Wilks Coefficient Formula Chart for Men

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There were two (2) updates added:
#1 – I added the Kutin correction for applying the Watts coefficient to non-hollow 3-Dimensional objects, and also:
#2 – I offered clarification on some definitions.

These coefficients, developed by Robert Wilks, of Australia, are widely used in powerlifting to determine the best lifter (or best individual lift), when comparing lifters of different bodyweights.

To use the chart, you look on the chart for the "Wilks Coefficient" for the lifter's bodyweight in kilograms. (Note: To convert the Wilks coefficients for use with pounds, take the number of pounds a lifter weighs, and divide by 2.2046 to get the number of kilograms the lifter weighs.) Then, once you've found the proper coefficient, you multiply that number by the lifter's total. The resulting number is the lifter's "Wilks total," and whoever has the largest total (or individual lift) is considered "the best lifter by Wilks" (as there are other formulas used) –or simply the "best lifter."

For example, if a 40-kg lifter has a total of 200 kg, and an 80-kg lifter has a total of 398 kg, one might initially think that the lighter lifter is stronger (since he lifted 5-times his own bodyweight, whereas the 80-kg lifter lifted only 4.975-times his own bodyweight). However, the lighter lifter only has a "Wilks total" of 1.335422866287198030-times-200-kg, or a 267.084573257439606-kg Wilks total. On the other hand, the heavier lifter has a "Wilks total" of 0.682698590168316912-times-398-kg, or a 271.714038886990130976-kg Wilks total, slightly larger than that of the other lifter. So, the heavier lifter, even though he didn't quite lift 5-times his bodyweight, like the lighter lifter, would nonetheless be declared the "best lifter" by the Wilks formula.

Here are the formulas used for all the coefficients shown on the included graph:

WILKS Coefficient for men = (500)/[(–216.0475144) + (16.2606339*x) – (0.002388645*x^2) – (0.00113732*x^3) + (0.00000701863*x^4) – (0.00000001291*x^5)]
(Shown in blue on the included graph: Blue for boys)

Where x = bodyweight in kilograms (both here and below)

WILKS Coefficient for women = (500)/[(594.31747775582) – (27.23842536447*x) + (0.82112226871*x^2) – (0.00930733913*x^3) + (0.00004731582*x^4) – (0.00000009054*x^5)]
(Shown in pink on the included graph: Pink for girls)

Note: I have no idea how Wilks derives the factors for his equation, but I suspect that he took a lot of available data from powerlifting competitions, and asked a computer to model a 'best-fit' 5th-order equation to match the data.

WATTS Coefficient for men = [(51.075/x)^(2/3)] → *(Caution: Strange, mind-bending "math-talk" follows...)*
(Shown in green on the included graph: Green for Gordon – as in Gordon Wayne Watts, the creator of the WATTS coefficient.)

Note: While I have no idea how Wilks derives **his** coefficients, I **can** give an explanation for ***my*** formula: First off, since Wilks' formula is very widely used, and his coefficient for men is 1.00 at a weight close to 51.075-kg (estimated to the nearest 25-thousandths by manual calculation), I have "normalized" my calculations to match his as closely as reasonably possible at this weight. Then, noting that surface area is a limiting factor of how much one can lift (due to the fact that the lifter is supporting the weight by the surface-area of his or her skin and structure), and surface area is merely a squared function, not a cubed function, its affect can be approximated by taking the ratio in mass and raising it to the 2/3rds-power. For example, is a Rubik's Cube of 2x2x2 inches square was placed on the ground and made to support a weight, its base and top (both under applied pressure) would only be four-square inches (2x2), not eight (its mass), and thus only be expected to support FOUR times as more weight than a smaller cube of 1x1x1 inches square (NOT eight, the ratio of difference in masses). So, here, the mass ratio, 8, is raised to the 2/3rds-power, and results in a factor of 4, as demonstrated above. Thus, the WATTS Coefficient Formula Chart for Men uses this 2/3rds-power correction factor. NOTE: Other factors (limb length, asymmetrical increases, possible hormonal differences, etc.) might affect strength, since the body does not necessarily hold the same shape as mass increases. Also, the ROM (range of motion) of a larger lifter changes, which affects things, particularly, the deadlift, where shorter lifters are closer to lockout at the start of the lift. Therefore, I do not know if the WATTS formula is more accurate than the WILKS formula in determining "best lifter." It is only a hypothesis, guess, theory, or "best guesstimate" as to whether my formula is more accurate: Only by a review of recent lifting competitions could this theory be tested. In any event, the included graphs demonstrate that the WATTS coefficient is quite close to the WILKS coefficient FOR ALL VALUES in the range of lifters' wights listed, and that for real light lifters (under about 51.0-kg) and real heavy lifters (above about 115.6-kg), the WILKS coefficient is slightly more helpful to them, but in between about 51.0-kg and 115.6-kg (that is, for most lifters), the WATTS coefficient is more helpful to them. While it is uncertain if the WATTS coefficient is more accurate, it (first) is based on solid laws of physics, and, (second) per Ockham's Razor, has a simple explanation, and (third and lastly) is very close to the widely-used Wilks formula; so, good evidences supports the (as yet untested) theory that the Watts coefficient might possibly be more accurate in comparing lifters of different weights and/or genders than the more widely-used Wilks formula.

