature of the society meant that women were always in demand on the marriage market, and women usually spent their entire adult lives in the married state. Child-bearing outside marriage was therefore unknown. The levirate was practiced (widows marrying their dead husband's brother), and estimates suggest that around 40% of widows may have been inherited in this way (Thompson 1965). Even after their reproductive years had ended, women who were divorced or widowed would contract 'nominal' marriages, so that on their deaths they would have a husband to hand them into heaven.

Methods

The relationship between a man's height and a number of components of reproductive success were analysed for this population. Only the reproductive performance of those men who had reached at least 50 years of age was investigated. The same cut-off point was used for women when analysing the relationship between height and RS, because this restricted the analysis to post-reproductive women. Men do not have such an easily identifiable end to their reproductive lives, and the age of 50 was chosen so that the cohorts of men and women are comparable (and to maintain a reasonable sample size). Men's childbearing was almost complete by the age of 50: only 17% of children were born to fathers over the age of 50 during the study period. The man's age was included as a covariate in all statistical models, to control for the fact that some of these men will continue to reproduce after the age of 50. Anthropometric data were collected repeatedly from villagers between 1950 and 1980, so a mean height measurement was constructed for each individual by averaging all height measurements taken from that individual after the age of 20.

Fertility. The effect of male height on a number of different measures of reproductive performance was investigated: the probability of childlessness, age at first birth, total number of children born before 1975 (for those men who were not childless), and the number of these children who survived to the age of 14. The latter variable comes closest to an estimate of reproductive success, as it is an indication of the number of children who survive to reproductive age. Logistic regression was used to analyse the probability of childlessness. Linear regression was used to analyse age at first birth, number of children born and number of surviving children. In all models, the man's age at death or censoring was entered as a covariate (men without a known date of death were censored at the date when they were last known to be alive. All men still alive at the start of 1975 were censored on the 1st January 1975). Dummy variables were entered for village and cohort of birth to control for any differences in fertility between villages and between birth cohorts. The fertility of older men may be under-estimated, as accurate records of births were only collected from 1950 onwards. Including a variable for birth cohort should control for this potential bias. To test for a non-linear relationship between height and reproductive outcomes, a term for height squared was included in all models.

Marriage. The relationship between height and marital success was also examined. For this analysis only data from two villages was used, as complete marriage histories could only be constructed for two of the four villages. For these villages, there is information on who married whom, but not when these marriages took place. Since there is no data on the timing of marriages, the analysis cannot be restricted to marriages contracted before 1975 and instead the analysis includes all data collected between 1950 and 1980 when McGregor's project (and therefore collection of marriage data) ended. There is evidence to suggest marriage patterns have changed somewhat in recent years in this population, but this appears to have been a very recent phenomenon (*i.e.* age at marriage for women seems to have increased since the 1990s: N Allal, pers. comm.).

Marriage is virtually universal for this sample of men (only 4 had never married by the age of 50), so no statistical tests were run on the probability of marriage. Linear regression was used to determine whether there was a correlation between height and the number of marriages contracted, including in the sample only those men who had at least one marriage. The relationship between height and divorce was also investigated. Logistic regression was used to determine the effect of height on the probability of divorce. The dependent variable was coded as a dichotomy: never-divorced and ever-divorced (the sample included only ever-married men). Linear regression was used to examine the effect of height on the number of divorces. Again, all models controlled for village and cohort of birth, and the man's age at death or censoring (in this case, men still alive in 1980 were censored on the 1st January 1980). Both linear and non-linear functions of height were tested, the latter by including a height squared term in the model.

RESULTS

Descriptive analysis

Table 1 provides a summary of height and reproductive outcomes for men in this sample. On average men were just under 168cm tall (about 5'6). 15.8% of the whole sample were childless. Of those who had fathered at least one child, the average number of children born was around 8, and less than 5 of these survived to reproductive age. Of the men from the two villages where genealogical trees are available, only 4 (2.1%) had never married by age 50. Those men who did marry, had an average of 3.35 marriages each (NB: this is the total number of marriages contracted, not the number of current wives). Divorce was fairly common among these men: 42.9% had ever been divorced, and 36% of the divorced men had been divorced more than once. When only this sample of two villages is considered, a slightly lower proportion of men are reported to be childless and slightly more children are recorded. Thus suggests there may have been some under-reporting of fertility in the other two villages, though these differences are slight (and all analyses controlled for village so that any potential under-reporting should not bias the results of the statistical analysis).

