Effect of Exercises on Endorphin Levels

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Group T

Literature

“Beta-endorphins are chemicals produced by the nervous system to manage pain or stress” (Schwarz). Studies have shown that most forms of exercise increase blood Beta-endorphin levels after 30 minutes. When the exercise intensity reaches the anaerobic threshold, there is an elevation of serum lactate level. Another factor that affect endorphin levels is age during exercise.

Research Question

Knowing that endorphins aid in pain management, and the literature shows that differences in age and participation in exercise can elevate endorphin levels in the blood, we wanted to investigate which exercise would be the most effective for increasing blood endorphin levels. In addition, we wanted to see if the effect was consistent across different age groups.

Design

Randomized Basic Factorial Design with two factors

1st Factor: Exercise - Swim Freestyle, Run Outdoors, Strength Training

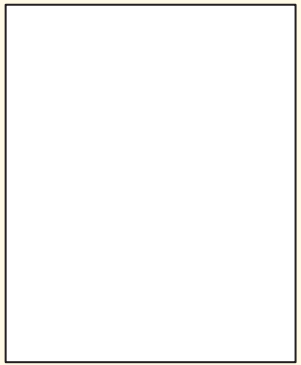
2nd Factor: Age group - 7-25, 26-50, 51+

Interaction between age group and exercise types

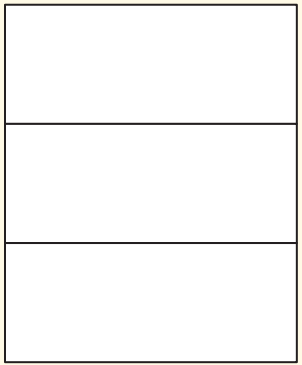
Response factor: Difference in Endorphins level (pg/mL)

Held constant factors : Sex (Male), City (Arcadia), Time (30 min)

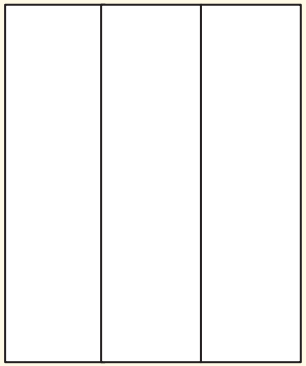
Benchmark df = 1



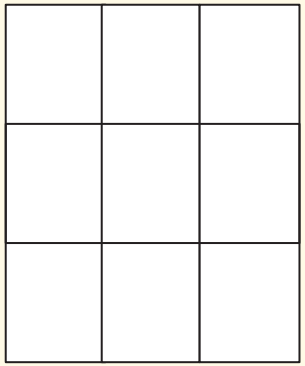
Exercise df = 2



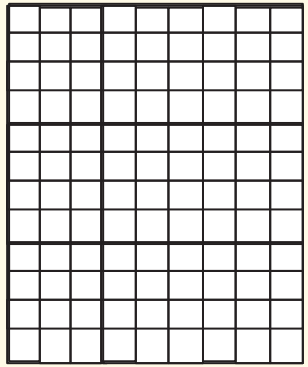
Age df = 2



Interaction df = 4



Error df = 189



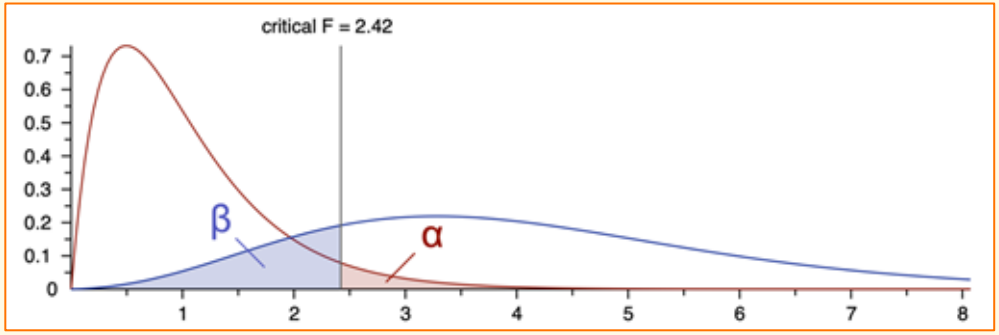
Sampling method

Recruited participants based on age groups

Randomly assigned participants to one of exercises

Sample size determination using G*Power

- Power of 80%
- Alpha of 0.05
- Effect size of 0.25
- G*Power estimation of 196
- Round up to 198
- 22 participants/group



