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On the Relation Between Oral Contraceptive Use, Boredom, and Flow

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Abstract: Across two samples, we investigated the relation between oral contraceptive (OC) use and self-reports of boredom and flow proneness in undergraduate females using OCs (Sample 1: OC group N = 343, Sample 2: OC group N = 162) and females not using any form of hormonal contraceptives (Sample 1: Non-OC group N = 1191, Sample 2: Non-OC group N = 852). We measured boredom proneness and the tendency to experience 'flow', defined as the experience of deep and effortless concentration; we also measured semester of data collection and symptoms of depression, anxiety and stress to use as control variables. Although there were some differences between samples, the key findings were that (1) boredom proneness and flow scores showed a modest negative correlation in both samples indicating they are associated but not simply opposite constructs; (2) OC users reported significantly less boredom proneness than non-users in Sample 2 and when the samples were combined, but this relation did not reach significance in Sample 1; (3) the association between OC use and boredom proneness remained even when semester of data collection and symptoms of depression, anxiety and stress were controlled; and that (4) there were no differences between OC and Non-OC groups for measures of flow proneness. Thus, OC use is related to reduced boredom proneness, although this relation is small.

Keywords: oral contraceptives, boredom, flow, deep effortless concentration.

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Supplementary Material

Sample 1

Results

DASS Planned Comparisons

We ran 3 independent samples t-test to determine whether OC users and non-users differed in their reports of depression, anxiety, and stress symptoms. OC users and non-users differed in terms of depression symptoms, $t(570.7) = 2.48$, $p = .013$, such that OC users reported fewer depression symptoms than non-users. There were no significant differences between groups on anxiety symptoms, $t(560.5) = 0.46$, $p = .645$, and stress symptoms, $t(572.1) = 0.33$, $p = .742$.

Original Regressions

To determine whether oral contraceptive use was associated with boredom and flow proneness over and above symptoms of depression and the semester of data collection, we conducted a series of hierarchical regressions. We entered semester and DASS-depression as predictors in the first step and then added oral contraceptive use in the second step.

As can be seen in Table S1, when semester and depression symptoms were entered in Step 1, they accounted for a significant amount of overall variance in boredom proneness ($R^2 = .321$, model $p < .001$) and internal ($R^2 = .030$, model $p < .001$) and external flow measures ($R^2 = .042$, model $p < .001$). More specifically, in Step 1 both semester and depression symptoms accounted for a significant amount of unique variance when predicting the SBPS and DECE, but only depression symptoms (and not semester) accounted for significant and unique variance in the DECI. The inclusion of OC use in Step 2 did not explain additional variance in any outcome variable (see ΔR^2 in Table S1). In Step 2, semester and depression symptoms continued to predict significant unique variance in the SBPS and DECE, while depression symptoms alone (not semester) continued to predict significant unique variance in the DECI.

Table S1. Regression model statistics for Sample 1

		B	***SE***	***p***
DV: SBPS		**$R^2 = .321$, F = 361.10, SE = 0.94, Model $p < .001$**		
Step 1	Intercept	3.36	0.03	< .001
	Winter 2022	0.10	0.05	.032
	DASS-Dep	0.86	0.03	< .001
Step 2		**$R^2 = .321$, F = 240.70, SE = 0.94, Model $p < .001$**		
		$\Delta R^2 = .000$, *p for* $\Delta R^2 = .608$		
	Intercept	3.36	0.03	< .001
	Winter 2022	0.10	0.05	.031
	DASS-Dep	0.86	0.03	< .001
	OC status	-0.03	0.06	.608
DV: DECE		**$R^2 = .042$, F = 33.97, SE = 1.27, Model $p < .001$**		
Step 1	Intercept	4.17	0.04	< .001
	Winter 2022	0.14	0.07	.038
	DASS-Dep	-0.35	0.04	< .001
Step 2		**$R^2 = .042$, F = 22.63, SE = 1.27, Model $p < .001$**		
		$\Delta R^2 = .000$, *p for* $\Delta R^2 = .997$		

	Intercept	4.17	0.05	< .001
	Winter 2022	0.14	0.07	.038
	DASS-Dep	-0.35	0.04	< .001
	OC status	-0.00	0.08	.997
DV: DECI		**R^2 = .030, F = 23.22, SE = 1.19, Model *p* < .001**		
Step 1	Intercept	4.09	0.04	< .001
	Winter 2022	0.06	0.06	.320
	DASS-Dep	-0.28	0.04	< .001
Step 2		**R^2 = .030, F = 15.57, SE = 1.19, Model *p* < .001**		
		ΔR^2 = .000, *p for* ΔR^2 = .583		
	Intercept	4.10	0.04	< .001
	Winter 2022	0.06	0.06	.318
	DASS-Dep	-0.28	0.04	< .001
	OC status	-0.04	0.07	.583

Note 1: DV = Dependent variable; SBPS = Boredom Proneness Scale – Short Form, DECE = Deep Effortless Concentration – External Scale, DECI = Deep Effortless Concentration – Internal Scale, DASS-Dep = Depression, Anxiety, and Stress Scale – Depression Subscale.

Note 2: Step 1 included semester of data collection and depression symptoms as predictors. In Step 2, OC use was added to the model.

Note 3. Semester and OC status are dummy coded. For semester, Fall 2021 is the reference group. For OC status, non-OC use is the reference group. The DASS-Dep variable was centered.

Sample 2

Results

DASS Planned Comparisons

To determine whether OC users and non-users differ in terms of their symptoms of depression, anxiety, and stress (measured by the DASS), we ran 3 independent samples t-tests. These results indicated that compared to non-users, OC users reported significantly fewer symptoms of depression ($t(254.9) = 3.85$, $p < .001$), significantly fewer symptoms of anxiety ($t(227.1) = 2.65$, $p = .008$, and no significant differences in stress ($t(227.9) = 0.14$, $p = .885$).

Original Regressions

To mirror our analyses of Sample 1 and to further investigate the differences in boredom proneness found in the present Sample, we conducted a series of hierarchical regressions predicting scores on our boredom and flow measures. We entered the semester of data collection and depression symptoms (measured on the DASS) as predictors in Step 1 and then added OC use as a predictor in the second step (see Table S2).

In Step 1, the semester of data collection and depression symptoms together accounted for an overall significant amount of variance in each dependent measure (SBPS: $R^2 = .297$, model $p < .001$, DECI: $R^2 = .036$, model $p < .001$, DECE: $R^2 = .056$, model $p < .001$). When the unique variance explained by each measure was considered, depression was a unique predictor of all measures, while semester (Winter 2023) only uniquely predicted internal flow (measured by the DECI). When OC use was added as a predictor in Step 2, its predictiveness varied across the dependent measures. Specifically, when boredom proneness was the dependent measure, the inclusion of OC use in Step 2 improved the model, with OC use and depression—but not semester of data collection—accounting for unique variance. This outcome differed from Sample 1. Consistent with Sample 1, however, for external flow (indexed by the DECE) we found that the addition of OC use in the second step did not explain additional variance. In this step, depression

continued to be the only predictor of unique variance. When predicting internal flow (indexed by the DECI) we found the addition of OC use in Step 2 did not explain additional variance; both semester of data collection and depression symptoms continued to be unique predictors of DECI as they were in Step 1 (see ΔR^2 in Table S2).

Table S2. Regression model statistics for Sample 2

		B	***SE***	***p***
DV: SBPS		**R^2 = .297, F = 213.50, SE = 0.90, Model *p* < .001**		
Step 1	Intercept	3.48	0.04	< .001
	Winter 2023	0.07	0.06	.236
	DASS-Dep	0.80	0.04	< .001
Step 2		**R^2 = .302, F = 145.50, SE = 0.90, Model *p* < .001**		
		ΔR^2 = .005, *p for* ΔR^2 = .009		
	Intercept	3.51	0.04	< .001
	Winter 2023	0.07	0.06	.198
	DASS-Dep	0.79	0.04	< .001
	OC status	-0.20	0.08	.009
DV: DECE		**R^2 = .056, F = 29.74, SE = 1.21, Model *p* < .001**		
Step 1	Intercept	4.12	0.05	< .001
	Winter 2023	0.08	0.08	.303
	DASS-Dep	-0.39	0.05	< .001
Step 2		**R^2 = .056, F = 19.95, SE = 1.21, Model *p* < .001**		
		ΔR^2 = .000, *p for* ΔR^2 = .532		
	Intercept	4.13	0.05	< .001
	Winter 2023	0.08	0.08	.292
	DASS-Dep	-0.40	0.05	< .001
	OC status	-0.07	0.10	.532
DV: DECI		**R^2 = .036, F = 18.72, SE = 1.19, Model *p* < .001**		
Step 1	Intercept	3.99	0.05	< .001
	Winter 2023	0.17	0.08	.027
	DASS-Dep	-0.29	0.05	< .001
Step 2		**R^2 = .038, F = 13.32, SE = 1.19, Model *p* < .001**		
		ΔR^2 = .002, *p for* ΔR^2 = .116		
	Intercept	4.01	0.05	< .001
	Winter 2023	0.17	0.08	.023
	DASS-Dep	-0.30	0.05	< .001
	OC status	-0.16	0.10	.116

Note 1: DV = Dependent variable; SBPS = Boredom Proneness Scale – Short Form, DECE = Deep Effortless Concentration – External Scale, DECI = Deep Effortless Concentration – Internal Scale, DASS-Dep = Depression, Anxiety, and Stress Scale – Depression Subscale.

Note 2: Step 1 included semester of data collection and depression symptoms as predictors. In Step 2, OC use was added to the model.