Insert Table 1 about here

Statistical analysis

Fertility. There was no evidence for a significant relationship between any fertility outcome and height (Table 2 shows the parameter estimates and significance levels for the height variable in all statistical models). All relationships were in the predicted direction (i.e. taller men were less likely to be childless, had earlier first births, had more children in total and more surviving children), but none of these relationships was statistically significant (Figure 1). There was no evidence for a non-linear relationship between height and any of these reproductive outcomes: including a variable for height squared did not improve the fit of any of the models, so this variable was dropped from the final models presented in Table 2.

Insert Table 2 & Figure 1 about here

Marriage. Height was, however, correlated with the number of marriages contracted: tall men had significantly more marriages than shorter men. Height was not correlated with the probability of divorce, nor with the number of divorces. There was no evidence for a non-linear association between height and marriage outcomes, as the height squared variable did not approach significance in any of the models and was dropped from the final models.

That height is correlated with number of marriages but not number of children is somewhat surprising, given that the number of marriages contracted has a significant positive influence on the total number of children born to men (linear regression on total number of children born controlling for village and cohort of birth, and age: β for number of marriages=0.92, SE=0.24, $p<0.01$). However, the r^2 values for both this model (adjusted $r^2=0.10$) and the model correlating number of marriages with height (adjusted $r^2=0.15$) are rather small, suggesting only a small proportion of the variation in the number of children is explained by number of marriages, and a small proportion of the variation in number of marriages is explained by height. As marriage is relatively unstable in this society, counting the number of marriages may not necessarily be a good predictor of reproductive success (if many marriages are brief and childless).

DISCUSSION

In contrast to studies on Western populations, there is no relationship between male height and RS in this rural Gambian population. The relationship between height and components of RS is generally positive, implying that there may be some tendency for tall men to have higher RS. But if there is such a tendency, then it is very weak. The fertility rate in this Gambian population is much higher, and the variance in male fertility much greater, than that seen in the West (the most reproductively successful man in this population had 34 children). If a positive relationship between height and male RS were a robust and universal feature of human society, then it should have been much easier to demonstrate this relationship in such a high fertility society (Nettle 2002a).

This analysis is not methodologically perfect. We have analysed the age-specific fertility of men over the age of 50 rather than reproductive success, as we do not have a sufficiently long time-series of data to investigate completed fertility for a cohort of men. Older men, who began reproducing before good quality data collection began in 1950, may have under-reported fertility. But the latter problem, at least, also applies to women, yet we found a clear association between height and RS for women (Sear et al. 2004). A further potential confound that has not been controlled for is paternity uncertainty. There are no quantitative estimates of paternity uncertainty in this population, but the large age gap between spouses, and late age at marriage for men suggests some potential for uncertain paternity may exist. If tall men are strongly preferred for extra-marital affairs, then this could have the effect of strengthening the relationship between height and RS for men in this population. However, though the degree of paternity uncertainty does vary between populations, it is usually rather low (Anderson unpublished manuscript). We suspect the level of misattributed paternity in this database would have to be unrealistically high for a significant correlation between height and RS to emerge. Overall, the most parsimonious explanation is that there is no correlation between height and RS for men in this community.

