



## Introduction

- Loaded jumps (LJs) are a simple alternative to other exercises.
- Power metrics are commonly used to assess effectiveness of LJs<sup>1</sup>.
- Momentum might be a useful metric to consider<sup>2</sup>.
- Traditional group-level statistics may overlook results that are critical in training application.

## Purpose

- To compare peak power and momentum in unloaded countermovement vertical jumps (CMVJ) with light and heavy loads in different loading conditions.

## Methods

- A convenience sample of 15 males and 5 females were recruited.
- Subjects were recreationally active, healthy, and could back squat (BS) at least 1.5x body mass.
- Two visits to the lab: anthropometric data and 1RM BS data was collected during 1<sup>st</sup> visit. Kinetic data collection of 4 jumps in each condition were collected during 2<sup>nd</sup> visit.
- Trial conditions included CMVJ with no added load (UL), a straight barbell placed across posterior aspect of trapezius with 20% and 60% of 1RM BS (SBJ20 and SBJ60, and with a hexagonal barbell held at arms' length with 20% and 60% of 1RM BS (HBJ20 and HBJ60).
- UL was completed first, followed by the 20% conditions, followed by the 60% conditions.
- Loading modality was counterbalanced.
- A one-way, within-subjects repeated measures ANOVA was used for the group-level statistics.
- The *Model Statistic*<sup>3</sup> was used to assess differences at the individual level.

# Researchers and strength coaches can use momentum to assess training effectiveness of loaded jumps on an individual basis.

**Table 1.** Group-Level Results for Jump Height, Momentum, and Peak Power

Variable	Unloaded	SBJ20	HBJ20	SBJ60	HBJ60
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Jump Height (m) <sup>a</sup>	0.44 ± 0.10	*0.23 ± 0.05	*0.26 ± 0.06	*0.08 ± 0.03	*0.08 ± 0.04
Momentum (kg·m·s <sup>-1</sup> ) <sup>a</sup>	253.05 ± 67.17	258.18 ± 68.57	268.89 ± 65.83	*202.79 ± 54.86	*191.98 ± 54.81
Peak Power (N·s <sup>-1</sup> ·kg <sup>-1</sup> ) <sup>a</sup>	69.77 ± 12.34	*43.71 ± 8.01	*44.93 ± 7.35	*25.08 ± 4.66	*25.34 ± 4.43

**Table 2.** Individual-Level Results for Momentum Across all Conditions

Participant	Unloaded		SBJ20		HBJ20		SBJ60		HBJ60	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	410.12	13.41	396.63	10.85	397.56	23.09	<b>314.90</b>	30.71	<b>306.16</b>	7.82
2	237.43	4.96	241.92	8.31	<b>277.45</b>	5.38	<b>208.25</b>	15.23	225.27	24.48
3	374.44	8.33	381.51	56.68	370.45	6.00	<b>253.81</b>	17.29	<b>225.34</b>	24.67
4	284.36	6.84	<b>320.58</b>	6.50	<b>341.01</b>	16.55	276.53	23.27	273.91	12.90
5	305.92	10.22	<b>353.62</b>	10.54	<b>356.98</b>	15.10	<b>258.31</b>	20.22	<b>227.44</b>	17.77
6	314.73	4.26	308.09	17.56	<b>299.32</b>	12.88	<b>247.07</b>	9.72	<b>221.59</b>	18.52
7	276.29	12.43	290.89	12.24	<b>324.08</b>	12.80	<b>133.82</b>	16.16	<b>221.20</b>	9.65
8	240.15	9.41	235.24	4.86	258.71	21.44	<b>208.66</b>	11.92	<b>213.93</b>	8.17
9	270.61	10.32	272.53	6.04	<b>294.16</b>	8.42	<b>208.85</b>	5.19	<b>175.30</b>	23.86
10	209.73	3.06	<b>228.97</b>	5.99	<b>233.83</b>	6.63	211.10	1.04	<b>152.03</b>	9.13
11	159.75	5.27	145.58	36.25	165.39	6.91	<b>115.36</b>	5.19	<b>88.38</b>	2.83
12	200.87	9.14	200.58	6.62	<b>221.07</b>	7.31	<b>143.07</b>	17.52	188.06	11.58
13	221.71	5.94	<b>179.33</b>	9.10	214.70	6.99	<b>113.36</b>	10.88	<b>113.69</b>	20.64
14	198.15	4.16	205.95	8.93	<b>193.43</b>	1.32	<b>164.32</b>	14.35	<b>143.31</b>	8.18
15	216.28	12.78	210.43	8.58	214.94	9.25	<b>189.77</b>	6.32	<b>142.77</b>	8.86
16	294.68	8.70	283.08	13.99	313.35	18.96	<b>258.67</b>	18.69	<b>248.27</b>	13.21
17	277.81	12.19	273.83	10.50	<b>252.45</b>	12.34	<b>195.63</b>	14.28	<b>142.80</b>	31.30
18	242.42	4.00	247.50	7.25	246.43	2.92	<b>215.86</b>	9.73	<b>210.71</b>	9.13
19	168.58	9.47	<b>194.08</b>	6.17	<b>206.24</b>	7.99	178.00	7.77	<b>153.60</b>	10.17
20	156.95	6.26	<b>193.11</b>	6.37	<b>196.24</b>	8.86	160.48	4.20	165.82	19.01
Group	253.05	67.17	258.18	68.57	268.90	65.83	202.79	54.86	191.98	54.81

## Results

- At the group level, jump height and peak power was lower in all loaded conditions compared to UL (Table 1).
- There was no statistical difference between UL and SBJ20 along with HBJ20 at the group level (Table 1).
- Individual-level analysis revealed that jump height and peak power was lower in all loaded conditions compared to UL for all subjects.
- The Model Statistic revealed that 4 and 9 subjects increased momentum from UL to SBJ20 and HBJ20, respectively (Table 2).
- 4 subjects did not decrease momentum from UL to SBJ60 and HBJ60 in the individual-level analysis (Table 2).

## Conclusion

- Based on the combined results of the group- and individual-level analyses, momentum may be a more useful metric in determining the effectiveness of LJ performance.

## Practical Applications

- Momentum can provide strength coaches with a broader loading range when programming LJs for their athletes.
- Researchers should consider incorporating a single-subject analysis to supplement group-level statistics in their research.

## References

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