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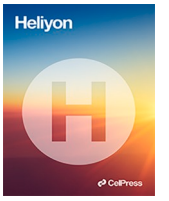

Research article

Associations between personality traits and emotional experiences as predictors of obesity during the COVID-19 pandemic: A cross-sectional study

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ABSTRACT

This quantitative cross-sectional descriptive research aimed to investigate the relationship between personality traits, emotions, and obesity among Saudi adults during the COVID-19 pandemic. The study recruited 383 participants from Riyadh using non-probability sampling. A validated online survey, including the PANAS-SF and BFI-10 measures, was used and hosted on Qualtrics. Descriptive and multiple regression analyses were performed on the data. The study found that conscientiousness was the highest personality trait among the sample, with an average score of 7.74, while the mean for openness was the lowest. The incidence of obesity was high among participants, with a rate of 29.2 %. Furthermore, there was a significant relationship between negative affect and obesity ($p = 0.033$). Based on these findings, public health specialists and health promoters should design programs using the socio-ecological model as a guide to address the important factors at every level of the model.

1. Introduction

SARS-CoV-2, also known as the Coronavirus or COVID-19, is a global public health hazard that has affected the daily lives of people all over the world, leading to varying levels of anxiety and stress and impacting mental well-being [1]. The Big Five model is widely used to classify personality traits, comprising conscientiousness, extraversion, agreeableness, openness to experience, and neuroticism, which help to understand human behaviour in different circumstances and environments [2]. Although traditionally viewed as immutable dispositional qualities, recent research indicates that people's Big Five personality traits can vary over time, even in maturity [3]. Since people have different defence strategies, behavioral disturbances, and psychiatric problems, personality traits play a crucial role in understanding human behavior [4]. The uncertainty surrounding when the COVID-19 pandemic will end may trigger higher spontaneous emotions in individuals with varying personality traits that represent their coping mechanisms [5]. Additionally, personality traits have been linked to body mass, including cognitive and behavioral components. Cognitive factors indicate that personality traits are involved in health-related decision-making and can be significant in risk evaluations. At the behavioral level, personality traits are examined in the context of health behavior, with food consumption and physical activity as the two most fundamental elements [6]. The pandemic's global presence may also result in emotional trauma, with heightened stress responses leading to increased caloric intake and a higher risk of obesity, especially for those with few social connections [7]. A previous study

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found that public health emergencies increase the likelihood of negative affect (NA) and mood disorders [8]. Therefore, it is possible that the COVID-19 environment has already had a detrimental impact on the emotional well-being of many individuals [9].

1.1. Big five personality traits during Covid-19

Numerous investigations have been conducted to understand the role of the Big Five personality traits during exceptional times such as the COVID-19 pandemic. One study assessed the impact of the Big Five personality traits, perceived risks, and individual hygiene practices on social distancing among Qatari residents [10]. A total of 430 individuals completed an online survey using BFI-10 as the tool via convenience sampling. SPSS multiple regression analysis found a significant positive relationship between social distance and conscientiousness, while a negative association was found between social distance and agreeableness. Another study was conducted in Germany, evaluating the Big Five personality traits as predictors of individual variances and changes in the COVID-19 environment [11]. Data were collected from 588 full-time workers during a ten-month period using online surveys. The study found that emotional stability was associated with lower levels of reported stress, while extraversion was linked to higher levels of felt stress. Moreover, another study examined the association between two personality traits, extraversion, and conscientiousness, and their involvement in two restriction measures, social distance, and hand hygiene during the COVID-19 outbreak [12]. A sample of 715 Brazilians completed the BFI-2-S using convenience sampling. Extraversion was found to be linked with reduced levels of social distancing, while conscientiousness was associated with higher levels of social distancing and hygiene. Additionally, a large study during COVID-19 in Canada used social media to disseminate a web survey and the BFI-10 to explore the associations between neuroticism, extroversion, and psychological wellbeing [13]. Neuroticism and extroversion in 1096 participants were shown to relate to all three aspects of cognitive health, with a stronger association with psychological and social well-being. These studies provide valuable insights into people's attitudes towards restriction measures and their personality traits during the pandemic.

