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For Debate . . .

Sport for tall

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Abstract

Eight new events (handball, basketball, and six rowing events) were introduced for women in the Olympic Games at Montreal in 1976. Of 187 women rowers who competed at Montreal, none was shorter than the mean height (162 cm, 64 in) of women aged 18-24 in the United States. In team events only two out of 250 participants were shorter than the reference mean. Even among the tall, it was the taller participants who won medals. What does the slogan "Sport for All" mean in this context? Moreover, the physical size required of champion rowers and basketball players is not to be found in some Asian, African, and Latin American populations.

International contests in many such events therefore seem to be at variance with the first charter of the Olympic Games. An independent reviewing body is urgently needed to examine the merits of man made rules in many sporting contests.

Introduction

There is an overwhelming bias in favour of the very tall in many athletics, swimming, and team contests.^{1,2} An urgent

need to review the sporting rules was suggested in 1968 but no action has been taken.¹ On the contrary, additional events have been introduced which are even more heavily biased. To focus attention on the problem results are presented for the following events which have recently been introduced for women: in rowing, sculls (single and double), coxless pairs, coxed quadruple sculls, coxed fours, and rowing eights and the team games handball and basketball. The choice of these events appears to be at variance with the slogan of the Sports Council, "Sport for All," and also with the first charter of the Olympic Games,³ which states: "They assemble the amateurs of all nations in fair and equal competition."

Data

The data on height and weight of the competitors taking part in the new eight events for women were derived from publications of the organising committee of the Olympics, Montreal 1976. The heights of women aged 18-24 in the United States were used as a reference population.⁴

Results

ROWING

Coxwains are known to be short and light, so coxswains from all women's rowing events are grouped separately in the table. As expected, they were 6.8 cm (2.7 in) shorter than the reference mean; the other mean differences ranged from +10.2 cm (4 in) for double sculls to +14.3 cm (5.6 in) for rowing eights. Out of 187 rowers from all events none was shorter than the reference mean. Only eight teams, all of them from North America and Europe, competed in

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the Olympic rowing eights. Even among the tall, it was the taller and heavier teams who won medals. The average weight of the gold medalist team was 13.6 kg (30 lb) greater than that of the non-medallist teams. The total weight advantage of the eight members of the winning crew was 109 kg (240 lb).

The standard normal deviates "Z," based on the null hypothesis of no difference between observed mean and reference mean (see table), ranged from 7.8 for single sculls to 18.7 for rowing eights; the probability levels associated with these are absurdly low ($p < 6 \times 10^{-6}$). Clearly the participants are not a "fair and equal" sample of the height distribution of the general population.

BASKETBALL, HANDBALL, AND VOLLEYBALL

In team events only two players out of 250 were slightly less tall than the reference mean and they belonged to teams who did not win any medals. The mean differences ranged from +8.3 cm (3.3 in) for handball to +15.8 cm (6.2 in) for basketball (see table).

Heights of women participants in newly introduced events at the Montreal Olympics 1976 and their differences from mean heights for women aged 18-24 in USA

	No	Mean (SD) height (cm)	Difference from reference mean	Z test	p Value
Sculls single	11	176.3 (4.7)	+14.3	7.8†	$< 6 \times 10^{-6}$
Sculls double	22	172.2 (3.9)	+10.2	7.8	
Coxless pairs	22	174.9 (4.0)	+12.9	9.9	
Coxed quadruple	36	174.5 (6.1)	+12.5	12.3	
Coxed fours	32	175.3 (3.6)	+13.3	12.3	
Rowing eights	64	176.3 (4.7)	+14.3	18.7	$< 6 \times 10^{-6}$
All rowers	187	175.1 (4.8)	+13.1	29.4	
All coxswains	25	155.2 (6.4)	-6.8	-5.6	
Basketball	72	177.8 (9.2)	+15.8	22.0	
Handball	82	170.3 (5.9)	+8.3	12.3	
Volleyball*	96	174.8 (5.1)	+12.8	20.6	$< 1.1 \times 10^{-6}$
Reference mean†		162 (6.1)			

*Volleyball was introduced earlier: it is included to give data for the complete set of women's team games in the Olympic Games.

†Women aged 18-24 in USA 1971-4.

