Current Psychology
https://doi.org/10.1007/s12144-021-02275-5

Exercise mediates the effect of job control on body mass index (BMI)

Alyssa S. Bardin[1] · Keaton A. Fletcher[1]

Accepted: 28 August 2021

Abstract

Previous research has examined how job control impacts either health behaviors or outcomes. This study examines the interaction of job control and job demands on body mass index (BMI) as mediated by exercise to test the physical activity mediated Demand-Control model (pamDC). We analyzed cross-sectional survey data from 315 participants within the National Survey of Midlife Development in the United States (MIDUS 1) dataset to explore this relationship. As hypothesized, after controlling for age, sex, and work hours, job control is associated with more frequent exercise, which is linked to a lower BMI. However, this link was stable regardless of the level of demands. These findings provide a basis to understand the intertwined nature of one's work and health. Future research may investigate this relationship from an experimental approach to better determine causality. Practically, these findings suggest that workplaces ought to provide employees with more job control which may enable them to engage in healthy behaviors (e.g., physical activity) that can impact key health outcomes such as BMI.

Keywords Job control · Body mass index · Exercise · Demands · Health

The physical activity-mediated Demand–Control (pamDC) model (Häusser & Mojzisch, 2017) specifies how health outcomes may result from the interaction of job demands and job control through leisure-time exercise — a heretofore untested proposition. This study tests the pamDC proposition that job demands and job control impact individuals' physical activity, and ultimately, their body mass index (BMI), which predicts a range of health outcomes including as hypertension, diabetes (Imai et al., 2008), and self-rated health (Prosper et al., 2009).

Job demands are aspects of a job that require physical or mental effort. Job control is the ability to make choices regarding when, how, and what one does on the job. Higher levels of job control are linked to positive outcomes (e.g., Jones & Fletcher, 2003), including increased physical activity (e.g., Bushnell et al., 2010; Chon et al., 2010). Job demands are linked to increased psychological strain (e.g., Downes et al., 2021) and reduced physical activity (e.g., Payne et al., 2010). In line with propositions of the pamDC model, we hypothesize:

✉ Keaton A. Fletcher
Kfletcher40@gatech.edu

[1] Georgia Institute of Technology, School of Psychology, Atlanta, GA, USA

(1) *Job control is positively associated with exercise frequency.*
(2) *Job demands is negatively associated with exercise frequency.*

Exercise is linked to better wellbeing and control of chronic conditions, lower mortality risk (U.S. Department of Health and Human Services, 2019), and decreased BMI (Kelley et al., 2005).We hypothesize:

(3) *More frequent exercise is associated with lower BMI.*

The pamDC model proposes that exercise is a proximal predictor of health outcomes (e.g., BMI) and explains relationships between workplace characteristics and health. The primary contribution of this paper is to highlight the role exercise plays in mediating the effects of job control and demands on employee BMI, thus testing a critical assertion of the pamDC model. Therefore, we hypothesize:

(4) *Exercise mediates (a) a negative relationship between job control and BMI and (b) a positive relationship between job demands and BMI.*

According to the buffer hypothesis of the pamDC model, as job demands increase, job control should be increasingly

Published online: 07 September 2021

related to exercise and health (Häusser & Mojzisch, 2017). Thus, we hypothesize:

(5) *Job demands acts as a first-stage moderator of the mediated relationship between job control and BMI via exercise, strengthening this relationship.*

Method

Sample

We used archival data from the Midlife Development in the United States 1 (see http://midus.wisc.edu/midus2/project1/ for details), which was collected from self-report surveys in 1995–1996 (Brim et al., 2019). We excluded individuals that did not answer two or more items on measures of interest and limited analyses to full time (35+ hours per week) workers, resulting in a final sample of 315 people.

Measures

Measures are available in the Online Supplement.

Job Control and Demands Job control was measured using six items capturing decision authority, and quantitative demands were captured using five items (Brim et al., 2019). Responses were on a 5-point scale (1 = never to 5 = all of the time).

