Reflections on Strength, Gender, and Lifting Formulas

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When Terry Todd called and suggested that I consider writing a brief history of how I developed the so-called "Schwartz Formula" more than thirty years ago, I was flattered, but the idea really didn't move me. It's been twenty years since I had any direct dealings with powerlifting and I've been busy with other things. Among them, I headed a materials research laboratory for the US Commerce Department for thirteen of those years, and then headed up basic research for the US Air Force. Powerlifting and weightlifting have never been too far from my thoughts, however; I've always displayed in my scientific manager's office an array of statuettes showing athletes in all states of starting or completing one or another lift. Some of these are serious, some whimsical, but all would draw some comment from my science and engineering visitors and bring to my mind the years of my own involvement in powerlifting as competitor, judge and administrator.

What did move me to write this brief note was the pleasure I had in watching the 2004 Olympic Games with my brother-in-law, Roger Yanule, and the discussion the Games engendered about how much stronger the men were than the women. (Some of the readers of this magazine may remember Roger, a strong national competitor at 242 lbs. in weightlifting in the early 1970's who just missed making the 1974 Olympic team at the tryouts in Detroit that year. Our mutual interest in the weight-sports brought Roger and me together and through him I met my wonderful wife, Celesta, whose sister Sylvia is Roger's wife...but that's another story.)

I told Roger that I knew the answer to the men/women strength difference. Men are 30% stronger than women. To be more accurate, when men and women train to their peak performances in the strength sports, powerlifting or weightlifting, the men achieve individual lifts and totals that exceed women of comparable weight by 30%. How do I know that? What data confirm that statement? Well, to clarify, I've got to go back to the Schwartz Formula and to the thinking that led me to develop it. So Terry Todd's request for an article will be answered.

We've all been confronted with the need to answer the question: "Who was the best lifter in that contest?" When powerlifting was a young sport, in the late 1960's and early 1970's, the way we answered that question was to use the Hoffman Formula. Named after Bob Hoffman of the York Barbell Company—one of weightlifting's strongest supporters in the USA from the 1930s to the 1980s—the formula worked quite well for weightlifting. Take the lifter's total, find a number in the Hoffman table corresponding to the lifter's bodyweight, multiply the two together, and you get a "corrected" total. The lifter in any contest with the highest corrected total is the "best."

What is this formula? Why does it work for weightlifting? (I'm going to be a bit mathematical here, so skip to the next paragraph if you want to return to plain English.) The simple theory behind the formula goes back to early giants in science and is based on the principle of self-similarity. Imagine two balloons in the shape of a lifter, one larger than the other. If we can match the big one by blowing air into the smaller, all dimensions growing in the same proportion, then the

Table 1
International Powerlifting Federation
Open Total Records, 2004

Weight Class in Kilos	Male Total in Kilos	Female Total in Kilos	Ratio
52 kg.	655	497.4	1.32
56 kg.	665	525	1.26
60 kg.	715	567.5	1.26
67.5 kg.	840	625	1.33
75 kg.	862.5	657.5	1.31
82.5 kg	952.5	637.5	1.49
90 kg.	967.5	687.5	1.41

original two balloons can be said to be similar. Body weight in similar objects increases as the cube of any length (for example height), while strength presumably depends on how big the muscles are and that increases as the square of a linear dimension. Thus, if we divide a lifter's total by his bodyweight taken to the 2/3 power, it will correct for differences in size.

That's really what the Hoffman Formula does, and it works. When corrected using this formula, the record totals for all weight classes are essentially the same. In fact, the same formula works just as well for the individual lifts, the snatch and the clean and jerk. The success of this approach in weightlifting contests has been confirmed by many people over the years.

When powerlifting developed in the 1960's, it grew from the weightlifting community, and it was natural to use the Hoffman Formula. But it didn't work for powerlifting. Some of us began to notice that when this approach was used the bigger lifters always won, and not by a little, by a lot. Actually, the Hoffman Formula works pretty well for the squat and deadlift, both performed with the body erect as with the snatch, the clean and jerk and the press (the press being until 1972 the third lift used in Olympic lifting). It's the bench press that is the outlier. All the data showed that bench press records increase directly with bodyweight. I never really understood the underlying physical reason for this, so I was forced to seek a better formula for powerlifting based on measured data, not theory.

Since powerlifting was still a young sport in the early 1970's there was uneven development in the three lifts on the part of most self-trained athletes. I compensated for such unevenness by creating artificial "best" totals by adding together the current records in the individual lifts. A "best" total would have been achieved by that ideal lifter who could match the best performances to date in all three powerlifts. Then I fitted these data to an artificial curve and picked off numbers from the curve for each bodyweight. To use the Schwartz Formula, a person would use my table of numbers and correct just as was done in weightlifting. And it worked. Lifters of all sizes could now be compared.