Method

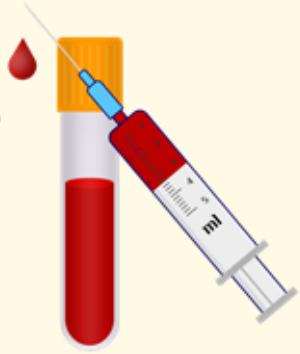
01

Measure initial Endorphins

02

Do randomly assigned exercise 30 min

03



Measure Endorphins after

Data Description

Name - Character value of full name for each Islander sampled

Age Group - Factor storing the age group of each Islander sampled (1 - (0 - 25 years), 2 - (26-50 years), 3 (51 + years))

Initial Endorphin Levels (pg / mL) - Numeric value of blood endorphin level prior to exercise

Exercise - Factor for type of exercise (“SWIM”, “RUN”, or “STRETCH”)

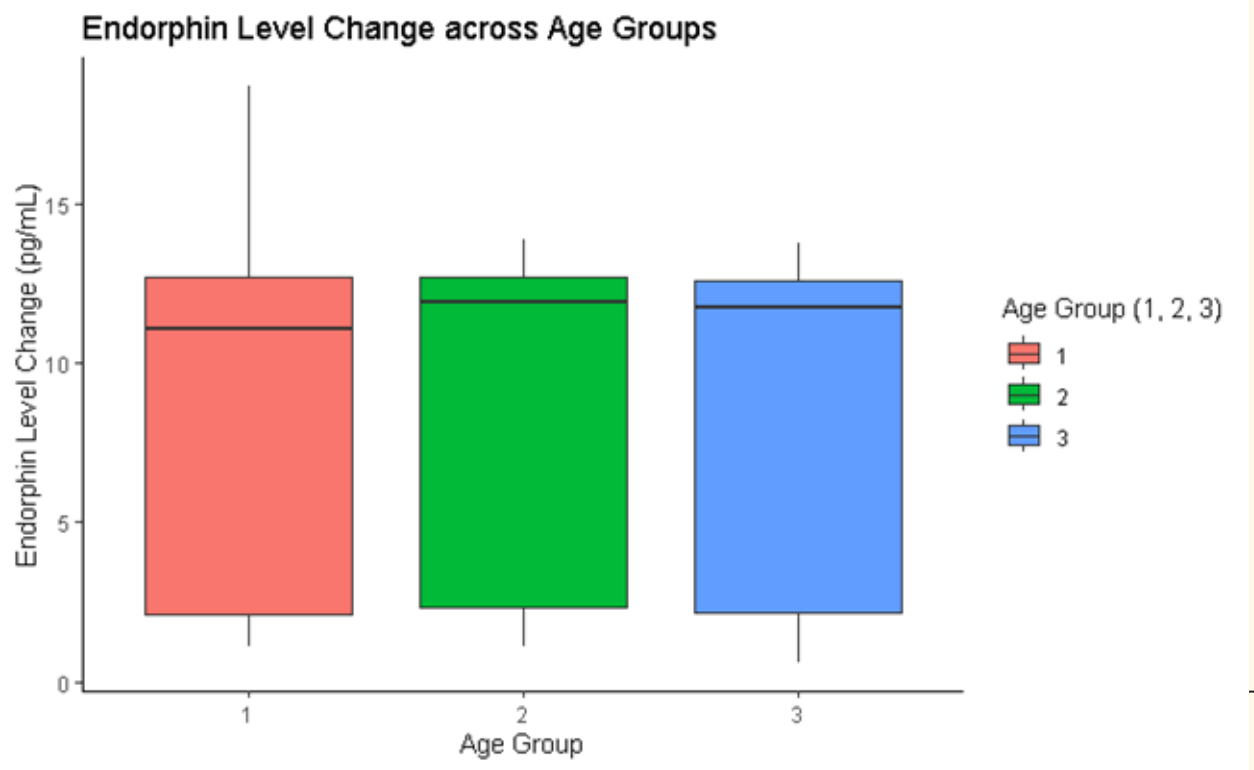
Endorphin Levels After (pg / mL) - Numeric value of blood endorphin level after exercise