Exercise Exercise was assessed with four items about moderate or vigorous activities performed in the summer and winter (Brim et al., 2019). Responses were on a 6-point scale (1 = never to 6 = several times a week or more). The final score was calculated by summing all items.

BMI BMI was self-reported weight in kilograms divided by height-squared (m^2).

Results

See Table 1 for descriptive statistics and correlations. Job demands and job control were grand-mean centered. Regression analyses in R using the Hmisc package (Harrell Jr. & Dupont, 2012) controlled for sex, age, and work hours as these directly affect either BMI or exercise ability (e.g., Kirk & Rhodes, 2012), but a similar pattern of results were found without controls (see Table 2).

Job control was positively associated with exercise frequency ($B = 0.64$, $p = .03$) but job demands showed no relationship ($B = 0.08$, $p = .84$). Hypothesis 1 was supported but not Hypothesis 2.

Exercise was significantly negatively associated with BMI, ($B = -0.21$, $p = .002$). Hypothesis 3 was supported.

Results of mediation analyses using the Mediation package in R (Tingley et al., 2014) with quasi-Monte Carlo simulation (1000 simulations) to estimate confidence intervals, suggest that job control had a significant negative indirect effect on BMI via exercise frequency (effect = −0.13, $CI_{95\%} = [-0.29, -0.00]$, $p < .05$), but job demands did not (effect = −0.02, $CI_{95\%} = [-0.18, 0.16]$, $p = .83$). Thus, Hypothesis 4a was supported but not 4b. These results suggest distal mediation (Kenny & Judd, 2014; Kim & Han, 2015) in which the mediator is weakly influenced by the predictor and significantly predicts the outcome, indicating an indirect path.

We allowed job demands to interact with job control which was neither a significant predictor of exercise ($B = -0.44$, $p = .34$) nor BMI ($B = 0.58$, $p = .28$). Hypothesis 5 was not supported.

The online supplement provides a similar pattern of results predicting BMI collected 10 years later.

Discussion

Results suggest job control was associated with more frequent exercise which was linked to decreased BMI, although with no direct relationship between exercise and BMI, thereby partially supporting the pamDC model. Results failed to support pamDC's buffer hypothesis which suggests job control interacts with job demands to predict exercise. We expand upon previous findings which have demonstrated the impact of work characteristics on health behavior frequency (e.g., Abdel Hadi et al., 2020) by directly testing the pamDC model. Results suggest that organizations can increase employees' job control, enabling individuals to engage in increased exercise and ultimately improving their health outcomes.

The cross-sectional nature of the data is a limitation, particularly to mediation analyses. It is unlikely but possible that job control is an outcome of exercise or BMI. Those with a higher BMI may face challenges in exercising or discrimination in hiring (e.g., Agerström & Rooth, 2011) and only find jobs with lower job control. Although our results support a distal mediation from job control to BMI via exercise, we are unable to draw causal conclusions. Future studies should address the cross-sectional and generalizability limitations by examining these relationships over different time spans (e.g., daily, weekly), and should also explore other forms of job control and demands for a nuanced understanding of this relationship.

This study supports exercise as a mechanism by which job control influences BMI. Results support alterations to job design to increase job control, particularly decision authority, to promote healthy behaviors which in turn could improve health outcomes.

