

DATA QUEST – Case Study Competition 2023

From *fork* to *fitness*

Exploring the Relationship Between Eating Patterns and Obesity

1. STUDY DESIGN

A 52 week, randomized double-blinded, controlled, parallel group, multi-center trial is proposed to be conducted in 564 teens with obesity and who have met *Diagnostic and Statistical Manual of Mental Disorders*, 4th Edition, (DSM-IV-TR) criteria for eating disorder. For your study design, consider a 15% dropout rate and 478 study participants are supposed to complete the treatments assigned. Eligible study participants are randomized to receive Testa 1.0 mg, Testa 2.0 mg and Placebo in a 1:2:1 manner based on body mass index(kg/m²). Induce a 15% missingness randomly for BMI, body weight in your data by considering the following missing data pattern. For simulation, use the seed number=12345.

Pattern	Visit 0 (Week 0) Baseline	Visit 1 (Week 13) Intermediate	Visit 2 (Week 26) Intermediate	Visit 3 (Week 52) End of treatment	%
I				X	9
II			X		4
III			X	X	2
					15

*X – The observation is missing at that Visit.

2. VARIABLE DESCRIPTION

Variables/ Visit Number	Visit 0	Visit 1	Visit 2	Visit 3
Body weight	X	X	X	X
BMI	X	X	X	X
Sex	X			
Age	X			
Waist Circumference	X	X	X	X
UCS	X	X	X	X
ECS	X	X	X	X
RCS	X	X	X	X
Motor impulsiveness	X	X	X	X
Lack of Planning	X	X	X	X
Attentional Impulsiveness	X	X	X	X
Country [Cook Islands, Mexico, Marshal Islands, USA, Brazil, Tuvalu, and Nauru]	X			
Added Sugar Consumption per Day	X	X	X	X

*X – The observation is collected at that Visit.

Description:

- (1) Body weight of teens measured at each visit by a standardized weighing scale in kilogram.
- (2) Body Mass Index of teens calculated using weight/height² and is measured in kg/m².
- (3) The gender of the study participant recorded at baseline.

- (4) Waist Circumference of study participant recorded at each visit in cm.
- (5) *TestQ*: Restrained Control Eating Score (RCS) - Dietary restraint, or the conscious methods for controlling food intake, is assessed by RCS. RCS ranges from 0 to 21. **Classification** - Scores between 0 and 10 are categorized as low to average restraint, 11 to 13 as high, and 14 to 21 as restraint levels that are clinically concerning.
- (6) *TestQ*: Emotional Eating Score (ECS) – ECS captures the tendency to overeat in response to negative emotions. Scores on ECS component range from 0 to 16. **Classification** - Scores of 0 to 8 are classified as low to average, 9 to 11 as high, and 12 to 16 as disinhibition levels that are clinically concerning.
- (7) *TestQ*: Uncontrolled Eating Score (UCS) – UCS captures tendency to overeat, with the feeling of being out of control. UCS scores range from 0 to 14. **Classification** - Scores of 0 to 7 are classified as low to average, 8 to 10 as high, and 11 to 14 as clinically concerning.
- (8) *Impulsivity Questionnaire*: This is a 30-item questionnaire measuring trait impulsivity, under the following 3 factors: attentional impulsivity (attention and cognitive instability), motor impulsivity (motor and perseverance), and non-planning (self-control and cognitive complexity). Each factor has questions scored on a four-point scale from 1 - (Never) to Four (Certainly/Always). Higher the score, greater is the impulsiveness. The total score of *Impulsivity Questionnaire* ranges from 30-120.
- (9) Motor impulsiveness – To act without giving it a thought.
- (10) Attentional impulsiveness – Inability to focus/concentrate on a task.
- (11) Non planning – Lack of planning into future.
- (12) Added Sugar Consumption per day – The amount of added sugar (in grams) consumed in a day. The recommended amount is 30g. It is observed that teens belonging to lower-middle income brackets are more susceptible to drinking sugar sweetened beverages.