Note 3. Semester and OC status are dummy coded. For semester, Fall 2022 is the reference group. For OC status, non-OC use is the reference group. The DASS-Dep variable was centered.

Combined Samples

Results

DASS Planned Comparisons

We ran 3 independent samples t-tests to determine whether symptoms of depression, anxiety, and stress varied by OC status. We found that compared to non-users, OC users reported significantly fewer symptoms of depression, $t(820.1) = 4.37$, $p < .001$, significantly fewer anxiety

symptoms, $t(786.9) = 2.44$, $p = .015$, and no significant differences in stress, $t(791.1) = 0.73$, $p = .465$.

Original Regressions

We again conducted regression analyses to examine whether OC use was associated with our boredom and flow measures over the above the semester of data collection and depression symptoms. The sample and depression symptoms were entered in the first step and OC use was added in the second step. In Step 1, all three models predicting our measures of interest accounted for a significant amount of variance (SBPS: $R^2 = .313$, model $p < .001$, DECI: $R^2 = .033$, model $p < .001$, DECE: $R^2 = .048$, model $p < .001$; see Table S3). In this step, depression symptoms predicted unique variance in each measure, while both winter semesters (Winter 2022 and 2023) also predicted unique variance in SBPS. Only Winter 2022 predicted unique variance in DECE, however no semester predicted unique variance in DECI. When OC use was added in the second step, OC use did not explain significant additional variance in any of our measures. Symptoms of depression remained the only unique predictor of all measures. The Winter semesters continued to predict unique variance in SBPS, Winter 2022 explained unique variance in DECE, and semester did not predict unique variance in DECI. However, when predicting boredom proneness, the B for OC use was close to, but did not reach significance (B = -0.09, $p = .059$).

Table S3. Regression model statistics for Combined Sample (Samples 1 and 2)

		B	***SE***	***p***
DV: SBPS		**$R^2 = .313$, F = 289.20, SE = 0.92, Model $p < .001$**		
Step 1	Intercept	3.39	0.03	< .001
	Winter 2022	0.10	0.05	.030
	Fall 2022	0.05	0.05	.334
	Winter 2023	0.12	0.05	.033
	DASS-Dep	0.84	0.02	< .001
Step 2		**$R^2 = .314$, F = 232.30, SE = 0.92, Model $p < .001$**		
		$\Delta R^2 = .001$, *p for* $\Delta R^2 = .059$		
	Intercept	3.40	0.03	< .001
	Winter 2022	0.10	0.05	.028
	Fall 2022	0.04	0.05	.398
	Winter 2023	0.11	0.05	.039
	DASS-Dep	0.83	0.02	< .001
	OC status	-0.09	0.05	.059
DV: DECE		**$R^2 = .048$, F = 32.04, SE = 1.25, Model $p < .001$**		
Step 1	Intercept	4.15	0.04	< .001
	Winter 2022	0.14	0.06	.034
	Fall 2022	-0.02	0.07	.806
	Winter 2023	0.06	0.07	.394
	DASS-Dep	-0.37	0.03	< .001
Step 2		**$R^2 = .048$, F = 25.64, SE = 1.25, Model $p < .001$**		
		$\Delta R^2 = .000$, *p for* $\Delta R^2 = .732$		
	Intercept	4.16	0.04	< .001
	Winter 2022	0.14	0.06	.034
	Fall 2022	-0.02	0.07	.790
	Winter 2023	0.06	0.07	.401
	DASS-Dep	-0.37	0.03	< .001
	OC status	-0.02	0.06	.732
DV: DECI		**$R^2 = .033$, F = 21.26, SE = 1.19, Model $p < .001$**		
Step 1	Intercept	4.08	0.04	< .001
	Winter 2022	0.06	0.06	.321

	Fall 2022	-0.07	0.06	.249
	Winter 2023	0.09	0.07	.181
	DASS-Dep	-0.28	0.03	< .001
Step 2		**R^2 = .033, F = 17.38, SE = 1.19, Model *p* < .001**		
		ΔR^2 = .001, *p for* ΔR^2 = .175		
	Intercept	4.09	0.04	< .001
	Winter 2022	0.06	0.06	.315
	Fall 2022	-0.08	0.06	.217
	Winter 2023	0.09	0.07	.197
	DASS-Dep	-0.28	0.03	< .001
	OC status	-0.08	0.06	.175

Note 1: DV = Dependent variable; SBPS = Boredom Proneness Scale – Short Form, DECE = Deep Effortless Concentration – External Scale, DECI = Deep Effortless Concentration – Internal Scale, DASS-Dep = Depression, Anxiety, and Stress Scale – Depression Subscale.

Note 2: Step 1 included semester of data collection and depression symptoms as predictors. In Step 2, OC use was added to the model.

Note 3. Semester and OC status are dummy coded. For semester, Fall 2021 is the reference group. For OC status, non-OC use is the reference group. The DASS-Dep variable was centered.