We did find a significant positive relationship between height and number of marriages contracted for men. A potential explanation for this is that Gambian women have the same preferences for tall men that Western women do. Tall height should be an even better predictor of health and wealth in the Gambia than in the West. In a population such as this, where food is sometimes scarce and infectious disease prevalent, there will be a greater environmental component to height and therefore height should be more strongly correlated with good nutritional status and ability to fight off disease (Roberts et al. 1978). We have not tested the mate preferences of either sex in the Gambia, so cannot make confident claims about mate preferences here. However, we have previously tried to investigate whether height is used as a mate choice cue in the Gambia by looking at the relative heights of husbands and wives (Sear et al. 2004). In Western populations, there is a strong male-taller norm, maintained by the preferences of both sexes, so that husbands are almost invariably taller than their wives (Gillis and Avis 1980). Additionally, couples mate assortatively for height, *i.e.* tall men tend to marry tall women, and short men marry short women (Susanne and Lepage 1988). These patterns are both absent in the Gambia. There is no evidence for a male taller norm: in approximately 10% of all marriages the wife is taller than the husband (which is no different from the proportion of female-taller marriages that would be expected by chance). To provide a comparison with Western data, we performed exactly the same analysis on the UK dataset which was used to demonstrate a negative relationship between height and RS for women (data collected as part of the National Child Development Survey in the late 1960s: Nettle 2002b). The percentage of female-taller marriages in this UK population was considerably less than in the Gambia (3.7%), and this percentage was significantly different from that expected if couples had paired up randomly for height (Figure 2). There is also no correlation between the heights of husbands and wives in the Gambia (see also Roberts et al. 1978), although a significant positive correlation between the heights of husbands and wives can be seen in the comparison UK population (Figure 3, and see Mascie-Taylor 1987).

In the absence of any other evidence that height is used as a mate choice cue in the Gambia, it may be premature to suggest that the relationship between height and men's number of marriages is due to female preference for tall men. There are alternative explanations. For example, taller men may be wealthier, and they may be able to afford more wives than poorer men (marriage in the Gambia involves bridewealth – a payment from the groom's family to the bride's family). A further complication is the relative lack of control that women have over their marriage partners. While the same logic should apply regardless of who is choosing a woman's marital partner (*i.e.* parents should also prefer men who are healthy and wealthy for their daughters), factors other than physical appearance might be more important if parents are doing the choosing. Parents or other guardians may be more concerned with establishing and maintaining social ties and political networks that enhance their own status and success and/or that of the extended family as a whole. It is worth noting, however, that a colleague did conduct focus group discussions with groups of both men and women in these villages in 2001, which included some discussion of the kinds of qualities both sexes look for in a potential spouse. Neither sex mentioned any aspect of physical appearance, though traits such as industriousness, honesty, and resources featured prominently (N.Allal, pers.comm.). While the lack of any mention of physical attractiveness does not necessarily mean it is unimportant in mate choice in the Gambia, it perhaps suggests other characteristics may be of greater importance when choosing a marriage partner. In a subsistence society such as this, where both sexes need to engage in hard physical labour in order to provide for their children, evidence of an ability to perform this kind of work may be more important when choosing a spouse.

Regardless of whether underlying mate preferences are the same in the Gambia as they are in the West, the relationship between height and RS for both men and women is clearly different in this subsistence Gambian economy compared to that seen in Western populations. We suggest this is because the determinants of RS may differ substantially for both sexes in different ecological and social environments. For women in the West, success in the mating market appears to be a significant determinant of female RS. In many traditional societies, including the one studied here, all women marry, and marry relatively young, so that differential marital success is likely to matter little in determining RS. In these societies, where medical care is absent, child mortality may be much more important in determining RS. For men, success on the mating market is likely to be a key determinant of RS in all societies, but the precise nature of this relationship, and the importance of factors other than mating success may vary between populations. In the Gambia, given the frequent dissolution of marriage, the quality rather than the quantity of marriage may be important. Other factors, such as a man's health, may also be important. In societies without modern medical care, the ability to maintain one's own body condition is likely to be an important component of RS for both sexes. It may be argued that this is another reason for expecting a positive correlation between height and RS for men in this society, since in Western societies tall height is generally associated with lower morbidity and mortality (Barker et al. 1990; Marmot et al. 1984; Waaler 1984). But the height-mortality relationship has also been studied relatively little in the developing world, and analysis of this Gambian dataset suggests that the inverse relationship between height and adult mortality may not be found universally. There is no relationship between height and mortality in adulthood for men in these villages, and for women the relationship is U-shaped: both tall and short women suffer higher adult mortality than women of average height (Sear under review).