Endorphin Level Change (pg / mL) - Numeric value obtained from Endorphin Levels After - Initial Endorphin Levels

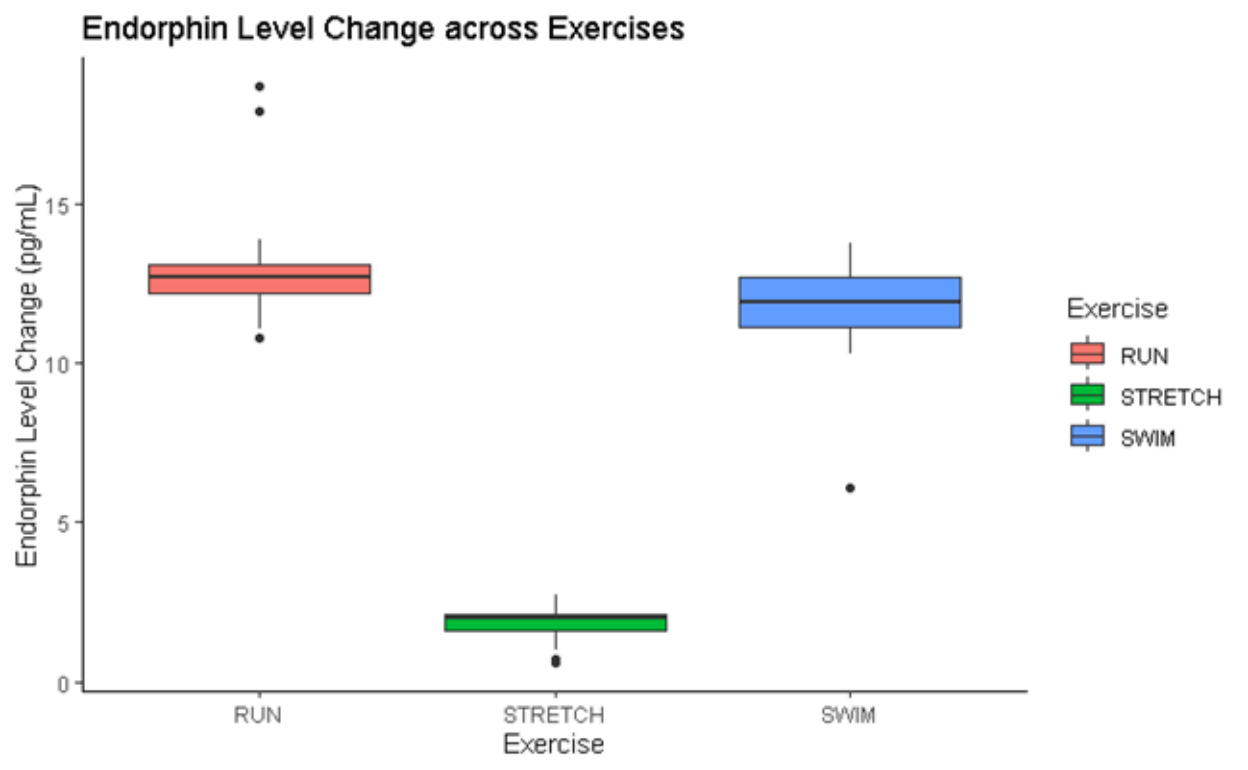
Data Summary

Name	Age Group (1, 2, 3)	Initial Endorphin Level (pg/mL)	Exercise	Endorphin Levels After	Endorphin Change
Length:198	1:66	Min. :46.70	RUN :66	Min. :49.70	Min. : 0.600
Class :character	2:66	1st Qu.:50.80	STRETCH:66	1st Qu.:55.23	1st Qu.: 2.100
Mode :character	3:66	Median :52.05	SWIM :66	Median :62.65	Median :11.750
NA	NA	Mean :51.99	NA	Mean :60.82	Mean : 8.836
NA	NA	3rd Qu.:53.40	NA	3rd Qu.:65.00	3rd Qu.:12.700
NA	NA	Max. :56.60	NA	Max. :73.50	Max. :18.700

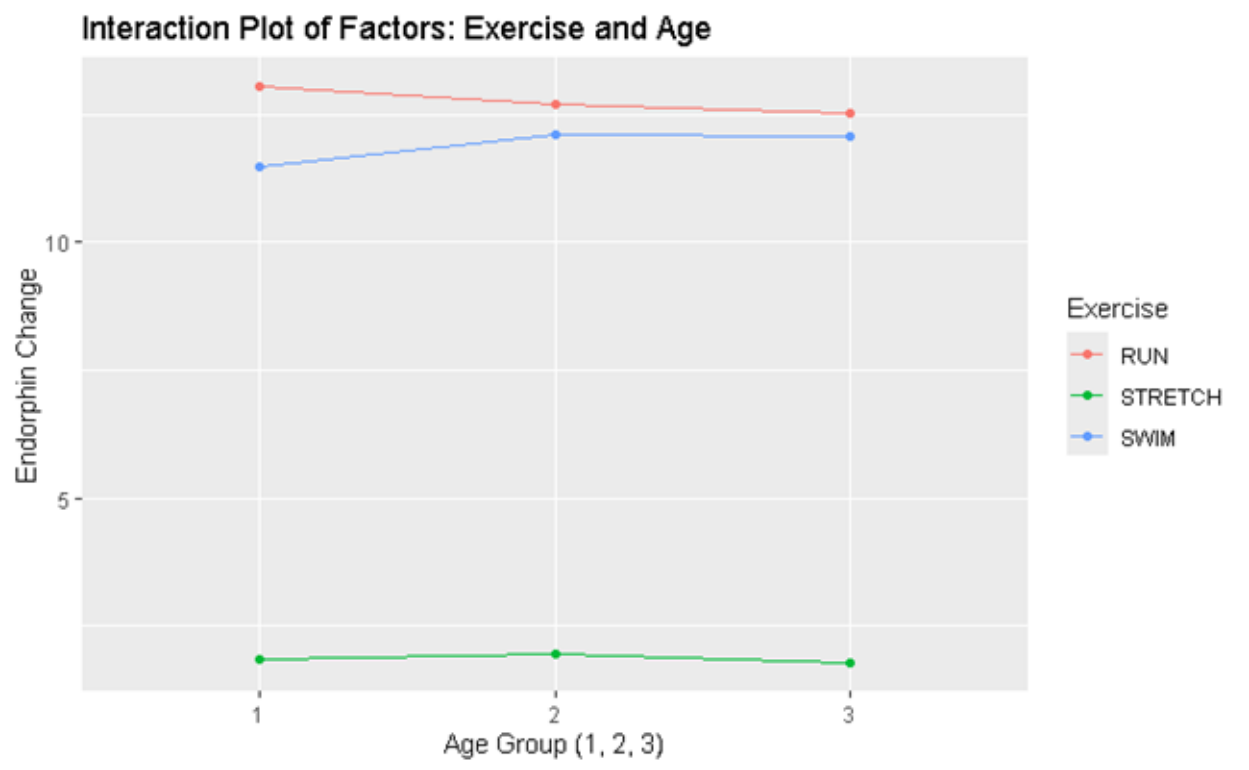
Comparison of Endorphin Level Changes across Age Groups



Comparison of Endorphin Level Changes across Exercises



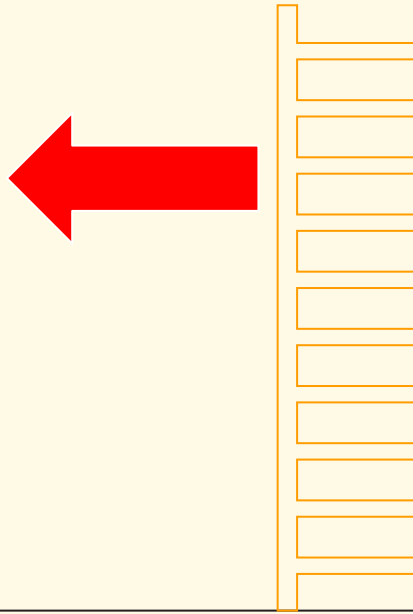
Do we consider the interaction?



ANOVA Results of Full Model

ANOVA Summary Table of Full Model

Df	Sum Sq	Mean Sq	F value	Pr(>F)
2	4843.119091	2421.5595455	2571.9814934	8.454943e-138
2	0.740303	0.3701515	0.3931445	6.754819e-01
4	7.952424	1.9881061	2.1116028	8.097232e-02
189	177.946364	0.9415152	NA	NA



ANOVA Results of Reduced Model

ANOVA Summary Table of Reduced Model

Df	Sum Sq	Mean Sq	F value	Pr(>F)
2	4843.1191	2421.5595455	2530.039	3.325919e-140
195	186.6391	0.9571235	NA	NA

Which Model is better?

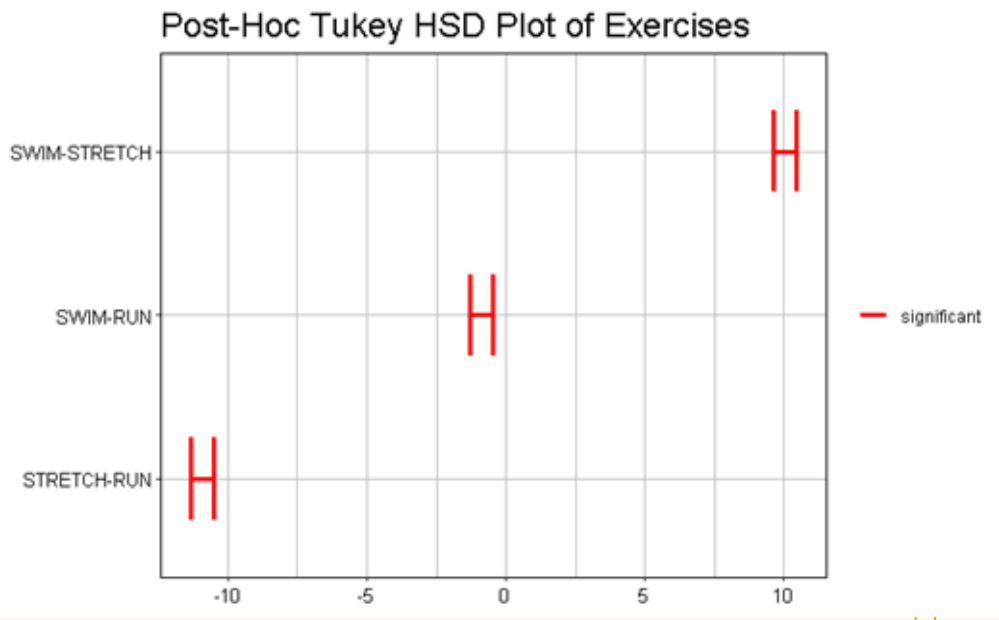
Partial F Test: Reduced Model vs Full Model

Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
195	186.6391	NA	NA	NA	NA
189	177.9464	6	8.692727	1.538783	0.1675427