#1 – First UPDATE: Since publishing this initially, I have found some errors in my initial application of the 'Watts coefficient.' – My friend, Ed Kutin, a very smart powerlifter, apparently paid attention in his math, physics, and statistics classes when studying for his vocation in financial service, and he gave me excellent feedback when I asked for his thoughts on my formula – Ed said: "In particular, to use your ruibik's cube example, your assertion is correct only if the cubes are hollow. As people are not hollow, the example breaks down." – I **now think I know how to correct for that:** When taking a lift, and then thinking about multiplying it by the Watts coefficient (like you would do for the Wilks coefficient), you must *first* add the person's body-weight to the lift – for, after all, the lifter is *_always_* lifting (or at least supporting) his or her body-weight AND the weight being lifted. In a squat, for example, the lifter would be squatting at least his/her upper body mass. And, in the bench press, only the arms would 'add to' the weight being lifted, but the lifter's ***full*** body-weight is still supported by his/her back -as it comes in contact with the bench press bench.

For example, if a 40-kg lifter has a total of 200 kg, and an 80-kg lifter has a total of 398 kg, one might initially apply the Watts coefficient as follows:

Lighter lifter has a WATTS total of: 1.176970531562958400-times-200-kg = 235.39410631259168-kg 'Watts total'
Heavier lifter has a WATTS total of: 0.741444973911064752-times-398-kg = 295.095099616603771296-kg 'Watts total' (note that while the heavier lifter wins using both Wilks and Watts, he wins by a much larger margin with the Watts formula, since Wilks favors very light lifters more.)

However, each lifter is also carrying around his bodyweight, so that must be accounted for – here is an example of how to do so:

Lighter lifter has a WATTS total of: 1.176970531562958400-times (200 + 40 + 40 +40) kg (add his bodyweight three times, once for each power-lift)
Lighter lifter has a WATTS total of: 1.176970531562958400-times (320-kg) = 376.630570100146688-kg WATTS total, with the Kutin bodyweight correction applied.

Heavier lifter has a WATTS total of: 0.741444973911064752-times (398 + 80 + 80 + 80) kg (add his bodyweight three times, once for each power-lift)
Heavier lifter has a WATTS total of: 0.741444973911064752-times (638-kg) = 473.041893355259311776

So, you can see here that merely using the Watts coefficient, the heavier lifter won by a factor of 1.2536, but when you apply the Kutin application correction for non-hollow 3-dimensional objects, he wins by a factor of 1.25598, slightly better, since he was also supporting more mass per surface area, being a larger lifter (and the Kutin correction accounted for that).

As an extreme case, remember the Rukik's cube example: When doubling the height, the volume goes up eight (8) times, whereas the surface area only goes up four (4) times, thus the increase in weight supported per surface area increases in a linear fashion -for heavier lifters. **Math is cool! :D**

So, I shall give my friend, Ed Kutin, credit for giving me the idea. You can Google his name to see what he's up to. Recently, he coached his 10-year old daughter, Naomi, to a world record in the squat. Yes, a 'World' record (not merely an age-class record), as she beat a 44-year old German lady for the record. Her height confers good leverage advantages, to be sure, but you can be sure that she worked hard training (and her father worked hard coaching) to help a 10-year-old grade school student to beat a middle-aged powerlifting champion, while adhering to safe and healthy training methods. (His son is also setting records in his age class.) So, you can be sure that Ed knows about powerlifting!

So, of course, to test the accuracy of either version of WATTS or compare it with WILKS, you would have to review some recent powerlifting competitions. If a comparison formula is accurate, you would expect all of the champions to have similar values, and that a linear regression of the data points would produce a graph plot that has a flat slope and a very low p-value, and a very high 'R' value (indicating a tight pattern). The more accurate a formula, the closer the slope (of score versus bodyweight) would approach zero, and the lower the p-value, and the higher the 'R' value. This would allow comparison of WILKS and either version of WATTS. ***(End of 1st update.)***

WATTS Coefficient for women – Since so many complex hormonal 'chemical' and 'biological' factors are involved here, an exact formula is impossible for mere mortals. (It was difficult enough

simply correcting for the laws of 'physics' relative to differences in physical size for the men's formula.) Rather → When computing values for women, use the following method: Compute a “tentative” value, using the men's value, and then, using several recent years of results from strictly-tested drug-free powerlifting federations, obtain the average values for the top finishers in both men's and women's competitions for the weight-class in question, and take the average for each, obtaining an overall “men's average” and an overall “women's average” of the top several finishers over a period of several recent years. Then, take the ratio of the men's average to the women's average, which should yield a number slightly greater then 1.0, and use this “gender-correction” factor to “boost up” the previous 'tentative' final result you just calculated using the men's value by multiplying the “correction factor” by your previous result. This final result should make comparison of women's results on level playing ground. **CAVEAT:** When calculating averages from recent powerlifting competitions, it is imperative to ensure these are strictly-tested drug-free competitions. If this is not done, then results will be inaccurate, since the women's averages will more closely approach the men's averages, thus unfairly raising the bar, and biasing the results against the women who are trying to be fairly compared here.
(NOT shown on the included graph.)

REDNECK Coefficient for men = [51.075/x] (Note: The 'Redneck coefficient for men' merely measures “pound-for-pound” comparison, so, for example, a lifter who weighs 102.15-kg will have a coefficient exactly half that of a lifter weighing 51.075-kg. This is because Rednecks are just dumb hillbilly country bumpkins who INCORRECTLY think that lifting ability goes up as a linear function with weight or mass – It does not: For example, the Empire State Building weighs a lot more than an average powerlifter, yet this structure can NOT support five (5) times its own weight like some elite-level men's powerlifters. Heck, it can BARELY supports it's **own** weight, since, of course, the base of the structure's surface area is merely a 2nd-order, “squared” function, whereas the mass (e.g., weight) of the structure is a 3rd-order, “cubed” function. A small ant, by contrast, can pick up around a HUNDRED times its own bodyweight, for the same reason here, based on on the laws of physics.)
(Shown in red on the included graph: Red for redneck.)

REDNECK Coefficient for women – Since country-bumpkin hillbillies Rednecks are really not that smart (heck, I should know: I am one!), there IS no 'coefficient for women' – Actually, their coefficient for men is NOT accurate, so why would they be smart enough to make one for women? LOL
(NOT shown on the included graph.)

#2 – Second UPDATE: Since publishing this initially, I also noticed that I might have foreign readers (who do not speak English as their native language), and, as such, I should define terms like “Redneck.”

Redneck – An informal slang term used in reference to poor, rural, working-class, uneducated, and usually White, farmers, especially from the southern United States. Synonyms include 'cracker' (especially regarding Georgia and Florida) and 'hillbilly' (especially regarding Appalachia and the Ozarks).

Hillbilly – A colloquial slang term for a person from the backwoods or a remote mountain area.

Country bumpkin – A derogatory or insulting term for an uneducated person, usually from a small, backwoods southern United States town out in the country; someone who speaks or behaves in a manner that indicates lack of understanding of the ever changing, modern world and who does not have much experience of city life.

Synonyms for 'country bumpkin' include hayseed, chawbacon, rube, redneck, hick, yokel, village, villager, countryman, countrywoman, bumpkin, country cousin, and backwoodsman.

Google image search: http://www.google.com/search?q=country+bumpkin&um=1&ie=UTF-8&hl=en&tbm=isch&source=og&sa=N&tab=wi&ei=r6KXT5SKNbKq0AGHl-T5Bg&biw=1680&bih=955&sei=sqKXT5xb56jQAeCjuNkG#um=1&hl=en&tbm=isch&sa=1&q=country+bumpkin+redneck+hillbilly&oq=country+bumpkin+redneck+hillbilly&aq=f&aqi=&aql=&gs_nf=1&gs_l=img.3...5921.8179.5.8288.10.10.0.10.10.0.0.0..0.0.PXkcqUcyktk&pbx=1&bav=on.2,or.r_gc.r_pw.r_qf.,cf.osb&fp=e29e530bea455f63&biw=1680&bih=955

Yahoo! Image search: http://images.search.yahoo.com/search/images;_ylt=A0oG7h0Fo5dP5EkAZ5JXNyoA?p=country+bumpkin+redneck+hillbilly&fr=yfp-t-701&fr2=piv-web

(Click on those Internet IMAGE searches – they are funny!)