Table 1 Descriptive statistics and intercorrelations

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. Exercise	19.01	4.42	*(.78)*						
2. Demands	3.06	0.66	.03	*(.77)*					
3. Control	3.75	0.81	.09	.05	*(.86)*				
4. BMI	27.34	5.10	−.17**	.03	.03	–			
5. Age	47.88	11.06	−.26***	−.05	.14*	.17**	–		
6. Work Hours	40.99	16.13	.11*	.23***	.09	.16**	−.03	–	
7. Sex	0.46	–	−.12*	.08	−.02	−.19***	−.08	−.26***	–

M = mean, *SD* = standard deviation. Cronbach's alphas, where relevant, are presented in italics and parentheses along the diagonal. BMI = Body Mass Index. Sex is coded as male = 0, female = 1. Pairwise deletion was used 304 ≤ N ≤ 315. * $p < .05$, ** $p < .01$, *** $p < .001$

Table 2 Regression results

Dependent Variable: Exercise						
Parameters	B *(SE)*	B *(SE)*	B *(SE)*	B *(SE)*	B *(SE)*	B *(SE)*
Intercept	19.01 *(0.25)****	24.17 *(1.36)****	19.01 *(0.25)**	23.77 *(1.36)****	19.03 *(0.25)*	23.94 *(1.39)****
Job Control	0.48 *(0.31)*	0.64 *(0.30)**			0.36 *(0.32)*	0.56 *(0.32)*
Job Demands			0.18 *(0.38)*	0.08 *(0.38)*	0.16 *(0.38)*	0.05 *(0.38)*
Age		−0.11 *(0.02)****		−0.11 *(0.02)****		−0.11 *(0.02)****
Sex		−1.02 *(0.50)**		−1.01 *(0.51)**		−1.02 *(0.51)**
Work Hours		0.02 *(0.02)*		0.02 *(0.02)*		0.02 *(0.02)*
Demands x Control					−0.66 *(0.47)*	−0.44 *(0.47)*
R^2	0.01	0.10	0.00	0.09	.01	.11
Dependent Variable: BMI						
Parameters	B *(SE)*	B *(SE)*	B *(SE)*	B *(SE)*	B *(SE)*	B *(SE)*
Intercept	31.21 *(1.26)****	28.00 *(2.23)****	31.15 *(1.25)****	27.40 *(2.46)****	31.02 *(1.26)****	28.31 *(2.24)****
Job Control	0.29 *(0.35)*	0.04 *(0.35)*			0.45 *(0.36)*	0.15 *(0.36)*
Job Demands			0.28 *(0.43)*	0.21 *(0.43)*	0.25 *(0.43)*	0.21 *(0.43)*
Exercise	−0.20 *(0.06)***	−0.21 *(0.07)***	−0.20 *(0.06)***	−0.21 *(0.07)***	−0.19 *(0.06)***	−0.21 *(0.07)***
Age		0.05 *(0.03)*		0.05 *(0.03)*		0.05 *(0.03)*
Sex		−1.80 *(0.58)***		−1.84 *(0.58)***		−1.84 *(0.58)***
Work Hours		0.04 *(0.02)**		0.04 *(0.02)**		0.04 *(0.02)**
Demands x Control					1.00 *(0.54)*	0.58 *(0.54)*
R^2	0.03	0.11	0.03	0.11	.04	.11

B = unstandardized beta weights. *SE* = Standard errors (presented in parentheses and italics). Job demands and job control are both grand mean centered. Sex is coded such that 0 = Male, 1 = Female. * $p < .05$ ** $p < .01$ *** $p < .001$

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s12144-021-02275-5.

Acknowledgements The authors would like to thank Dr. Meghan Babcock and Ms. Claire E. Burnett for their input on various iterations of this work.

Code Availability Not applicable.

Funding Publicly available data from the MIDUS study was used for this research. Since 1995 the MIDUS study has been funded by the following: John D. and Catherine T. MacArthur Foundation Research Network, National Institute on Aging (P01-AG020166), National institute on Aging (U19-AG051426).

Data Availability Data are publicly available as part of the Midlife in the United States project at https://www.icpsr.umich.edu/web/ICPSR/studies/2760. Previous publications using the MIDUS data can be found http://midus.wisc.edu/findings/.

Declarations

Ethics Approval The MIDUS data are reviewed and approved by institutional review boards at the University of Wisconsin-Madison.

