Does A Brief Exposure to Thin and Attractive Body Images Impact Young Women's Body Appreciation?

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Background and Introduction

Social networking sites have become popular with the advancement of technology. Besides providing more opportunities for the public to promote self-expressions, social media have also promoted sociocultural standards of body image, with celebrities who have ideal body shapes attract mass followers [1].

Since the pandemic, people have spent more time on social media. According to e-Marketer analysts in their most recent forecast of media spending time in the United States, adult social network users logged in for an average of 1 hour and 22 minutes per day in 2020, with a 7-minute increase from 2019 [2]. Also, compared with Facebook and Snapchat, Instagram have seen most active daily user time increases, up to 30 minutes [2]. The increase implies that individuals are spending more time on social media to socialize and to access a broad range of outside information. Instagram has also become one of the most popular social media platforms for adults and women (in the United States, a much higher percentage of women (43%) use Instagram than men (31%) [3], especially as the engagement on its platform has increased in recent years, and many celebrities and creators start using Instagram to share snippets of their lives [4]. Also, a study by the Pew Research Center shows that a more percentage of women (78%) use social media rather than men (66%) [5]. As a result, the content that female Instagram users are exposed to, the bloggers that they follow, and the topics in which they participate are invariably related to body images and looks.

Numerous recent studies have found that being exposed to thin and attractive body images may increase negative emotions and body dissatisfaction among women [6]. The stark contrast between photos that accentuate the body and those that do not have a negative impact on a woman's body image and decrease her appreciation of her body [7].

In this study, we are interested in whether a brief exposure to thin and attractive body images would affect women body appreciation. we randomly assigned 91 young women into either the control group or one of the treatment groups and instructed them to view a set of ten images for about 3 minutes and to share their true feelings about self body appreciation and body dissatisfaction through visual analogue scales before and after the experiment.

Methods

Participants

We utilized a randomized experimental design with three different levels to investigate the impact of brief exposure to social media images (regular body shape control, and attractive body from unknown persons and celebrities) to young women's body appreciation and dissatisfaction. The experiment was conducted through online surveys (Can be accessed through https://bostonu.qualtrics.com/jfe/form/SV_cDaJhaGYHQlvrtc).

Randomization

We created the survey for our experiment via the web-based survey tool Qualtrics. When designing the the survey, we created a start page for survey instruction, followed by one question block that collects basic information such as gender, age group, BMI (body mass index) and pre-experiment body appreciation and dissatisfaction from participants, one randomizer that assigns participants into either the control or one of the treatment groups to view a set of 10 pictures, and the other question block that gather post-experiment body image information from all participants.

Procedure

Apart from participants' basic information, we also asked their social network uses and experiences, about which networking site they mostly use and how much time they spend on social network platforms every day.

In the randomized experiment, participants were given 10 thin and attractive images with or without celebrity identities shown in the treatment group, versus images of 10 normal-shaped people who dress ordinary apparels with unknown identities in the control group. Each set of pictures consists of 10 different celebrities or top influences (e.g., Pamela Reif (8.2 M followers), Kendall Jenner (202 M followers), Selena Gomez (277 M followers), Kylie Jenner (282 M followers) on Instagram. All images were taken from Instagram profiles that were publicly accessible.

All survey participants were asked to spend 15 seconds on each of the pictures and they were asked to share honest feelings before and after viewing the entire set of images. For quantitative measurement, we used the visual analogue scales (VAS) to record state body appreciation and dissatisfaction.

At the end of the experiment, we successfully collected responses from 91 females aged between 18 and 34 years old, with 30 observations in the control group, 30 in the Treatment 1 group and 31 observations in the Treatment 2 group, respectively.

Result

Importing data

By importing the BA830_survey_data.csv, we are able to load our survey dataset of 91 rows and 12 columns.

```
data <- fread('BA830_survey_data.csv')
nrow(data)
```

```
## [1] 91
```

```
colnames(data)
```

```
##  [1] "treatment"                   "PlatformPreference"
##  [3] "TimePerDay"                  "age_group"
##  [5] "bmi"                         "body_appreciation_before"
##  [7] "body_dissatisfaction_before" "self_esteem_before"
##  [9] "interested"                  "body_appreciation_after"
## [11] "body_dissatisfaction_after"  "self_esteem_after"
```

Variables	Values	Explanation
treatment	0,1,2	0 refers to the control group, 1 and 2 refer to the treatment arm 1 and 2.
any_treatment	0,1	O refers to the control group, 1 refers to both treatment arm 1 and 2
platform_preference	Facebook, Instagram, Other, Snapcaht, Twitter	The most frequent social media platform used
time_per_day	<1, 1-3, 4-6, >6	Hours spent on social media per day, with prefix for creating dummy variable columns in R
age_group	18-24, 25-34	Age, with prefix for creating dummy variable columns in R
bmi	<18, 18-24, 24-29,29-30	Bmi = weight ÷ height², with prefix for creating dummy variable columns in R
body_appreciaiton_before	0-100	Body appreciation self-rating before the experiment
body_dissatisfaction_before	0-100	Body dissatisfaction self-rating before the experiment
self_esteem_before	0-100	Self esteem self-rating before the experiment
body_appreciation_after	0-100	Body appreciation self-rating after the experiment
body_dissatisfaction_after	0-100	Body dissatisfaction self-rating after the experiment
self_esteem_after	0-100	Self esteem self-rating after the experiment

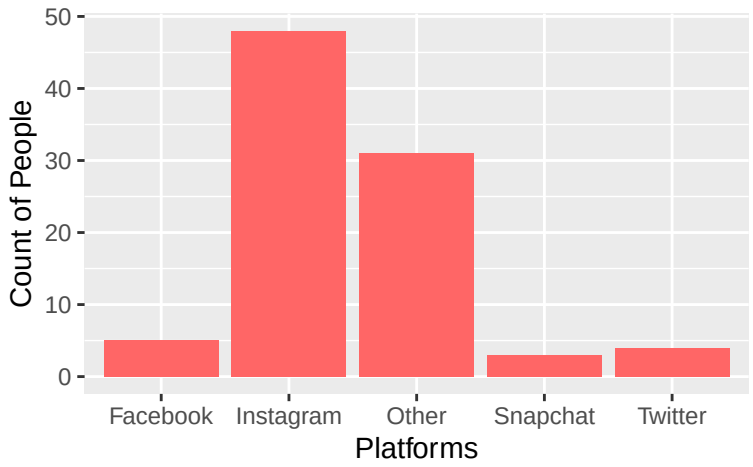
Figure 1: Variable List

```
# creating a new column indicating if the observation is in the any of the treatment group
data[,any_treatment := ifelse((treatment==1)|(treatment==2),1,0)]
```

Data Visualization

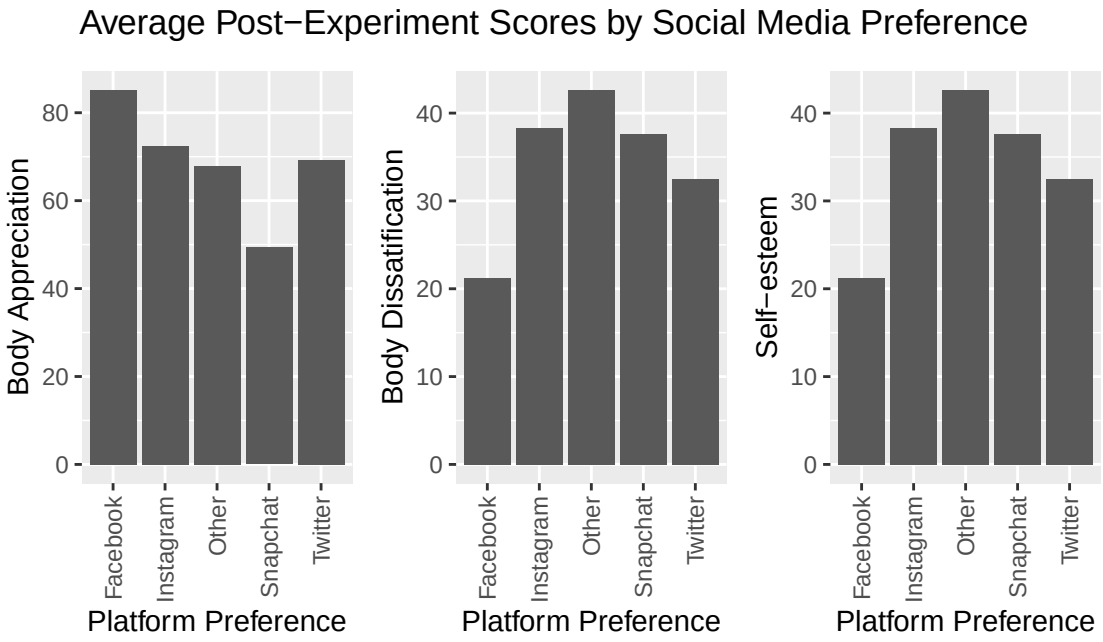
In general, Instagram is the most popular social media platform among all participants.

```
plot <- ggplot(data, aes(x=PlatformPreference))+
  geom_bar( fill = "#FF6666") + xlab('Platforms') + ylab("Count of People")
plot
```



Participants who like Facebook the most has the highest average body appreciation score and the lowest average body dissatisfaction score and self-esteem score. Participants who like Snapchat the most has the lowest average body appreciation score.

```
eda1 <- data[,list(avg_appreciation=mean(body_appreciation_after)),by=list(factor(PlatformPreference))]
eda2 <- data[,list(avg_dissatisfaction=mean(body_dissatisfaction_after)),by=list(factor(PlatformPrefere
eda3 <- data[,list(avg_esteem=mean(body_dissatisfaction_after)),by=list(factor(PlatformPreference))]
par(mfrow=c(1,3))
plot1<-ggplot(eda1,aes(x=factor,y=avg_appreciation))+geom_bar(stat='identity') +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  xlab("Platform Preference") + ylab('Body Appreciation')
plot2<-ggplot(eda2,aes(x=factor,y=avg_dissatisfaction))+geom_bar(stat='identity') +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1))+
  xlab("Platform Preference")+ ylab('Body Dissatification')
plot3<-ggplot(eda3,aes(x=factor,y=avg_esteem))+geom_bar(stat='identity') +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1))+
  xlab("Platform Preference") + ylab('Self-esteem')
plot1+plot2+plot3 +
  plot_annotation(title = "Average Post-Experiment Scores by Social Media Preference") &
  theme(plot.title = element_text(hjust = 0.5))
```

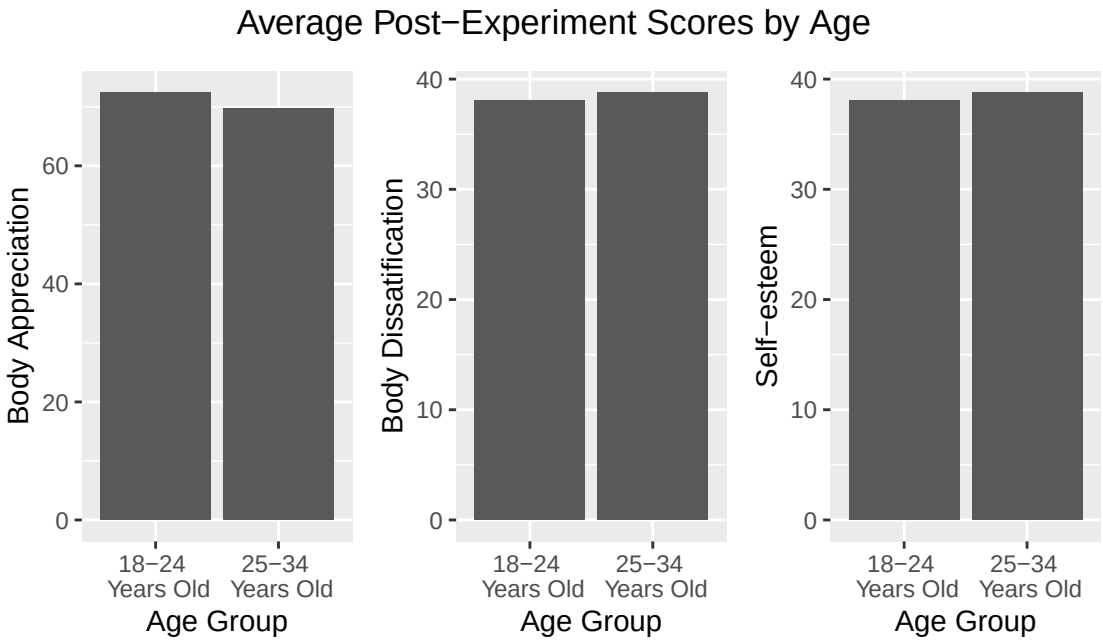


Participants in different age groups have similar average scores.

```
eda4 <- data[,list(avg_appreciation=mean(body_appreciation_after)),by=list(factor(age_group))]
eda5 <- data[,list(avg_dissatisfaction=mean(body_dissatisfaction_after)),by=list(factor(age_group))]
eda6 <- data[,list(avg_esteem=mean(body_dissatisfaction_after)),by=list(factor(age_group))]

plot4<-ggplot(eda4,aes(x=factor,y=avg_appreciation))+geom_bar(stat='identity')+
  xlab("Age Group")+ylab('Body Appreciation') +
  scale_x_discrete(labels=c("18-24 \n Years Old", "25-34 \n Years Old"))
plot5<-ggplot(eda5,aes(x=factor,y=avg_dissatisfaction))+geom_bar(stat='identity')+
  xlab("Age Group")+ ylab('Body Dissatification')+
```

```
  scale_x_discrete(labels=c("18-24 \n Years Old", "25-34 \n Years Old"))
plot6<-ggplot(eda6,aes(x=factor,y=avg_esteem))+geom_bar(stat='identity')+
  xlab("Age Group") + ylab('Self-esteem')+
  scale_x_discrete(labels=c("18-24 \n Years Old", "25-34 \n Years Old"))
(plot4+plot5+plot6+plot_annotation(title = "Average Post-Experiment Scores by Age") &
  theme(plot.title = element_text(hjust = 0.5)))
```



Average True Effect (ATE) Analysis Using Regression and t-Test

For our survey, we have 3 outcomes (body_appreciation_after, body_dissatisfaction_after, self_esteem_after). For the below regressions, we run function of each outcomes on any_treatment, and set social media visit time per day, BMI, interested as fixed effects. The result is that, for boy_appreciation_after, the treatment has a negative effect on it, aligning with our pre-experiment expectation, but this effect is not statistically significant. For body_dissatisfaction_after and self_esteem_after, the treatment has positive effects on them, and also not statistically significant. The former one aligns with our expectation but the later one doesn't.

```
sample_n(data,3)
```

```
##    treatment PlatformPreference TimePerDay age_group   bmi
## 1:         2          Instagram      3-Jan     25-34 18_24
## 2:         2              Other      3-Jan     25-34 24_29
## 3:         0          Instagram      3-Jan     18-24 18_24
##    body_appreciation_before body_dissatisfaction_before self_esteem_before
## 1:                       68                          15                 73
## 2:                       72                          30                 92
## 3:                       70                          40                 85
##               interested body_appreciation_after body_dissatisfaction_after
## 1: Somewhat_uninterested                      66                         24
## 2:               Neutral                      71                         30
## 3:   Somewhat_interested                      67                         47
```

	body appreciation	body dissatisfaction	self-esteem
constant	73.633***	35.100***	74.333***
	(2.555)	(4.580)	(3.133)
treatment	−4.355	5.146	−1.350
	(3.828)	(5.772)	(4.224)
Num.Obs.	91	91	91
R2	0.011	0.008	0.001
R2 Adj.	0.000	−0.003	−0.010
R2 Within			
R2 Pseudo			
AIC	804.7	857.9	811.0
BIC	809.7	862.9	816.1
Log.Lik.	−400.356	−426.957	−403.524
Std.Errors	Heteroskedasticity-robust	Heteroskedasticity-robust	Heteroskedasticity-robust

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

```
##    self_esteem_after any_treatment
## 1:                78             1
## 2:                90             1
## 3:                79             0
```

```
reg1 <- feols(body_appreciation_after ~ any_treatment,data=data,se='hetero')
reg2 <- feols(body_dissatisfaction_after ~ any_treatment,data=data,se='hetero')
reg3 <- feols(self_esteem_after ~ any_treatment,data=data,se='hetero')
modelsummary(list('body appreciation'=reg1,'body dissatisfaction'=reg2,
                  'self-esteem'=reg3),
             stars =TRUE,coef_rename=c('(Intercept)'='constant',
                                       'any_treatment'='treatment'))
```

```
## Warning: In version 0.8.0 of the ‘modelsummary‘ package, the default significance markers produced by
## This warning is displayed once per session.
```

We then tried to add fixed effects and control variables.

```
reg4 <- feols(body_appreciation_after ~ any_treatment| TimePerDay + bmi +
                factor(PlatformPreference),data = data,se = 'hetero')
reg5 <- feols(body_dissatisfaction_after ~ any_treatment| TimePerDay + bmi +
                factor(PlatformPreference), data = data,se = 'hetero')
reg6 <- feols(self_esteem_after ~ any_treatment| TimePerDay + bmi +
                factor(PlatformPreference),data = data,se = 'hetero')
modelsummary(list('body appreciation'=reg4,'body dissatisfaction'=reg5, 'self-esteem'=reg6),
             stars = TRUE,coef_rename = c('any_treatment'='treatment'))
```

```
reg7 <- feols(body_appreciation_after ~ any_treatment + factor(age_group) +
                body_appreciation_before, data = data,se = 'hetero')
reg8 <- feols(body_dissatisfaction_after ~ any_treatment + factor(age_group) +
                body_dissatisfaction_before, data = data,se = 'hetero')
reg9 <- feols(self_esteem_after ~ any_treatment +factor(age_group) +
                self_esteem_before, data = data,se = 'hetero')
modelsummary(list('body appreciation'=reg7,'body dissatisfaction'=reg8, 'self-esteem'=reg9),
```

	body appreciation	body dissatisfaction	self-esteem
treatment	−0.982	4.882	1.351
	(3.866)	(6.769)	(4.231)
Num.Obs.	91	91	91
R2	0.187	0.073	0.234
R2 Adj.	0.074	−0.056	0.127
R2 Within	0.001	0.007	0.001
R2 Pseudo			
AIC	806.8	871.8	806.9
BIC	836.9	901.9	837.1
Log.Lik.	−391.404	−423.880	−391.461
Std.Errors	Heteroskedasticity-robust	Heteroskedasticity-robust	Heteroskedasticity-robust
FE: TimePerDay	X	X	X
FE: bmi	X	X	X
FE: factor(PlatformPreference)	X	X	X

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

```
            stars = TRUE,coef_rename = c('any_treatment'='treatment',
            '(Intercept)'='constant','factor(age_group)25-34'='age 25-34',
            'body_appreciation_before'='pre body appreciation',
            'body_dissatisfaction_before'='pre body dissatisfaction',
            'self_esteem_before'='pre self-esteem'))
```

We then run regressions with more control variables (age_group). From the regression results, body appreciation and dissatisfaction still remain the pattern from the previous regressions, however, the treatment has a negative effect on self_esteem_after which is not statistically significant.

```
reg10 <- feols(body_appreciation_after ~ any_treatment + factor(age_group) +
                body_appreciation_before| TimePerDay + bmi +
                 factor(PlatformPreference),
              data = data,se = 'hetero')
reg11 <- feols(body_dissatisfaction_after ~ any_treatment + factor(age_group) +
                body_dissatisfaction_before| TimePerDay + bmi +
                 factor(PlatformPreference), data = data,se = 'hetero')
reg12 <- feols(self_esteem_after ~ any_treatment + factor(age_group) +
                self_esteem_before|TimePerDay + bmi +
                 factor(PlatformPreference), data = data,se = 'hetero')
modelsummary(list('body appreciation'=reg10,'body dissatisfaction'=reg11, 'self-esteem'=reg12),
             coef_rename = c('any_treatment'='treatment',
                             'factor(age_group)25-34'='age 25-34',
                             'body_appreciation_before'='pre body appreciation',
                             'body_dissatisfaction_before'='pre body dissatisfaction',
                             'self_esteem_before'='pre self-esteem'),stars = TRUE)
```

Randomization Check

Although we use randomization survey assigning feature from the survey website, we still want to check the control variables to confirm that our treatment groups have great diversity. The result of following regressions all have statistically insignificant coefficients for control variables, which suggest fail to reject the

	body appreciation	body dissatisfaction	self-esteem
constant	5.783	0.914	16.054
	(4.480)	(2.583)	(16.731)
treatment	−2.544	3.806	−1.267
	(2.039)	(2.519)	(2.411)
age 25-34	−1.741	−0.074	−2.671
	(2.115)	(2.603)	(3.810)
pre body appreciation	0.956***		
	(0.048)		
pre body dissatisfaction		0.925***	
		(0.053)	
pre self-esteem			0.807***
			(0.193)
Num.Obs.	91	91	91
R2	0.810	0.814	0.627
R2 Adj.	0.804	0.808	0.614
R2 Within			
R2 Pseudo			
AIC	658.4	709.6	725.5
BIC	668.4	719.7	735.5
Log.Lik.	−325.192	−350.814	−358.737
Std.Errors	Heteroskedasticity-robust	Heteroskedasticity-robust	Heteroskedasticity-robust

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

	body appreciation	body dissatisfaction	self-esteem
treatment	−2.632	3.263	−0.766
	(2.078)	(2.743)	(2.346)
age 25-34	−2.979	0.625	−3.457
	(2.009)	(3.077)	(3.999)
pre body appreciation	0.972***		
	(0.050)		
pre body dissatisfaction		0.935***	
		(0.059)	
pre self-esteem			0.779***
			(0.193)
Num.Obs.	91	91	91
R2	0.843	0.832	0.677
R2 Adj.	0.816	0.803	0.623
R2 Within	0.806	0.820	0.580
R2 Pseudo			
AIC	661.5	720.5	732.2
BIC	696.6	755.7	767.3
Log.Lik.	−316.737	−346.254	−352.083
Std.Errors	Heteroskedasticity-robust	Heteroskedasticity-robust	Heteroskedasticity-robust
FE: TimePerDay	X	X	X
FE: bmi	X	X	X
FE: factor(PlatformPreference)	X	X	X

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

	body appreciation	body dissatisfaction	self-esteem	age group
constant	1.077**	0.982***	0.904**	1.032***
	(0.344)	(0.155)	(0.336)	(0.149)
pre body appreciation	−0.001			
	(0.005)			
pre body dissatisfaction		0.001		
		(0.003)		
pre self-esteem			0.001	
			(0.004)	
age 25-34				−0.032
				(0.183)
Num.Obs.	91	91	91	91
R2	0.000	0.001	0.001	0.000
R2 Adj.	−0.011	−0.011	−0.010	−0.011
R2 Within				
R2 Pseudo				
AIC	225.8	225.8	225.7	225.8
BIC	230.8	230.8	230.7	230.8
Log.Lik.	−110.896	−110.890	−110.860	−110.900
Std.Errors	IID	IID	IID	IID

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

null hypothesis of treatment groups and the control group have similar platform preference and age group. Therefore, our randomization for assigning the treatment group is quite decent.

```
before1 <- feols(treatment~body_appreciation_before,data)
before2 <- feols(treatment~body_dissatisfaction_before,data)
before3 <- feols(treatment~self_esteem_before,data)
age_test<-feols(treatment~factor(age_group),data)
modelsummary(list('body appreciation'=before1,'body dissatisfaction'=before2,
                  'self-esteem'=before3,'age group'=age_test),stars = TRUE,
             coef_rename =c('(Intercept)'='constant',
                            'body_appreciation_before'='pre body appreciation',
                'body_dissatisfaction_before'='pre body dissatisfaction',
                'self_esteem_before'='pre self-esteem','factor(age_group)25-34'='age 25-34'))
```

We also test the power of the experiment on our major outcome, body_dissatisfaction_score. As shown below, our t-test power is only 0.286, which suggests that we are less likely to detect the effect. In order to detect the effect, we may plan for further experiment with larger sample sizes.

```
atehat<-data[any_treatment==1,mean(body_dissatisfaction_after-body_dissatisfaction_before)-
               data[any_treatment==0,mean(body_dissatisfaction_after-body_dissatisfaction_before)]]
cohens_d<-atehat/sd(data[,body_dissatisfaction_after-body_dissatisfaction_before])
pwr.t2n.test(n1=61,n2=30,d=cohens_d,sig.level=0.05,power=NULL)
```

```
##
##      t test power calculation
##
##              n1 = 61
##              n2 = 30
##               d = 0.314
```

```
##       sig.level = 0.05
##           power = 0.286
##     alternative = two.sided
```

Moreover, we are interested to see whether treatment 1 and 2 may have difference treatment effects. For body appreciation and self-esteem, the t-test results all have p-values larger than the significance level, therefore it's reasonable to conclude that there's no significant difference. For body dissatisfaction, the t-test shows that there is no difference under 95% significance level, but there's difference under 90% significance level. We are 90% confident that recognized celebrity body figure photo cause more more effect on body dissatisfaction in treatment arm 2 than photo without showing identity in treatment arm 1.

```
t.test(data[treatment==1,body_appreciation_after-body_appreciation_before],
       data[treatment==2,body_appreciation_after-body_appreciation_before])
```

```
##
##  Welch Two Sample t-test
##
## data:  data[treatment == 1, body_appreciation_after - body_appreciation_before] and data[treatment ==
## t = 0.3, df = 50, p-value = 0.8
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -4.01  5.26
## sample estimates:
## mean of x mean of y
##    -0.633    -1.258
```

```
t.test(data[treatment==1,body_dissatisfaction_after-body_dissatisfaction_before],
       data[treatment==2,body_dissatisfaction_after-body_dissatisfaction_before])
```

```
##
##  Welch Two Sample t-test
##
## data:  data[treatment == 1, body_dissatisfaction_after - body_dissatisfaction_before] and data[treatr
## t = -2, df = 50, p-value = 0.1
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -10.77   1.32
## sample estimates:
## mean of x mean of y
##     -0.60      4.13
```

```
t.test(data[treatment==1,self_esteem_after-self_esteem_before],
       data[treatment==2,self_esteem_after-self_esteem_before])
```

```
##
##  Welch Two Sample t-test
##
## data:  data[treatment == 1, self_esteem_after - self_esteem_before] and data[treatment == 2, self_est
## t = 0.5, df = 33, p-value = 0.6
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -6.13  9.72
```

```
## sample estimates:
## mean of x mean of y
##      -0.3      -2.1
```

Limitation

Our regression results are generally statistically insignificant and the t-test power is only 0.286, all indicating that our sample size is not large enough. Also, probably not all participants followed our instruction of viewing the images for 3 minutes. Moreover, impact of influencers was limited depending on the individual preference.

Conclusion

From our analysis, we discovered that viewing good body shape photo will decrease body appreciation, increase body dissatisfaction, and decrease self esteem, however the effects are not statistical significant, mainly due to small t-test power from small sample size. Randomization check confirmed that diverse participants are randomly assigned to the control and treatment 1&2 groups. Also, treatment 2 has more effect of body dissatisfaction than treatment 1, indicating that influencers could amplified effect on leading viewers' sentiment on social media.

Therefore, when appreciating photos on social media, influences' impact amplification should also be recognized. We suggest that people who are concerned about their anxiety and pressure can use the dislike button on social media platforms, utilizing big data algorithms to avoid viewing photos that might cause negative feelings. Social Media platforms can also take the user anxiety source into account for their recommendation algorithms.

Reference

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