(End of 2nd update.)

Here is the graphing program I used:
Graph, version 4.3, build 384, Copyright © 2007
by: http://www.padowan.dk
Copyright © 2009 by Ivan Johansen

For further information – Related links:
http://en.wikipedia.org/wiki/Wilks_Coefficient

http://www.powerliftingwatch.com/node/780

http://www.powerlifting-ipf.com/fileadmin/data/Downloads/Wilksformula.pdf

Bodyweight in kilograms (kg)	Wilks formula for men
40.0	1.335422866287198030
40.1	1.331073584150518150
40.2	1.326758160010707220
40.3	1.322476215539588220
40.4	1.318227378030363030
40.5	1.314011280293613990
40.6	1.309827560555605620
40.7	1.305675862358827160
40.8	1.301555834464718690
40.9	1.297467130758524960
41.0	1.293409410156222940
41.1	1.289382336513470500
41.2	1.285385578536525280
41.3	1.281418809695083960
41.4	1.277481708136994160
41.5	1.273573956604791900
41.6	1.269695242354019270
41.7	1.265845257073278310
41.8	1.262023696805977980
41.9	1.258230261873732710
42.0	1.254464656801371850
42.1	1.250726590243520860

42.2	1.247015774912715620
42.3	1.243331927509013010
42.4	1.239674768651061180
42.5	1.236044022808594640
42.6	1.232439418236319700
42.7	1.228860686909157100
42.8	1.225307564458809330
42.9	1.221779790111621260
43.0	1.218277106627703290
43.1	1.214799260241287260
43.2	1.211346000602286170
43.3	1.207917080719029230
43.4	1.204512256902145040
43.5	1.201131288709565920
43.6	1.197773938892627430
43.7	1.194439973343237710
43.8	1.191129161042091980
43.9	1.187841274007908040
44.0	1.184576087247659540
44.1	1.181333378707784070
44.2	1.178112929226343920
44.3	1.174914522486117830
44.4	1.171737944968602840
44.5	1.168582985908905390
44.6	1.165449437251502020
44.7	1.162337093606849870
44.8	1.159245752208828280
44.9	1.156175212872992710
45.0	1.153125277955623150
45.1	1.150095752313549340
45.2	1.147086443264735670
45.3	1.144097160549609050
45.4	1.141127716293113530
45.5	1.138177924967475690
45.6	1.135247603355665340
45.7	1.132336570515536510
45.8	1.129444647744633870
45.9	1.126571658545650320
46.0	1.123717428592521670
46.1	1.120881785697144850
46.2	1.118064559776706080
46.3	1.115265582821606350
46.4	1.112484688863971130
46.5	1.109721713946732260
46.6	1.106976496093269650
46.7	1.104248875277601240
46.8	1.101538693395109530
46.9	1.098845794233793530
47.0	1.096170023446035130
47.1	1.093511228520869190
47.2	1.090869258756746920
47.3	1.088243965234782300
47.4	1.085635200792471560
47.5	1.083042819997876140
47.6	1.080466679124259330
47.7	1.077906636125167680
47.8	1.075362550609947770
47.9	1.072834283819689700
48.0	1.070321698603588620
48.1	1.067824659395715740
48.2	1.065343032192190700
48.3	1.062876684528747200
48.4	1.060425485458683860