Post-Hoc Analysis of Exercise

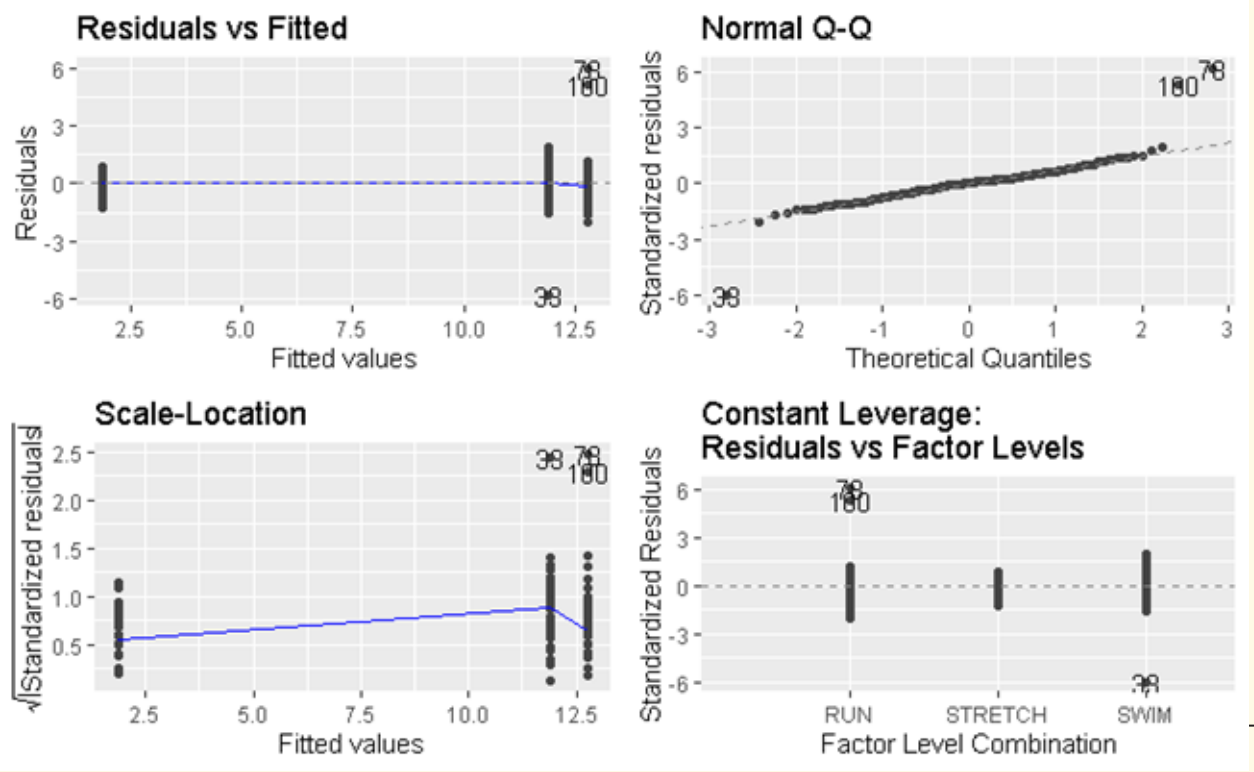
Tukey HSD 95% Confidence comparison of means

	diff	lwr	upr	p adj
	-10.9045455	-11.306763	-10.5023280	0.000000e+00
	-0.8818182	-1.284036	-0.4796008	1.662826e-06
	10.0227273	9.620510	10.4249447	0.000000e+00



Final Linear Model

	(1)
(Intercept)	12.765
	(0.120)
ExerciseSTRETCH	-10.905
	(0.170)
ExerciseSWIM	-0.882
	(0.170)
Num.Obs.	198
R2	0.963
R2 Adj.	0.963
AIC	558.2
BIC	571.4
Log.Lik.	-275.100
RMSE	0.97



Final equations

Final equation:

$$\text{`Endorphin Change`} = \alpha + \beta_1(\text{Exercise}_{\text{STRETCH}}) + \beta_2(\text{Exercise}_{\text{SWIM}}) + \epsilon$$

Model Fit Equation:

$$\widehat{\text{`Endorphin Change`}} = 12.77 - 10.9(\text{Exercise}_{\text{STRETCH}}) - 0.88(\text{Exercise}_{\text{SWIM}})$$

Conclusion

Under the assumption that alpha level is 0.05, the type of exercise is a significant predictor variable and age was not a significant predictor variable for the difference in endorphin levels.