As the sport grew in popularity and the better lifters trained to new heights, lifters became proficient in all three lifts, totals grew and, to my delight, the formula still worked well in the early 1980's. My approach using "best" lift totals had done a pretty good job of estimating what we could expect from more uniform training by the athletes. But then something very new appeared on the scene. Women began to claim a spot on the powerlifting platform. Their results, however, didn't seem to fit my formula, and it was not long before Pat Malone, using a procedure similar to mine, made the appropriate adjustments. The Malone Formula corrected for bodyweight when women competed against women and did a fine job of it. Problem solved!

Well, not quite. There was still this little issue that when women competed against men (often the case in local contests where there were few women on the platform), the men always won. And not by a little; the men would win by ten to fifty percent. This was brought to my attention by my old training buddy Bill Ennis, who was promoting co-ed meets. He asked if I could do something about this? The answer to Bill's question turned out to be a remarkable *yes.* I took the powerlifting records for men and corrected them using my formula. Then I did the same for women using the Malone formula. When I took the ratio of "corrected" totals, the men bested the women by 30%. This worked for every weight class except for unlimited (no formula works for these somewhat "overweight" athletes—they lift more than their smaller counterparts, but not as much as all that extra weight would produce if their bodies retained a similar shape).

So much for history. Does this all still make sense today? Well, it's really pretty hard to make comparisons in powerlifting. Drug-free, drug-using(?), this federation or that one, one-ply bench shirts vs. four-ply, loose rules or strict rules, etc., etc. What data can one trust? Terry Todd assures me that the most reliable data is that associated with the International Powerlifting Federation, and so that will be the first test. Turning to the IPF internet web sight I found the data displayed in Table I.

Since the weight classes in men's and women's competition are the same for the 52-90 kilo classes, I can ask the question of men's strength vs. women by taking the direct ratios of totals. This eliminates any issue of the differences introduced by using the Schwartz Formula for the men and the Malone Formula for the women. Clearly, for the first five weight classes displayed, the ratio clusters tightly around 1.30. Men in these weight classes do have powerlifting totals that are 30% greater than women. The disparity for the 87.5 and 90Kg classes can be traced to the relatively low totals the women in these classes are posting, and perhaps to

women who are "bulked up" and would lift almost as much as this if they shed some bodyweight. I suspect this will change as the women's participation matures further.

Another option for serious comparison is weightlifting, and what better and more timely data set could we find than the recently completed Olympic competition? I pulled the data below from a web site I Googled and analyzed them using the simplest formula available, bodyweight to the two-thirds power (see attached Table II). Lo and behold, the result is the same; men are really (only?) 30% stronger than women. (The ratio of average men's to women's results is 1.31 for the snatch, 1.25 for the clean and jerk, and 1.28 for the totals. That's 1.3 on average (30% better for men), with an uncertainty that's rather small considering the still young state of the women's weightlifting development worldwide.)

I'm going to leave the explanation for this result to the sports physiologists, but there seems to be no doubt of the result. There are certainly many things that the fairer sex can do better than men, some things that only they can do, but men really are stronger. This is the way we evolved, and this is the way we are.

Table II

Gold Medal Results of Olympic Weightlifting, Athens, 2004

(All weights in Kilos. Formula is bodyweight to the two thirds power. Corrected data (*) are results divided by formula.)

BW	Formula	Snatch	Snatch*	C&J	C&J*	Total	Total*
Men							
56	14.64	135.0	9.22	160.0	10.93	295.0	20.15
62	15.66	152.5	9.74	172.5	11.02	325.0	20.75
69	16.82	160.0	9.51	187.5	11.15	347.5	20.66
77	18.10	172.5	9.53	202.5	11.18	375.0	20.72
85	19.33	177.5	9.18	205.0	10.61	382.5	19.33
94	20.67	187.5	9.07	220.0	10.64	407.5	19.72
105	22.26	195.0	8.76	230.0	10.33	425.0	19.09
163	29.84	210.0	7.04	263.5	8.83	472.5	15.83
		AV(M)=9.29		**AV(M)=10.84**		**AV(M)=20.13**	
BW	**Formula**	**Snatch**	**Snatch***	**C&J**	**C&J***	**Total**	**Total***
Women							
48	13.20	97.5	7.39	112.5	8.52	210.0	15.90
53	14.10	97.5	6.91	125.0	8.87	222.5	15.78
58	14.98	107.5	7.18	130.0	8.68	237.5	15.85
63	15.83	107.5	6.79	135.0	8.53	242.5	15.32
69	16.82	122.5	7.28	153.0	9.09	275.0	16.35
75	17.78	122.5	6.89	150.0	8.44	272.5	15.33
120	24.32	122.5	5.04	182.5	7.50	305.0	12.54
		AV(W)=7.07		**AV(W)=8.69**		**AV(W)=15.76**	
		M/W=1.31		**M/W=1.25**		**M/W=1.28**	