1.2. Emotional experiences during Covid-19

Few studies have examined the impact of the COVID-19 pandemic on human emotions and feelings. Two studies by Wang et al. [15] and Kornilaki [14] used a cross-sectional design to investigate the pandemic's influence on university students' emotional states and experiences on two different continents [14,15]. Both studies recruited students via non-random sampling and used an online survey that included a PANAS questionnaire to assess students' positive affect (PA) and NA regarding the pandemic in the preceding week. One found that 17,876 Chinese students who expressed dissatisfaction with control measures had lower PA and higher NA [15], while the other examined 1098 students living in Greece and found that excitement and enthusiasm were low, and the only positive impact that received a high score was interest [14]. However, NA was high, with anxiety, upset, and anxiousness being the most prominent. These findings suggest that people did not experience strong positive feelings while confined, which may account for the heightened levels of depression. A cross-sectional survey including 906 participants reached by email and social media examined the emotional impact of the COVID-19 lockdown among the general population in Spain [16]. After 8 weeks of lockdown, the study found an increase in NA and a decrease in PA, as well as a corresponding decline in mood. Another cross-sectional online survey of German and Austrian citizens examined respondents' emotional state and other sociodemographic characteristics in relation to the COVID-19 crisis [17]. Overall, these studies suggest that the negative impacts of the pandemic, such as increased anxiety and decreased PA, are more prevalent.

1.3. Big Five personality, emotional experience, and obesity

People with obesity have been shown to be particularly susceptible to severe COVID-19 infection [18]. The rates of obesity and sedentary-lifestyle-related morbidity have increased rapidly worldwide, affecting one-third of the world's population, with the incidence rising over the past 40 years [19], which has been especially visible in the Gulf states [20]. In Saudi Arabia, the prevalence of obesity and overweight among adults has risen from 38.1 % in 1975 to 69.7 % in 2016, with 20,000 Saudis dying each year due to obesity-related complications [21].

Numerous studies have investigated personality traits associated with obesity in different settings. Cross-sectional and longitudinal studies have investigated personality traits linked with obesity in Germany [22]. The cross-sectional model found a statistically significant relationship between obesity and the personality traits of neuroticism, extraversion, openness, and agreeableness. Among the 2026 participants in the longitudinal study, only two personality traits, extraversion and agreeableness, showed a statistically significant link with obesity. The relationship between personality and obesity in a large Danish population sample found that all personality traits except neuroticism were strongly correlated with BMI, with extraversion and agreeableness being the most consistent predictors in both genders [23]. Similarly, a separate study found that participants who scored higher on neuroticism or extraversion or lower on conscientiousness had a higher BMI [24].

Little research has studied the relationship between PA and NA and obesity. A quantitative descriptive cross-sectional investigation in Australia examined the relationship between obesity and PA and NA in 273 women involved in a medical experiment [25]. The results of the regression revealed that obesity had a significant relationship with NA, but there was no association between BMI and positive emotion. Another study explored the relationship between BMI and positive and negative emotion and whether this link is mediated by physical health and stressful interpersonal relationships [26]. They found that obesity was associated with high NA and less PA and that the physical and psychological challenges connected with obesity may exacerbate an individual's depressed feelings.

1.4. Current study

While several studies have investigated the association between personality, emotional experience, and obesity in different countries, none have focused on Riyadh, Saudi Arabia, despite its large population and growing economy. The prevalence of obesity in Saudi Arabia is expected to continue to increase [27], and exploring the relationship between personality, emotional experience, and obesity in Saudi Arabia could help direct preventive measures and inform the development of public health programmes aimed at supporting obese residents. Additionally, an evaluation of the psychological status and personality of Saudi people could help provide strategies for targeted psychological interventions and the development of public health services. The aim of this study is to explore whether personality and emotional experience measures among Saudi adults residing in Riyadh are associated with obesity. The study's primary research objectives are to.

1. Explore the Big Five personality traits among Saudi adults in Riyadh during the COVID-19 pandemic.
2. Explore emotional health indicators among Saudi adults in Riyadh during the COVID-19 pandemic.
3. Investigate the association between personality, emotional health, and obesity among Saudi adults in Riyadh during the COVID-19 pandemic.

2. Methodology

2.1. Study design

This study employed a cross-sectional quantitative design. A survey research design was used to provide a quantitative description of patterns, ideas, and beliefs as it evaluates correlations between variables of populations by surveying a sample of that population [28].

2.2. Study sample and procedures

The target population for this study was Saudi adults of both sexes who resided in Riyadh during the COVID-19 pandemic and were subjected to its effects during that period. The study was conducted online from October–November 2021, using the Qualtrics survey software. The sample procedures employed in this investigation were snowball and convenience sampling. The inclusion criteria for the study were Saudi adults of both genders who had internet access and lived in Riyadh during the COVID-19 pandemic. The study's exclusion criteria were children and adolescents due to their lower likelihood of maintaining healthy eating behaviours and the need for independent examination. A statement in Arabic was presented at the beginning of the survey to ensure that participants met the inclusion criteria. To reach the study's target population, researchers used a web-based survey conducted on the WhatsApp platform, which was expected to be more convenient than alternative methods. The study design and sample selection aimed to effectively obtain the needed sample size while ensuring that the study's results were representative of the target population.

The questions were written in English; however, an Arabic translation version was included because the target group spoke Arabic. Initiating the survey in English was crucial to align with the English literature review. Subsequently, to tailor the survey to Arabic-speaking participants, a two-step translation process was employed. Initially, two translators facilitated the translation of the survey from English to Arabic. Following this, individuals with backgrounds in health education meticulously reviewed and edited the translated survey to enhance its clarity and accessibility. To verify precision, the Arabic version underwent back translation to English by a separate translator. Furthermore, initial email invitations were sent to a randomly selected group from an existing Ministry of Health (MOH) database, and the survey was also advertised on social media platforms, including student groups and Doctors Group. The survey took the respondents 15 min to finish. Since this study employed a cross-sectional design, it was crucial to choose the most appropriate time period to distribute the survey for the target population in order to obtain the best findings. Since the majority of Saudi Arabia's population is Muslim, certain periods of the year, such as Ramadan, the Islamic Eid holiday, were avoided because they may have altered the study's findings [29]. Additionally, there are various national holidays; hence, the survey was intentionally distributed on normal working days from 25 to 30 November and was conducted over a seven-day period to mitigate the influence of these events on recruiting a suitable number of participants.

2.3. Ethical considerations

This research received ethical clearance reference 1810 21, from the CHHS-REC at Swansea University to ensure that ethical standards were adhered to throughout the procedure. Participants' autonomy was ensured by obtaining their consent when they agreed to participate in the research and accepted the study's terms and conditions, which were attached to the survey. The researchers took steps to maintain the confidentiality and anonymity of the participants by ensuring that the data collected was kept secure and that no identifying information was collected. These measures were taken to protect the participants' privacy and ensure that their participation in the study was voluntary and that their rights were respected.

2.4. Sample size

The statistical approach for this study involved a power calculation, which was used to determine the statistical significance of the

study's results when comparing variables [30]. The sample size for this investigation was determined using G power software (Version 3.1.9.6), which is an application that performs power evaluations on statistical tests used in sociological and behavioral research [31]. A priori power analysis was conducted using multiple regression as the statistical test for this investigation. A power curve was extracted based on the parameters of 1-β = .80 for the needed power, a level of significance of .05, an effect size limited within a modest range of .15 in accordance with Cohen's criteria [32], and 14 predictors. Based on the power analysis, a minimum sample size of n = 135 was required to achieve a power of .80. This approach ensured that the study's results were statistically significant and robust, and that the sample size was sufficient to achieve the desired power.

2.5. Measures

Data for this study was collected through an online survey that measured three distinct parameters. The Big Five Inventory 10 (BFI-10) was used to measure personality, as established by previous research [33]. The BFI-10 measures personality using 10 questions, with two questions used to measure each of the five personality traits (Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness); see Table 2. Some questions were reversed, so the score of answers needed to be changed (5 = strongly agree to 1 = strongly disagree). The BFI-10 scales have a high degree of reliability (.83) and validity [33]. All data was entered digitally to minimise the risk of error.

PANAS-SF [34] was employed to measure emotional health. The PANAS-SF is a ten-item self-report test that measures PA and NA experienced in the previous week. It consists of five PA (alert, inspired, determined, attentive, and active) and five NA (afraid, upset, hostile, ashamed, and nervous) measured on a five-point scale ranging from 1 (indicating no affect at all) to 5 (indicating a great deal of affect). The PANAS-SF has a high level of internal consistency, with a Cronbach's alpha coefficient of .89 for the PA scale and .85 for the NA scale [35]. The measure was employed to examine the association between affect and obesity within a specific timeframe. Although it may not capture the complete range of emotional fluctuations, it still offers valuable insights into the role of affect in obesity during the study period.

Finally, information on BMI was obtained through questions about height and weight. BMI is used to evaluate overall obesity and is calculated by dividing an individual's weight in kilograms by the square of their height in metres (kg/m2); see Table 4 for details of BMI classification [36]. This information was collected to investigate the association between personality, emotional health, and obesity in Saudi adults residing in Riyadh during the COVID-19 pandemic.

2.6. Data analysis

SPSS (Version 27) was used to analyse the data obtained via the Qualtrics platform. Descriptive statistics were used to show the frequencies and percentages of the different variables. Inferential statistical analysis was used to determine whether a relationship between the variables existed [37]. A multiple regression analysis was performed to investigate the relationship between these predictors and obesity, as the dependent predicted variable, during the COVID-19 pandemic using 10 predictors: five personality (BFI-10) measures and two emotional experience (PANAS-SF) measures, gender, age and education level as independent variables. The normality and constant variance assumptions of the regression were assessed through Q-Q plots and scatter plots, respectively. Additionally, collinearity between variables was evaluated using the variance inflation factor (VIF), ensuring that each variable exhibited VIF values less than 10 [37].

The sample was tested again using G power software (Version 3.1.9.6), and post-hoc analysis revealed that the 10 predictors had a power of 0.99 when considering a small effect size which is .14. With this sample, there was a 1 % possibility of obtaining a type 2 error, in which the assumption is rejected although it shouldn't be [32]. Hence, the minimum required sample size was 126

Table 1
Distribution of personal information.

Variable		N	%
Q1 gender	Male	146	38.1 %
	Female	237	61.9 %
Q2 age group	18–29	66	17.2 %
	30–39	103	26.9 %
	40–49	81	21.1 %
	50–59	78	20.4 %
	60–64	42	11.0 %
	65 and above	13	3.4 %
Q3 marital status	Married	298	77.8 %
	Widowed	7	1.8 %
	Divorced	12	3.1 %
	Never married	66	17.2 %
Q4 education level	Primary education	1	.3 %
	Intermediate education	3	.8 %
	High school education	39	10.2 %
	Diploma	42	11.0 %
	Undergraduate Education	227	59.3 %
	Graduate Education	71	18.5 %

observations; however, this study had much larger than that at 383 participants.

3. Results

3.1. Demographic data

Table 1 displays sample demographics: majority females (61.9 %), 30–49 age groups prominent (48 %), mostly married (77.8 %), and educated individuals with university degrees (59.3 %) were analyzed for representativeness in data interpretation. These personal characteristics were taken into account when analysing the data to ensure that the results were representative of the target population.

3.2. Big Five Inventory-10 (BFI-10)

The Big Five Inventory was measured using 10 questions, with every two questions used to measure specific personality traits: Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness; see Table 2. Some questions were reversed, so the scores of the answers needed to be changed (5 = strongly agree to 1 = strongly disagree).

Regarding Extraversion(Q_1_R, Q_6), 33.9 % of participants described themselves as reserved, while 35.5 % neither agreed nor disagreed. More than half of the participants (60.3 %) believed themselves outgoing and sociable. With respect to Agreeableness (Q_2, Q_7_R), a large number of participants (71 %) agreed that they tend to find fault with others. For Conscientiousness (Q_3_R, Q_8), the majority of participants (81.7 %) believe they often do a thorough job. In terms of Neuroticism (Q_4_R, Q_9), some participants (29.7 %) felt they were relaxed and handled stress well. For Openness (Q_5_R, Q_10), a large number of participants (64.5 %) reported that they had an active imagination.

These findings provide insight into the personality traits present in the sample population and can be used to further analyse the relationship between personality, emotional health, and obesity during the COVID-19 pandemic.

3.3. PANAS-SF

Table 3 displays the five NA (afraid, upset, hostile, ashamed, and nervous) and five PA (alert, inspired, determined, attentive, and active) reported by participants. In terms of NA, the emotion with the highest score (M = 2.32, SD = 1.12) was a tendency toward nervousness. Upset was ranked as the second negative emotion experienced during the pandemic (M = 2.19, SD = 1.07), while fear was ranked third (M = 1.93, SD = 1.09). Overall, the average score (M = 13.93, SD = 3.64) suggested a somewhat negative attitude toward the pandemic.