Conflicts of Interest/Competing Interests On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

Abdel Hadi, S., Mojzisch, A., Parker, S. L., & Häusser, J. A. (2020). Experimental evidence for the effects of job demands and job control on physical activity after work. *Journal of Experimental Psychology*: Applied. Online first.

Agerström, J., & Rooth, D.-O. (2011). The role of automatic obesity stereotypes in real hiring discrimination. *Journal of Applied Psychology, 96*(4), 790–805. https://doi.org/10.1037/a0021594

Brim, O.G., Baltes, P.B., Bumpass, L.L., Cleary, P.D., Featherman, D.L., Hazzard, W.R., … Shweder, R.A (2019). Midlife in the United States (MIDUS 1), 1995-1996. Ann Arbor, MI: Inter-university Consortium for Political and Social Research. https://doi.org/10.3886/ICPSR02760.v14.

Bushnell, P. T., Colombi, A., Caruso, C. C., & Tak, S. (2010). Work schedules and health behavior outcomes at a large manufacturer. *Industrial Health, 48*(4), 395–405.

Chon, S. H., Kim, J. Y., Cho, J. J., & Ryoo, J. G. (2010). Job characteristics and occupational stress on health behavior in Korean workers. *Korean Journal of Family Medicine, 31*(6), 444–452.

Downes, P. E., Reeves, C. J., McCormick, B. W., Boswell, W. R., & Butts, M. M. (2021). Incorporating job demand variability into job demands theory: A meta-analysis. *Journal of Management*, *47*(6), 1630–1656.

Harrell Jr., F. E., & Dupont, M. C. (2012). *R package Hmisc*. R Foundation for Statistical Computing.

Häusser, J. A., & Mojzisch, A. (2017). The physical activity-mediated demand-control (pamDC) model: Linking work characteristics, leisure time physical activity, and well-being. *Work & Stress, 31*(3), 209–232.

Imai, K., Gregg, E. W., Chen, Y. J., Zhang, P., De Rekeneire, N., & Williamson, D. F. (2008). The association of BMI with functional status and self-rated health in US adults. *Obesity, 16*(2), 402–408.

Jones, F., & Fletcher, B. C. (2003). Job control, physical health and psychological well-being. In M. J. Schabracq, J. A. M. Winnubst, & C. L. Cooper (Eds.), *The handbook of work and Health Psychology* (2nd ed.). John Wiley & Sons, Ltd.

Kelley, G. A., Kelley, K. S., & Tran, Z. V. (2005). Aerobic exercise, lipids and lipoproteins in overweight and obese adults: A meta-analysis of randomized controlled trials. *International Journal of Obesity, 29*(8), 881–893.

Kenny, D. A., & Judd, C. M. (2014). Power anomalies in testing mediation. *Psychological Science, 25*(2), 334–339.

Kim, T. H., & Han, E. (2015). Impact of body mass on job quality. *Economics & Human Biology, 17*, 75–85.

Kirk, M. A., & Rhodes, R. E. (2012). Physical activity status of academic professors during their early career transition: An application of the theory of planned behavior. *Psychology, Health & Medicine, 17*(5), 551–564.

Payne, N., Jones, F., & Harris, P. R. (2010). A daily diary investigation of the impact of work stress on exercise intention realisation: Can planning overcome the disruptive influence of work?. *Psychology and Health, 25*(1), 111–129.

Prosper, M. H., Moczulski, V. L., & Qureshi, A. (2009). Obesity as a predictor of self-rated health. *American Journal of Health Behavior, 33*(3), 319–329.

Tingley, D., Yamamoto, T., Hirose, K., Keele, L., & Imai, K. (2014). Mediation: R package for causal mediation analysis. *Journal of Statistical Software, 59*(5). https://doi.org/10.18637/jss.v059.i05.

U.S. Department of Health and Human Services (2019). Physical activity guidelines for Americans (2nd ed.). Retrieved from https://health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf