

has given advice: on public health in 1627; on plague in at least five epidemics; on cholera in the nineteenth century. The College was referred to as "the natural guardian of the public health." It gave excellent advice (spontaneously) on the gin-drinking of the eighteenth century. The College's reports on smoking, from the one on home-grown tobacco in 1619 to the one drawing public attention to the effect of smoking on lung cancer in 1962, are typical of work of this sort done in the public interest throughout the ages.

The first attempt to bring order into the chaos of pharmacy was made by the College when it published the *Pharmacopoeia Londinensis* in 1618, a far more difficult process to start than

modern doctors would appreciate. Subsequent revisions appeared at intervals until the Medical Act of 1858 transferred the duty to the British Pharmacopoeia Commission of the G.M.C.

And lastly, perhaps the most important of all, the College never forgets the injunction of William Harvey not only "to search and study out the secrets of Nature by experiment," but also "to continue in mutual love and affection amongst themselves, without which neither the dignity of the College can be preserved, nor yet particular men receive that benefit by the admission into the College which else they might expect, ever remembering that *Concordia res parvae crescunt, discordia magnae dilabuntur*."

Unfairness of Certain Events in the Olympic Games

T. KHOSLA,* M.Sc

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Summary: Boxing, weight-lifting, wrestling, and judo are graded events in that opponents are matched by weight. If protection were to be denied by removing this restriction such sports would overwhelmingly favour the heavyweights. Data on Olympic winners show that many running and jumping events are seriously biased in favour of the very tall. It is suggested that the rules of these events should be revised to include a grading by height. This would remedy an element of unfairness in many athletic contests, beginning at school.

Introduction

Bodyweight has long been recognized as an important variable in boxing, weight-lifting, and judo, to the extent that contestants are matched within officially defined weight classes. In American football weight is often the factor which decides team selection. In basket-ball it is height. Since height and weight are highly correlated, it follows that enthusiasts of average or less than average height can aspire to become champion boxers, wrestlers, or weight-lifters, but tend to be debarred from participating in such sports as American football and basket-ball. Events in which weight classes are officially recognized are, in this sense, fairer or more sporting than certain other events in which they are not.

In what follows it is shown that in many running and jumping athletic contests there is an overwhelming bias in favour of the very tall. In events of this type participants of average or less than average height have, in effect, lost before they have begun.

Data

Hirata (1966) has published the average height and weight (but without standard deviation) of participants for each event in the Tokyo Olympics of 1964, and also the height and weight of the corresponding winners. In addition, Hirata and Kaku (1964) have provided data on the winning athletes from the Olympics held in Rome in 1960. The analyses in this paper are based on the data in those publications.

In Table I the Olympic events are divided into two broad categories: closed and open. The closed events officially

recognize that the heavier weights have an advantage over the lighter weights: the open events do not recognize any form of advantage.

TABLE I.—Closed and Open Olympic Events

Open Events		Closed Events	
			No. of Classes
Throwing	Hurdling	Boxing ..	10
Shot put	Short-distance	Wrestling ..	8
Discus	Steeplechase	Judo ..	4
Hammer		Weight-lifting ..	7
Javelin	Jumping		
	High		
Running	Long		
Short-distance	Triple		
Middle- and long-distance	Pole vault		
Marathon			
	Swimming, gymnastics, etc.		

Closed Events

In amateur boxing, except for the heavyweight class, in which the upper boundary of weight is open, contestants are "fairly" matched, and 10 weight classes are recognized: fly, bantam, feather, light, light-welter, welter, light-middle, middle, light-heavy, and heavy. It is clear from Fig. 1 that, even within each of these narrowly defined classes in the Olympics; weight is considered of such importance that contestants regulate their own weight so that it lies just within the permitted maximum for their class.

In the heavier classes for weight-lifting, wrestling, and judo the upper boundary of weight is open. Table II shows that the Olympic winners in these heavyweight classes are much heavier than the average for all participants in the corresponding events. Table III shows the standing height of gold medallists from the United States and Japan.

TABLE II.—Weights of Winners and Average Weights of Participants in the Heavyweight Categories of Some Olympic Events

Event	Weight of Winner (lb.)	Average Weight of Heavy-weight Participants (lb.)	Difference (lb.)
Boxing ..	196	193	3
Wrestling (free style) ..	234	226	8
Wrestling (Graeco-Roman) ..	298	254	44
Judo* ..	265	230	35
Weight-lifting ..	346	256	90

* "All weights" class.

* Lecturer in Medical Statistics, Welsh National School of Medicine, Cardiff.

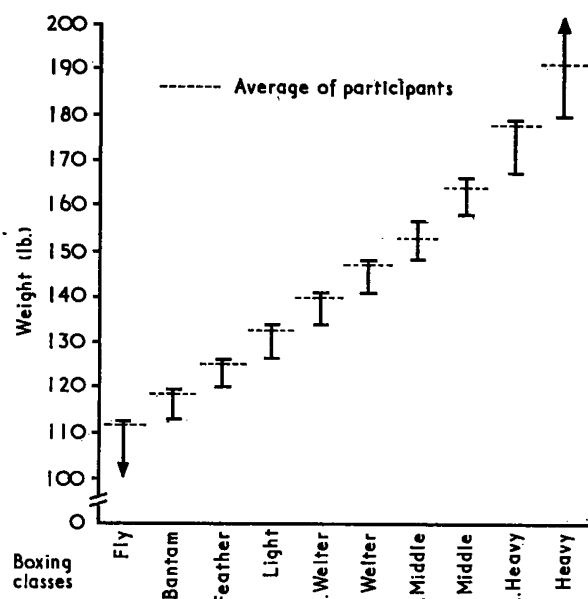


FIG. 1

TABLE III.—Standing Height (inches) of Gold Medallists* from the United States and from Japan

United States			Japan		
Event	Category	Height (in.)	Event	Category	Height (in.)
Heavyweight boxing ..	Open	71	Bantamweight boxing	Closed	65
Athletics			Wrestling (Graeco-Roman)		
(a) 100 metres ..	Open	72	(a) Flyweight ..	Closed	63
(b) 200 metres ..	Open	75	(b) Bantamweight ..	Closed	64
(c) 400 metres ..	Open	73	Wrestling (Free style)		
(d) 5,000 metres ..	Open	72	(a) Flyweight ..	Closed	64
(e) 10,000 metres ..	Open	71	(b) Bantamweight ..	Closed	65
Hurdles			(c) Featherweight	Closed	63
(a) 110 metres ..	Open	70	Judo		
(b) 400 metres ..	Open	72	(a) Lightweight ..	Closed	65
Pole vault ..	Open	72	(b) Middleweight ..	Closed	67
Throwing			(c) Heavyweight ..	Closed	68
(a) Shot put ..	Open	76	Weight-lifting (featherweight)	Closed	61
(b) Discus ..	Open	76	Gymnastics (average of 4 separate events)	Open	64
Swimming					
(a) Average of 4 separate events	Open	73			
(b) Spring dive ..	Open	70			
(c) High dive ..	Open	69			

* Team events are excluded (basket-ball, relay, etc.).

Table IV and Fig. 2 give the trends for the average weight-for-height of participants in each of the 10 boxing classes, and those (7 in weight-lifting; 8 in wrestling) in the other closed events. The unidirectional trends in relation to weight, height, and class in all these imply that progressively heavier weight groups are also on average progressively taller. However, for the same height the boxers are lighter than the wrestlers, and in turn the

TABLE IV.—Average Weights and Average Heights of Participants in Boxing, Wrestling (Graeco-Roman*), and Weightlifting Classes of Closed Events

Boxing			Wrestling			Weight-lifting		
Class	Weight (lb.)	Height (in.)	Class	Weight (lb.)	Height (in.)	Class	Weight (lb.)	Height (in.)
Fly ..	112	63.6	Fly ..	117	62.2	Bantam	124	61.8
Bantam	119	64.4	Bantam	132	63.8	Feather	133	63.3
Feather	125	65.5	Feather	142	64.8	Light	150	64.6
Light ..	135	66.7	Light	154	66.9	Middle	169	66.7
Welter	142	67.9	Welter	175	68.9	Light	181	67.3
Welter ..	149	68.7	Middle	190	70.7	Heavy	200	67.7
Light middle	153	68.9	Light	212	71.9	Heavy	256	70.1
Middle	164	69.7	Heavy	254	74.4			
Light heavy	179	71.3						
Heavy ..	193	73.4						

* Freestyle wrestling follows a similar trend.

wrestlers are lighter than the weight-lifters. Some boxers are no taller than 64 in. (162.5 cm.) and some weight-lifters and wrestlers are even shorter. Flyweight Olympic champions are about 63 in. (160 cm.) tall. In other words, shortness does not debar enthusiasts from aspiring to become champions in closed events, because they know they will be matched (indirectly) with contestants of their own or similar height.

Open Events

It is well known that Olympic throwers (shot put, discus, hammer, and javelin) tend to be "heavyweights." Winners among them are for the most part even heavier than the average weights for the events (Table V), while the throwers are also very tall and the winners among them are usually even taller than the average height for the events (Table VI). The shortest

TABLE V.—Weights of Winners and Average Weights of Participants in Throwing Events

Throwing Events	Weights (lb.)		
	Winners		Participants
	Rome	Tokyo	Tokyo
Shot put ..	240	260	233
Discus ..	225	260	226
Hammer ..	209	227	213
Javelin ..	225	176	184

TABLE VI.—Heights of Winners and Average Heights of Participants in Throwing Events

Throwing Events	Heights (in.)		
	Winners		Participants
	Rome	Tokyo	Tokyo*
Shot put ..	74.8	76.0	74.9
Discus ..	75.2	76.0	74.5
Hammer ..	72.4	73.6	71.9
Javelin ..	73.6	70.1	72.1

* Average of teams (all events). United States, 71.8; Britain, 70.1; Japan, 67.8

winner (javelin) is 70 in. (178 cm.) tall; the others stand well over 6 feet (183 cm.). From Table VI it is clear that Japan is unlikely ever to produce an Olympic winner in the shot put, discus, or hammer events. A Japanese contestant might possibly be able to satisfy the criterion of weight but not that of height, also demanded for a winner.

Table VII gives the average heights of participants in the running events. In long-distance events (10,000 metres and marathon) some champions have been of no greater height than the average for their class, but in the shorter-distance events champions are always considerably taller than the average for the events. This does not imply that the tallest participant will be the winner, but it does mean that participants below the average of the group are certain losers.

TABLE VII.—Heights of Winners and Average Heights of Participants in Running Events

Event	Winners		Participants
	Rome (in.)	Tokyo (in.)	Tokyo (in.)
100 metres ..	71.7	72.1	68.9
200 ..	70.9	75.2	69.7
400 ..	72.8	73.2	70.1
800 ..	70.9	70.5	70.2
1,500 ..	71.7	70.5	69.4
5,000 ..	70.9	72.4	68.7
10,000 ..	68.1	70.9	68.0
Marathon ..	66.9	69.7	67.1

Except for steeplechasing (3,000 metres) all participants in the jumping events are very tall (Table VIII), and among them the winners are usually even taller. The shortest winner is 70 in. (178 cm.) tall; all others stand over 6 feet (183 cm.).

TABLE VIII.—Heights of Winners and Average Heights of Participants in Hurdling and Jumping Events

Event	Winners		Participants
	Rome (in.)	Tokyo (in.)	Tokyo (in.)
Hurdling			
110 metres	72.8	70.1	72.1
400 metres	72.1	72.1	71.0
3,000 metres steeplechase ..	67.7	68.5	68.0
Jumping			
High	73.2	72.4	73.3
Long	73.2	74.4	70.7
Triple	72.4	72.1	70.4
Pole vault	74.8	72.1	70.1

This built-in bias in favour of the very tall in most athletic events imposes an unfair handicap on the performance of many of the competing nations. The average Asian, for example, is very much shorter than the average European. And indeed the average height of the male teams in the Tokyo Olympics ranged from 62.6 in. (159 cm.) (Nepal) to 71.8 in. (182.4 cm.) (United States).

Some of the consequences of this unfairness are highlighted in Table III, which gives particulars of the events won by the United States and Japan. Of the 14 gold medals won by Japan listed in the table, 10 are for protected (closed) events, the remaining 4 are for gymnastics. All the United States gold medals are for open events. The tallest Japanese winner (68 in. ; 173 cm.) is one inch (2.5 cm.) shorter than the shortest United States medallist.

Discussion

The results show quite clearly that, with a few exceptions such as the long-distance events, most of the athletic events listed in the open categories in Table I are biased in favour of the very tall. This is true for female athletes as well as for male athletes. These Olympic events are unfair to shorter participants, and therefore unfair to the shorter nations. To compare the number of gold medals won by the United States with the number won by Japan tells us little about the relative athletic abilities of these two nations. As Table III shows, they win medals in quite different events. Japan would be out of the race for Olympic gold medals if protection were withdrawn from the closed events.

It is of course not surprising that tall athletes have a clear advantage in most athletic events. As leg length is positively correlated with height they can take longer strides. A shorter participant has to increase the frequency of strides to keep pace with his taller opponents. This calls for far greater effort in sprinting. In addition, shorter athletes have the handicap of lower lung volume, which is positively correlated with height, so that a man of 72 in. (183 cm.) standing height has 35% more lung volume than one of 62 in. (157.5 cm.) (Lowe *et al.*, 1968).

There is good evidence (Tanner, 1962) that in Western European countries the height of adult males has been increasing by about one inch (2.5 cm.) per generation since 1850, and that in Britain an increase of the same magnitude is still in progress (Khosla and Lowe, 1968). Tanner (1964) reports that Rome Olympic athletes in 1960 were much taller than athletes in the 1928 Amsterdam Olympics: on average at Rome the middle-distance runners were 3 in. (7.6 cm.) taller and the throwers 4 in. (10 cm.) taller than the comparable groups in the Amsterdam Olympics. It is not surprising that over the past 40 years many records have been broken, and it seems likely that they will continue to be broken for some time to come.

Fairness should surely be a guiding factor in the International Olympics. It may be argued that boxing and wrestling demand special safety measures to protect the lighter weights from coming to bodily harm if matched with heavier weights.

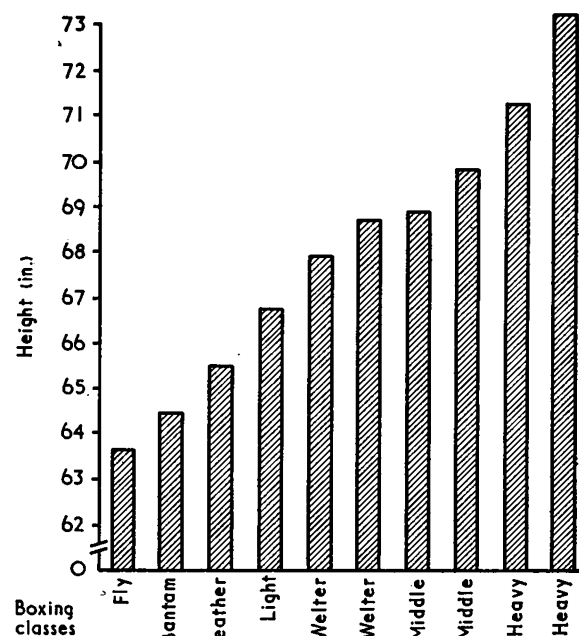


FIG. 2

But in weight-lifting no risk is directly caused by the opponent. Yet weight-lifting is fairly contested and the throwing events are not. It is possible for a weight-lifter shorter than 61 in. (155 cm.) to become a champion in the feather-weight class, and there are short (62 in. ; 157.5 cm.) and tall (74 in. ; 188 cm.) champion wrestlers. In effect the closed events cater for a full range of heights. The throwing events, however, are "open." Champion discus-throwers are over 74 in. (188 cm.) tall, having the same body dimensions (weight and height) as those of tall champion wrestlers. In the same way champion javelin-throwers have body dimensions similar to those of heavyweight boxers (Table IV). Short persons can become champion boxers, wrestlers, or weight-lifters in the flyweight class because they are "fairly" matched with contestants of their own build. If these events were "open" only the tall would stand any chance of winning, a hypothetical situation now actually observed among throwers.

Short champion throwers, runners, hurdlers, and jumpers are waiting to be discovered. Within every nation shorter enthusiasts, however athletically able, are systematically screened off by a process of selection in the open events which favours the very tall. It seems that the rules of many Olympic events should be modified in order to remedy this "unfairness" to potential enthusiasts of average or less than average height, an unfairness which first manifests itself at school.

It is suggested that there should be at least four classes based on height in some of the "unfair" open events; short, average, tall, and "all heights" classes, as in judo. This would ensure much fuller participation in athletic and other sporting activities in every country, and would produce contestants "fairly" matched on height in the International Olympics.

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