With respect to PA, there appeared to be a tendency toward feeling active emotion (M = 2.93, SD = 0.91). Attentiveness was in second place (M = 2.91, SD = 1.03), while being alert (M = 2.87, SD = 1.07) was shown to be more common than the other PA observed during the pandemic. Thus, the total average score (M = 9.61, SD = 3.73) revealed lower tendencies for PA.

These findings provide insight into the emotional experiences of the sample population during the COVID-19 pandemic and can be used to further analyse the relationship between emotional health, personality, and obesity.

3.4. Obesity (BMI)

The distribution of BMI was found to be approximately symmetric. The mean BMI of the sample population was 27.8, with a standard deviation of 5.601. According to Table 4, males had a prevalence of 39.0 % for being overweight and 27.4 % for being obese, while females had a prevalence of 39.7 % for being overweight and 30.4 % for being obese. The overall prevalence of obesity in the sample population was 29.2 %.

Table 2
Five-point scale of BFI-10
Instructions: How well do the following statements describe your personality?

I see myself as someone who	Agree strongly		Agree a little		Neither agree nor disagree		Disagree a little		Disagree strongly	
	N	%	N	%	N	%	N	%	N	%
Q_1_R … is reserved	25	6.5 %	38	9.9 %	136	35.5 %	130	33.9 %	54	14.1 %
Q_2 … is generally trusting	33	8.6 %	67	17.5 %	85	22.2 %	150	39.2 %	48	12.5 %
Q_3_R … tends to be lazy	122	31.9 %	85	22.2 %	68	17.8 %	79	20.6 %	29	7.6 %
Q_4_R … is relaxed, handles stress well	48	12.5 %	66	17.2 %	90	23.5 %	136	35.5 %	43	11.2 %
Q_5 … has few artistic interests	64	16.7 %	57	14.9 %	91	23.8 %	115	30.0 %	56	14.6 %
Q_6 … is outgoing, sociable	21	5.5 %	36	9.4 %	81	21.1 %	130	33.9 %	115	30.0 %
Q_7_R … tends to find fault with others	206	53.8 %	69	18.0 %	72	18.8 %	26	6.8 %	10	2.6 %
Q_8 … does a thorough job	9	2.3 %	18	4.7 %	43	11.2 %	112	29.2 %	201	52.5 %
Q_9 … gets nervous easily	56	14.6 %	57	14.9 %	74	19.3 %	132	34.5 %	64	16.7 %
Q_10 … has an active imagination	95	24.8 %	152	39.7 %	75	19.6 %	32	8.4 %	29	7.6 %

Scoring the BFI-10 scales: Extraversion: 1R, 6; Agreeableness: 2, 7R; Conscientiousness: 3R, 8; Neuroticism: 4R, 9; Openness: 5R; 10 (R D item is reversed-scored).

Table 3
Distribution of positive and negative affect short form (PANAS-SF).

Positive and Negative Affect Short Form (PANAS-SF)	Not at all		A little		Moderately		Quite a bit		Extremely		Mean/SD
	N	%	N	%	N	%	N	%	N	%	
Negative affects											
Upset	127	33.2 %	111	29.0 %	101	26.4 %	35	9.1 %	9	2.3 %	2.19(1.07)
Hostile	278	72.6 %	67	17.5 %	26	6.8 %	10	2.6 %	2	.5 %	1.41(.77)
Ashamed	213	55.6 %	70	18.3 %	78	20.4 %	17	4.4 %	5	1.3 %	1.78(1.00)
Nervous	103	26.9 %	132	34.5 %	88	23.0 %	43	11.2 %	17	4.4 %	2.32(1.12)
Afraid	179	46.7 %	104	27.2 %	61	15.9 %	27	7.0 %	12	3.1 %	1.93(1.09)
Mean = 13.93 SD = 3.64											
Ppositive affects											
Alert	45	11.7 %	77	20.1 %	158	41.3 %	89	23.2 %	14	3.7 %	2.87(1.07)
inspired	67	17.5 %	90	23.5 %	159	41.5 %	57	14.9 %	10	2.6 %	2.62(1.02)
Determined	69	18.0 %	97	25.3 %	142	37.1 %	64	16.7 %	11	2.9 %	2.61(1.05)
Attentive	40	10.4 %	81	21.1 %	147	38.4 %	102	26.6 %	13	3.4 %	2.91(1.03)
Active	27	7.0 %	82	21.4 %	175	45.7 %	89	23.2 %	10	2.6 %	2.93(.91)
Mean = 9.61 SD = 3.73											

Table 4
Distribution of BMI categories.