In summary, our results suggest that a positive relationship between height and RS for men, and a negative relationship between height and RS for women are not universal features of human reproductive behaviour. Yet the results of analyses performed on the height-RS relationship in Western populations have been used to explain the evolution of sexual dimorphism in the human species (Nettle 2002b), and the negative relationship between height and RS found for women in the UK has been used to support evolutionary arguments in two other recent papers (Chu and Geary 2005; Kanazawa and Novak 2005). We argue that constructing arguments to explain evolutionary processes in the human species based entirely on analyses performed on Western populations is extremely dangerous. Basing such arguments on the study of a single society from any other region of the world is also dangerous, however, we note that Western societies are additionally problematic in that the low mortality, low fertility and late marriage which characterise the West are likely to be very recent developments in the history of the human species. Reproductive strategies may differ according to social and ecological conditions, so that ignoring the importance of environmental context is not wise. In the context of mate choice, evidence for this has been presented by, for example, Furnham and Baguma (1994), Yu and Shepard (1998) and Wetsman and Marlowe (1999). All these authors have demonstrated different mate choice preferences in non-Western compared to Western societies. While a preference for mates who indicate high reproductive value may be universal, the precise indicator of reproductive value is likely to differ between societies. In order to make confident claims about the universal nature of a particular human trait, we concur with Wetsman and Marlowe (1999) that cross-cultural research is essential to test for these traits across a variety of ecological and cultural conditions.

ACKNOWLEDGEMENTS

Thanks to the Gambian Scientific Co-ordinating Committee and Ethical Committee for permission to use the data.

REFERENCES

Allal, N., R. Sear, A. M. Prentice and R. Mace

2004 An evolutionary model of stature, age at first birth and reproductive success in Gambian women. *Proceedings of the Royal Society of London, Series B, Biological Sciences* 271**:**465-470.

Anderson, K. G.

unpublished manuscript How well does paternity confidence match actual paternity? Evidence from worldwide nonpaternity rates.

Barker, D. J. P., C. Osmond and J. Golding

1990 Height and mortality in the counties of England and Wales. *Annals of Human Biology* 17**:**1-6.

Billewicz, W. Z. and I. A. McGregor

1981 The demography of two West African (Gambian) villages, 1951-75. *Journal of Biosocial Science* 13**:**219-240.

Cavelaars, A., A. E. Kunst, J. J. M. Geurts, R. Crialesi, L. Grotvedt, U. Helmert, E. Lahelma, O. Lundberg, A. Mielck, N. K. Rasmussen, E. Regidor, T. Spuhler and J. P. Mackenbach

2000 Persistent variations in average height between countries and between socio-economic groups: an overview of 10 European countries. *Annals of Human Biology* 27**:**407-421.

Chu, S. and K. Geary

2005 Physical stature influences character perception in women. *Personality and Individual Differences* 38**:**1927-1934.

Furnham, A. and P. Baguma

1994 Cross-cultural differences in the evaluation of male and female body shapes. *International Journal of Eating Disorders* 15**:**81-89.

Furnham, A., M. Dias and A. McClelland

1998 The role of body weight, waist-to-hip ratio, and breast size in judgments of female attractiveness. *Sex Roles* 39**:**311-326.

Gillis, J. S. and W. E. Avis

1980 The male taller norm in mate selection. *Personality and Social Psychology Bulletin* 6**:**396-401.

Hume, D. K. and R. Montgomerie

2001 Facial attractiveness signals different aspects of "quality" in women and men. *Evolution and Human Behavior* 22**:**93-112.

Kanazawa, S. and D. L. Novak

2005 Human sexual dimorphism in size may be triggered by environmental cues. *Journal of Biosocial Science* 37**:**657-665.

Lamb, W. H., C. M. B. Lamb, F. A. Foord and R. G. Whitehead

1984 Changes in maternal and child mortality rates in three isolated Gambian villages over ten years. *Lancet* 2 (8408)**:**912-914.

Marmot, M. G., M. J. Shipley and G. Rose

1984 Inequalities in death--specific explanations of a general pattern? *Lancet* 1**:**1003-1006.

Mascie-Taylor, C. G. N.

1987 Assortative mating in a contemporary British population. *Annals of Human Biology* 14**:**59-68.

McGregor, I. A.

1991 Morbidity and mortality at Keneba, the Gambia, 1950-75. In *Disease and Mortality in Sub-Saharan Africa*, R. G. Feacham and D. T. Jamison, ed. Pp. 306-324. Oxford: Oxford University Press for the World Bank.

McGregor, I. A. and D. A. Smith

1952 A health, nutrition and parasitological survey in a rural village (Keneba) in West Kiang, Gambia. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 46**:**403-427.