However, based on the Tukey HSD and the comparison of exercises, swimming and running produce a high difference in endorphin levels, but stretching had a relatively low difference in endorphin levels. In conclusion, not all forms of exercise are equivalent in boosting endorphin levels and by extension helping with pain management..

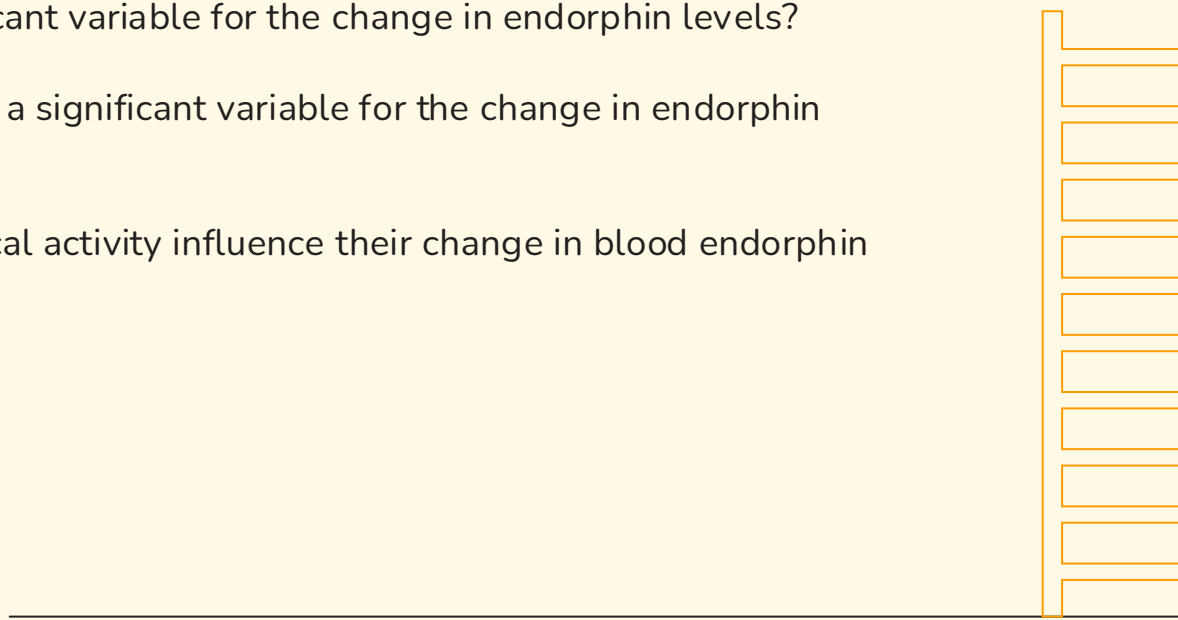
Future research can investigate the effect of factors that were held constant in the study.

Future Research Questions

Is the sex of the person a significant variable for the change in endorphin levels?

Are the locations of the subjects a significant variable for the change in endorphin levels?

Would a person's level of physical activity influence their change in blood endorphin levels?



References

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https://www.semanticscholar.org/paper/Release-of-Endomorphin-Hormone-and-Its-Effects-on-A-Rokade/d9d6a77f113bb866ea1588edf646a60e25ca1755?p2df

Journal about Changed in Endorphin Levels in Response to Aerobic and Anaerobic Exercise (Lothar Schwarz and Wilfried Kindermann)
https://link.springer.com/article/10.2165/00007256-199213010-00003

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https://onlinelibrary.wiley.com/doi/abs/10.1002/smi.892?casa_token=c21BfIBNmn4AAAAA%3AxQ89rJnCjxX8g0oCE98A0YhUyAS5q9_cR0MhnTNKSiyiqSu_WaeJXcz-FYHlpgVd0R7ubol9i72aNQ

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https://pubmed.ncbi.nlm.nih.gov/6252495/