‡Standard normal deviate $Z = \frac{176.3 - 162}{6.1/\sqrt{11}} = 7.77$.

MEDALLISTS

The heights of 186 medallists from newly introduced events are shown superimposed on the height distribution of the reference population in the figure. These events are so heavily biased that enthusiasts from below the mean height, constituting half the population, can hope only to be drawn as coxswains. In absolute numbers there are nine medallists below the mean compared with 177 above. The distribution of medallists shows clearly that the taller the person the better the chance of success: 51% of medals were won by competitors taller than 174 cm (68.5 in). In the United States only 2.3% of women are as tall as this. Interestingly, champion female rowers match the average heights for men in the United States.

Discussion

There is no reason to believe that physical fitness is related to height in people of normal stature. Gymnasts who are very short are extremely agile and fit. Internationally acclaimed gymnasts Olga Korbut, Nelli Kim, and Nadia Comanenci are extremely short (152 to 154 cm (60 in)), much below the average height for women—in fact around the seventh percentile (unpublished observations). Nevertheless, of course, absolute strength is related to size: shorter people are less strong than taller people.

EFFECTS OF GRADING AND NOT GRADING

In men boxing and wrestling were contested in ancient Greece during the Olympiads but without any weight divisions;

Distribution of heights of women aged 18-24 years (USA), and heights of medallists from nine events (see table). Vertical lines are drawn at 1, 2, and 3 standard deviations on either side of the reference mean of 162 cm. The first row gives the percentage distribution of heights within these ranges in USA (total female population in this age range 12 900 000). The second row gives the percentage distribution of 186 medallists (shown by black circles) and the third row calculates the relative ratio of medals per population. The heights of nine medallists below the mean relate to coxswains from three rowing events. The ratios show a J shaped trend with lowest representation for the range of heights 156-162 cm (61-64 in) just below the mean and the highest for the tallest group exceeding 180 cm (71 in), a 4500-fold increase.

size and strength were considered prime qualifications. The ninth Marquess of Queensberry introduced the system of grading in boxing by weight in 1865. The division into classes according to weight greatly extended the sizes and numbers of men able to engage in championship contests.^{5,6} The number of categories in boxing increased from seven in 1904 to 11 in 1968, and in wrestling there are now 11 weight divisions. As a consequence we have champion boxers ranging in height from 150 cm (59 in) among light flyweights (under 48 kg (106 lb)) to 197 cm (77.6 in) among heavyweights (over 81 kg (179 lb)).

In contrast, throwing events are conducted in much the same way as in ancient Greece, without any weight division. Male shotput medallists have an average weight of 126 kg (278 lb), and because of the high correlation between weight and height they also happen to be very tall—193 cm (76 in)—only 0.5% men in the United States being taller than this.

A question naturally arises: if weight confers such an advantage in boxing, wrestling, and weight lifting that grading is needed to encourage competitive participation of individuals of all sizes, why should events such as throwing and rowing, in which the advantage of size is similar, lack such a grading system? Lighter crews would like to row competitively, and in some countries lightweight rowing is traditional. Grading by weight in international competition would provide an enormous boost to skilled and keen rowers who through no fault of their own cannot match larger people in open competition.⁷

INNATE DISADVANTAGES

Height varies among nations. Japanese women are on average 10 cm (4 in) shorter than North American women. Twelve women gold medalist volleyball players from Japan ranged in height from 169 to 180 cm (66.5-70.9 in). Their shortest player was 7 cm (2.7 in) taller than the reference mean of USA women and 17 cm (6.7 in) taller than national mean for Japanese women. Fewer than 0.3% of women from Japan would be expected to

be taller than 169 cm. This indicates that within every country selection in height biased events is primarily from among those who satisfy a minimum standard of height which is far above the average of the population.

In volleyball the Japanese have both mastered the technique of playing and been able to select players of the right physique. But in basketball there was an insuperable problem: the gold medallist Russian team (average height 183.4 cm (72.2 in)) was much taller than the Japanese (171.8 cm (67.6 in)). Six of the 12 listed players from the winning team were taller than the tallest Japanese, with heights of 185, 185, 190, 192, 193, and 210 cm. On the basis of a normal distribution a female height of 190 cm or more in Japan amounts to a standard normal deviation of about 6. Such heights do not occur among Japanese women. Similarly the tallest girl from the winning Russian team—at a height of 210 cm (82.7 in), practically worthy of entry in the *Guinness Book of Records*—is a chance phenomenon of extreme rarity in the whole world. She helped tremendously in her team's winning of the gold medal.

SPORTS FOR ALL?

The histories of basketball⁸ and volleyball⁹ indicate that these games were intended primarily for the general population. James Naismith, a physical education instructor at the International Young Men's Christian Association, USA, invented basketball in 1891 for the benefit of students to relieve the boredom of routine exercises in gymnasium classes. Its value for general physical training is widely recognised. Despite sound motivation, the effect on attendance was disastrous: from a class of 50-60 members the basketball court was monopolised by 10-19 people. The game was banned by various associations because the outcome of contests created ill feeling among members. Later, professionals took a keen interest in the game, and coaches began to recruit and train tall boys from schools to build their teams from among the tallest. Initially an attempt to introduce basketball was rebuffed by the US Olympic committee in 1932, but four years later it gained entry in Berlin.

William Morgan, physical director of the YMCA, invented volleyball in 1895, primarily to attract middle aged businessmen who found the new game of basketball too strenuous.⁹ The game was widely accepted by both sexes in schools, in industry, and in the armed forces. Soon the game spread to other countries, and in Asia the game is played with a lower net to cater for the shorter stature of Asians. The first world championship for men was held in 1949 with an official net height of 2.43 m (96 in). The official net height for women is 2.24 m (88 in) and for younger players 2.13 m (84 in).

PHYSIQUE

Body weight varies with height and frame size. Very broadly, within each height grouping three body frame sizes are defined: small, medium, and large. At a height of 175 cm (70 in) champion women rowers with their large frames are about 19 kg (42 lb) heavier than small framed 1500 m runners (unpublished observation). The additional weight is most likely to be in form of muscle mass on a larger frame to provide energy from anaerobic metabolism. By their very build endurance runners cannot become rowers and vice versa. These restrictions are natural and it would be unwise to advocate "All Sport for All." Nevertheless, it is essential to distinguish between restrictions imposed by natural build and those imposed by man made rules.

Physique is just one of the essential factors in a chain along with many others in the making of a good athlete: physiology, psychology, motivation, training, and coaching facilities are some of the other important variables. A chain can only be as strong as its weakest point. It needs emphasising that, though an ideal physique is not sufficient by itself, its lack even in the

presence of other desirable attributes may be a serious handicap to a potential enthusiast. Although selection is based on performance, in the events under discussion those who perform better are also taller. As a consequence thousands of aspirants of average height who are probably extremely good for their height are likely to be systematically screened out of many such events.

The new events and games are at variance with the primary objective—namely, to increase physical fitness in the general population. The well intentioned aim of the Sports Council "Sport for All" campaign will founder if only taller people stand a chance of success in competition. Moreover, because of a large international variation in height, events with a serious height bias violate the aim for internationalism expressed in the first charter of the Olympic Games. The size required of champion rowers, throwers, and basketball players is not to be found in all Asian, African, and Latin American populations.

CHANGE THE RULES

The rules need changing. Nevertheless, very emotional objections are raised to any suggestion of a change. The attitudes of seemingly reasonable people vary from indifference to allusions to the administrative difficulties of organising sport within categories. A few tend to dismiss pleas for grading on the ground that if a height classification is introduced for an event there will be a demand for a further classification by weight or by some other variable. But it is ridiculous to suggest a marathon race for heavyweights or discus throwing for underweights. A few contend that if a person is good enough he or she can make it to the top no matter what the handicap. If so, why are rowers of average height not found in open competition? Some organisers may well fear that if grading is introduced much charm will be robbed from the spectacular sports where the giants participate and the rest of the population watch. But spectacular sport will always remain attractive; the introduction of grading has not diminished the wide appeal of heavyweight boxing.

It is indeed surprising that so many enjoyable sporting activities are kept as the exclusive preserve of the very tall. There is an urgent need for an independent reviewing body to examine the merits of man made rules in the newly introduced and indeed in many older, events, at both national and international levels. The existing rules are unfair and discriminatory and ways must be found to remedy the seriousness of height bias in competitive sport.

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