48.5	1.057989305531192940
48.6	1.055568016770058970
48.7	1.053161492652720350
48.8	1.050769608089686400
48.9	1.048392239404303030
49.0	1.046029264312860130
49.1	1.043680561905033870
49.2	1.041346012624657520
49.3	1.039025498250814150
49.4	1.036718901879245160
49.5	1.034426107904068370
49.6	1.032147001999799710
49.7	1.029881471103672600
49.8	1.027629403398249420
49.9	1.025390688294319250
50.0	1.023165216414076580
50.1	1.020952879574575550
50.2	1.018753570771454400
50.3	1.016567184162925130
50.4	1.014393615054023240
50.5	1.012232759881112660
50.6	1.010084516196641090
50.7	1.007948782654141010
50.8	1.005825458993471700
50.9	1.003714446026297960
51.0	1.001615645621800800
51.1	0.999528960692616129
51.2	0.997454295180996924
51.3	0.995391554045194931
51.4	0.993340643246057756
51.5	0.991301469733837413
51.6	0.989273941435206442
51.7	0.987257967240477786
51.8	0.985253456991024722
51.9	0.983260321466897195
52.0	0.981278472374630972
52.1	0.979307822335246156
52.2	0.977348284872431601
52.3	0.975399774400911897
52.4	0.973462206214993641
52.5	0.971535496477287771
52.6	0.969619562207604820
52.7	0.967714321272019999
52.8	0.965819692372105090
52.9	0.963935595034324189
53.0	0.962061949599590391
53.1	0.960198677212980580
53.2	0.958345699813605537
53.3	0.956502940124632634
53.4	0.954670321643458440
53.5	0.952847768632028620
53.6	0.951035206107302554
53.7	0.949232559831860159
53.8	0.947439756304648450
53.9	0.945656722751865407
54.0	0.943883387117978797
54.1	0.942119678056877610
54.2	0.940365524923153830
54.3	0.938620857763512319
54.4	0.936885607308306611
54.5	0.935159704963198469
54.6	0.933443082800939108
54.7	0.931735673553270002

54.8	0.930037410602941269
54.9	0.928348227975845632
55.0	0.926668060333266011
55.1	0.924996842964234842
55.2	0.923334511778003244
55.3	0.921681003296618189
55.4	0.920036254647605891
55.5	0.918400203556759620
55.6	0.916772788341030226
55.7	0.915153947901517661
55.8	0.913543621716561828
55.9	0.911941749834931127
56.0	0.910348272869107077
56.1	0.908763131988663448
56.2	0.907186268913738345
56.3	0.905617625908597737
56.4	0.904057145775288925
56.5	0.902504771847382494
56.6	0.900960447983801320
56.7	0.899424118562735203
56.8	0.897895728475639763
56.9	0.896375223121318226
57.0	0.894862548400084777
57.1	0.893357650708008163
57.2	0.891860476931234272
57.3	0.890370974440386409
57.4	0.888889091085042056
57.5	0.887414775188284871
57.6	0.885947975541330761
57.7	0.884488641398226835
57.8	0.883036722470622093
57.9	0.881592168922608730
58.0	0.880154931365632929
58.1	0.878724960853474060
58.2	0.877302208877291227
58.3	0.875886627360736083
58.4	0.874478168655130909
58.5	0.873076785534710927
58.6	0.871682431191929854
58.7	0.870295059232827716
58.8	0.868914623672459967
58.9	0.867541078930386962
59.0	0.866174379826222855
59.1	0.864814481575243025
59.2	0.863461339784049105
59.3	0.862114910446290766
59.4	0.860775149938443374
59.5	0.859442015015640666
59.6	0.858115462807561625
59.7	0.856795450814370720
59.8	0.855481936902710716
59.9	0.854174879301747247
60.0	0.852874236599264389
60.1	0.851579967737810457
60.2	0.850292032010893276
60.3	0.849010389059224188
60.4	0.847734998867010068
60.5	0.846465821758292631
60.6	0.845202818393334330
60.7	0.843945949765050159
60.8	0.842695177195484673
60.9	0.841450462332333563
61.0	0.840211767145509130

61.1	0.838979053923749009
61.2	0.837752285271267517
61.3	0.836531424104448989
61.4	0.835316433648582499
61.5	0.834107277434637360
61.6	0.832903919296078805
61.7	0.831706323365723272
61.8	0.830514454072632721
61.9	0.829328276139047407
62.0	0.828147754577356567
62.1	0.826972854687106474
62.2	0.825803542052045307
62.3	0.824639782537204333
62.4	0.823481542286014855
62.5	0.822328787717460443
62.6	0.821181485523263917
62.7	0.820039602665108612
62.8	0.818903106371893423
62.9	0.817771964137021158
63.0	0.816646143715719729
63.1	0.815525613122395716
63.2	0.814410340628019843
63.3	0.813300294757543929
63.4	0.812195444287348865
63.5	0.811095758242723185
63.6	0.810001205895371799
63.7	0.808911756760954480
63.8	0.807827380596653677
63.9	0.806748047398771253
64.0	0.805673727400353751
64.1	0.804604391068845790
64.2	0.803540009103771195
64.3	0.802480552434441501
64.4	0.801425992217691425
64.5	0.800376299835640963
64.6	0.799331446893483732
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