3. 'Sugar tax' imposition policy

Consider a hypothetical scenario. Based on WHO policy implementation guidelines, the governments of the above-mentioned countries have decided to impose a tariff/tax of 0.5\$/L on beverages (containing > 8 g of sugar per 100 mL) for the entire year Jul 2023 – Jul 2024. This action would indirectly have an impact on the added sugar consumption per day and hence tackle obesity in teens. The tax rate was levied aiming the manufacturers of the drinks to incentivize them to reduce the sugar content of beverages.

4. SIMULATION PARAMETERS

*Mean (SD) is mentioned for all the parameters listed below.

(a) Testa 1.0 mg:

Parameters (Testa 1mg)	Visit 0	Visit 1	Visit 2	Visit 3
RCS	7.3(4.24)	9.2(4.26)	10.1(4.31)	12.4(4.54)
ECS	13.3(2.27)	10.7(2.21)	9.5(2.17)	6.3(2.13)
UCS	10.2(3.17)	7.3(2.90)	6.6(2.87)	5.4(2.70)
Motor impulsivity	22.3(4.52)	21.8(4.40)	21.3(4.37)	21.7(4.41)
Lack of Planning	24.2(4.96)	23.3(4.94)	23.7(4.98)	22.8(4.90)
Attentional Impulsivity	15.7(3.35)	14.4(3.32)	14.8(3.89)	13.2(3.29)
BMI	37.3(5.97)	32.6(5.72)	30.3(5.63)	28.5(5.52)
Body Weight	108.9(23.14)	101.5(20.59)	92.4(19.82)	82.7(18.67)
Waist Circumference	95.4(8.57)	92.6(8.43)	90.1(8.32)	86.8(8.54)
Added sugar consumption per day	73(15.43)	65(10.51)	54(10.24)	48(9.45)

(b) Testa 2.0 mg:

Parameters (Testa 2mg)	Visit 0	Visit 1	Visit 2	Visit 3
RCS	8.2(4.53)	12.2(4.62)	13.1(4.7)	13.8(4.72)
ECS	12.8(2.47)	4.6(2.31)	4.5(2.27)	3.2(2.08)
UCS	10.4(3.51)	4.7(2.89)	4.5(2.82)	3.9(2.65)
Motor impulsivity	22.1(4.79)	21.5(4.68)	20.7(4.58)	20.2(4.50)
Lack of Planning	24.5(5.72)	22.4(5.67)	21.8(5.64)	20.6(5.62)
Attentional Impulsivity	15.0(4.11)	14.3(4.05)	13.8(4.01)	13.3(3.96)
BMI	36.5(5.87)	31.5(5.71)	28.1(5.64)	26.7(5.61)
Body Weight	107.5(22.59)	100.4(20.34)	90.7(19.59)	80.6(18.88)
Waist Circumference	93.4(7.89)	91.7(7.81)	88.4(7.76)	85.2(7.63)
Added sugar consumption per day	69(18.64)	61(14.53)	53(13.21)	41(10.43)

(c) Placebo:

Parameters (Placebo)	Visit 0	Visit 1	Visit 2	Visit 3
RCS	6.4(4.01)	7.3(4.23)	7.5(4.30)	9.4(4.41)
ECS	13.2(2.37)	12.8(2.35)	11.3(2.27)	10.4(2.24)
UCS	11.4(2.45)	10.5(2.41)	9.2(2.34)	7.5(2.21)
Motor impulsivity	22.2(4.37)	21.9(4.65)	21.6(4.60)	21.9(4.56)
Lack of Planning	25.4(6.39)	24.7(6.41)	24.9(6.47)	23.8(6.32)
Attentional Impulsivity	16.2(4.60)	15.7(4.54)	14.3(4.50)	14.8(4.55)
BMI	38.2(6.23)	34.3(6.10)	32.7(5.89)	29.5(5.82)
Body Weight	110.5(24.45)	103.4(20.78)	95.7(19.89)	85.5(19.78)
Waist Circumference	97.8(8.75)	95.4(8.69)	90.5(8.54)	89.7(8.43)
Added sugar consumption per day	80(23.29)	73(20.35)	62(18.41)	53(16.32)