Mueller, U. and A. Mazur

2001 Evidence of unconstrained directional selection for male tallness. *Behavioral Ecology and Sociobiology* 50**:**302-311.

Murray, J. E.

2000 Marital protection and marital selection: Evidence from a historical-prospective sample of American men. *Demography* 37**:**511-521.

Nettle, D.

2002a Height and reproductive success in a cohort of British men. *Human Nature* 13**:**473-491.

Nettle, D.

2002b Women's height, reproductive success and the evolution of sexual dimorphism in modern humans. *Proceedings of the Royal Society of London Series B, Biological Sciences* 269**:**1919-1923.

Pawlowski, B., R. I. M. Dunbar and A. Lipowicz

2000 Evolutionary fitness: tall men have more reproductive success. *Nature* 403**:**156.

Pawlowski, B. and S. Koziel

2002 The impact of traits offered in personal advertisements on response rates. *Evolution and Human Behavior* 23**:**139-149.

Perrett, D. I., D. M. Burt, I. S. Penton-Voak, K. J. Lee, D. A. Rowland and R. Edwards

1999 Symmetry and human facial attractiveness. *Evolution and Human Behavior* 20**:**295-307.

Pierce, C. A.

1996 Body height and romantic attraction: a meta-analytic test of the male-taller norm. *Social Behavior and Personality* 24**:**143-149.

Roberts, D. F., W. Z. Billewicz and I. A. McGregor

1978 Heritability of stature in a West African population. *Annals of Human Genetics, London* 42**:**15-24.

Sear, R.

under review Size, body condition and adult mortality in rural Gambia: a life history perspective.

Sear, R., N. Allal and R. Mace

2004 Height, marriage and reproductive success in Gambian women. *Research in Economic Anthropology* 23**:**203-224.

Sear, R. S.

2001 *Evolutionary Demography of a Rural Gambian Population*. PhD thesis, University College London.

Shepperd, J. A. and A. J. Strathman

1989 Attractiveness and height: the role of stature in dating preference, frequency of dating, and perceptions of attractiveness. *Personality and Social Psychology Bulletin* 15**:**617-627.

Silventoinen, K.

2003 Determinants of variation in adult body height. *Journal of Biosocial Science* 35:263-285.

Silventoinen, K., E. Lahelma and O. Rahkonen

1999 Social background, adult body-height and health. *International Journal of Epidemiology* 28:911-918.

Singh, D.

1993 Body shape and women's attractiveness: the critical role of waist-to-hip ratio. *Human Nature* 4:297-321.

Strassmann, B. I. and B. Gillespie

2002 Life-history theory, fertility and reproductive success in humans. *Proceedings of the Royal Society of London Series B-Biological Sciences* 269:553-562.

Streeter, S. A. and D. H. McBurney

2003 Waist-hip ratio and attractiveness: new evidence and a critique of "a critical test". *Evolution and Human Behavior* 24:88-98.

Susanne, C. and Y. Lepage

1988 Assortative mating for anthropometric characteristics. In *Human Mating Patterns*, C. G. N. Mascie-Taylor and A. J. Boyce, ed. Pp. 83-99. Cambridge: Cambridge University Press.

Symons, D.

1992 On the use and misuse of Darwinism in the study of human behaviour. In *The Adapted Mind: Evolutionary Psychology and the Generation of Culture*, J. H. Barkow, L. Cosmides and J. Tooby, ed. Pp. 137-159. Oxford: Oxford University Press.

Thompson, E. D. B.

1965 *Marriage, Childbirth and Early Childhood in a Gambian Village: a Socio-Medical Study*. PhD thesis, University of Aberdeen.

Turrell, G.

2002 Socio-economic position and height in early adulthood. *Australian and New Zealand Journal of Public Health* 26**:**468-472.

Waaler, H. T.

1984 Height, weight and mortality: the Norwegian experience. *Acta Medica Scandinavica* Suppl. 679**:**1-51.

Weaver, L. T. and S. Beckerleg

1993 Is health sustainable? A village study in the Gambia. *Lancet* 341**:**1327-1330.

Wetsman, A. and F. Marlowe

1999 How universal are preferences for female waist-to-hip ratios? Evidence from the Hadza of Tanzania. *Evolution and Human Behavior* 20**:**219-228.

Yu, D. W. and G. H. Shepard

1998 Is beauty in the eye of the beholder? *Nature* 396**:**321-322.

LIST OF TABLES

LIST OF FIGURES

Table 1

Variable	All men		Men from villages A and B only	
	Mean	**Range**	**Mean**	**Range**
Height (cm)	167.83	151-184	167.78	151-184
Age (years)	60.74	50-87	61.55	50-88
% childless	15.8		9.6	
Age at first birth (years)	34.26	14-63	34.31	14-62
Total number of children born[1]	8.07	1-34	8.81	1-34
Number of children surviving to age 14[1]	4.69	0-20	5.26	0-20
% never married			2.1	
Number of marriages[2]			3.35	1-10
% ever divorced			42.9	
Number of divorces[2]			0.70	0-6
N	303		188	

[1] For those with least one child only

[2] For those with at least one marriage only

Table 2

Dependent variable	**Parameter estimate for height**[1]	**SE**	**p**	**Odds ratio**
Fertility				
Probability of childlessness[2]	-0.02	0.03	0.53	0.98
Age at first birth[3]	-0.01	0.08	0.93	
Total number of children[3]	0.07	0.05	0.17	
Number of surviving children[3]	0.04	0.03	0.19	
Marriage				
Number of marriages[3]	**0.04**	**0.02**	**0.02**	
Probability of divorce[2]	-0.01	0.02	0.51	1.01
Number of divorces[3]	0.01	0.01	0.45	

[1] All models also control for age, village and cohort of birth

[2] Logistic regression

[3] Linear regression

Figure 1

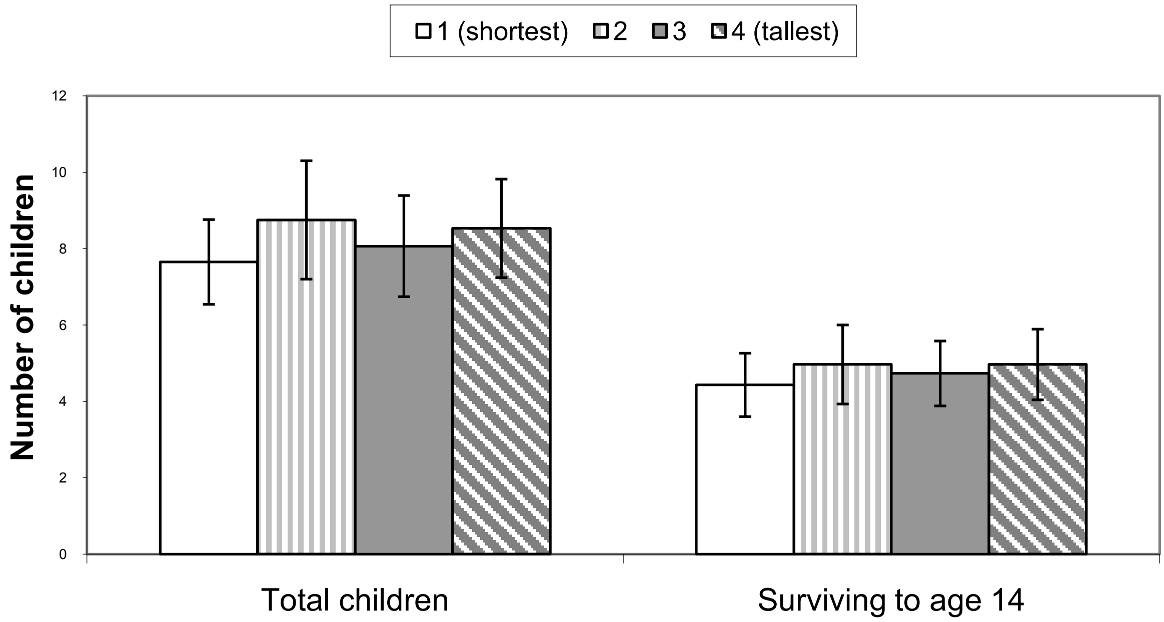

1 (shortest)
2
3
4 (tallest)
Number of children
0
2
4
6
8
10
12
Total children
Surviving to age 14

Figure 2

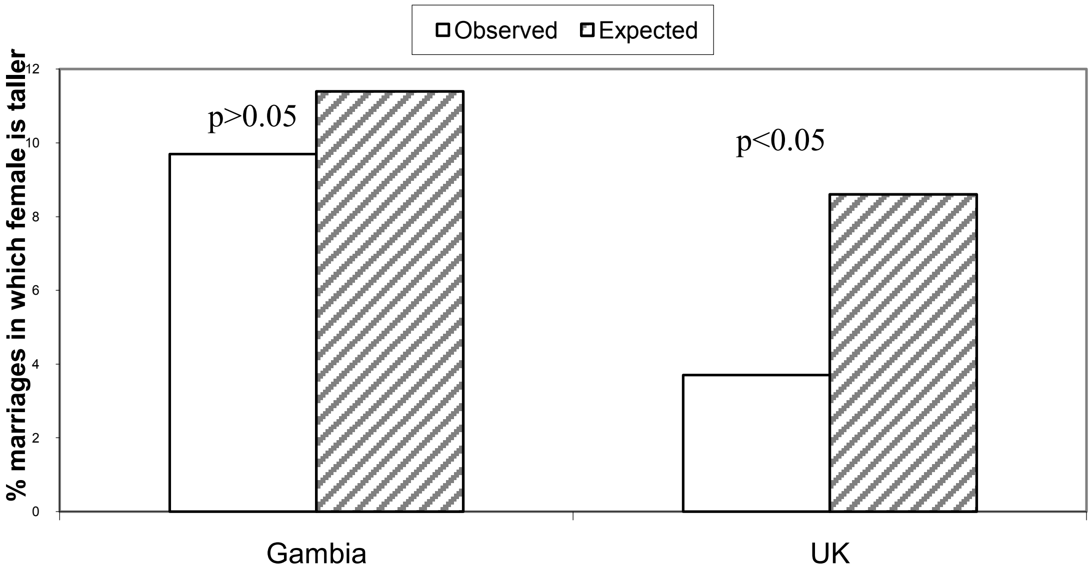
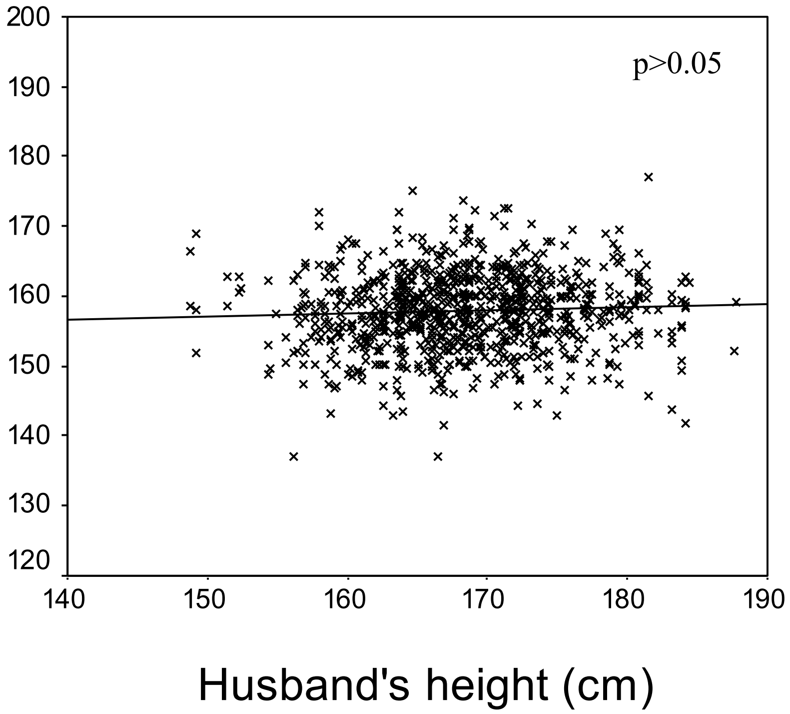

Observed
Expected
% marriages in which female is taller
12
10
8
6
4
2
0
p>0.05
p<0.05
Gambia
UK

Figure 3

(a) the Gambia



(b) UK