	All		Male		Female	
	Frequencies	Per cent	Frequency	Per cent	Frequency	Per cent
Underweight: ≤18.5	8	2.1	4	2.7	4	1.7
healthy weight: between 18.5 and 24.9	112	29.2	45	30.8	67	28.3
Overweight: between 25 and 29.9	151	39.4	57	39.0	94	39.7
Obese: ≥30	112	29.2	40	27.4	72	30.4

These findings provide insight into the weight status of the sample population during the COVID-19 pandemic and can be used to further analyse the relationship between weight status, emotional health, personality, and other factors related to the pandemic.

3.4.1. Relationship between BFI and PANAS-SF with BMI

The results of the study revealed that BMI had a significant weak negative correlation with PANAS-PA (corr = −.100, p-value = .050), but a positive correlation with PANAS-NA (corr = .102, p-value = .046). Additionally, as indicated in Table 5, the multiple linear regression model showed that emotional experience (PANAS-NA) was a significant positive predictor of BMI (β = .201, p-value = .003), while personality trait (BFI) was not a significant predictor of BMI. The control variables of age, gender, and education level were also not significant predictors of BMI.

These findings suggest that emotional experiences, specifically NA, may be related to obesity in some way, especially during stressful times, like the COVID-19 pandemic. Further research is needed to explore the mechanisms underlying this relationship and to develop effective interventions to promote emotional and physical health during times of crisis.

Table 6 displays the results of the linear regression analysis, which involved an unadjusted model (without control variables) and an adjusted model (including control variables). The normality assumption of the model was assessed using the P-P plot depicted in Fig. 1, which revealed that the residuals were approximately normally distributed. Furthermore, the scatterplot of residuals versus fitted values in Fig. 2 showed no evidence of heterogeneity, as the points were randomly scattered around the fitted line.

The adjusted model was statistically significant (ANOVA: F = 3.029, p-value<.001) and explained only 7.9 % of the variation in BMI. The effects of several variables changed after adjusting the model, and there was no issue of collinearity as all the predictors had a VIF less than 10. Among the adjusted variables, only PANAS-NA demonstrated a significant impact on BMI (B = .172, t = 2.136, p-value = .033).

4. Discussion

4.1. Big Five personality traits

Within the context of a pandemic such as COVID-19, individuals' reactions could vary according to their personality [10]. Regarding the first research objective, our study found that conscientiousness was the dominant personality trait among the sample population (M = 7.74, SD = 1.76), while openness was the lowest (M = 5.45, SD = 1.61). This could be explained by the restrictive measures during the pandemic, which may have limited individuals' opportunities to explore new experiences and ideas. Prior studies in the literature [10–12] have shown the importance of exploring personality traits in the COVID-19 environment to depict the differences between people during such an outbreak.

Table 5
Correlation between the personality BFI and emotional experience PANAS-SF with BMI.

		BMI	Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness	PANAS _PA	PANAS_ NA
BMI	Correlation		.032	.027	.004	−.051	.043	−.100*	.102*
	p-value		.527	.605	.940	.322	.399	.050	.046
Extraversion	Correlation			.186**	.091	−.186**	−.042	−.149**	.070
	p-value			<.001	.076	<.001	.409	.003	.172
Agreeableness	Correlation				.076	−.134**	.012	−.209**	.074
	p-value				.139	.009	.818	.000	.146
Conscientiousness	Correlation					−.169**	−.010	−.244**	.220**
	p-value					.001	.848	<.001	<.001
Neuroticism	Correlation						.012	.302**	−.111*
	p-value						.820	<.001	.030
Openness	Correlation							−.097	−.056
	p-value							.058	.271
PANAS _PA	Correlation								.086
	p-value								.092
PANAS_ NA	Correlation								
	p-value								

Table 6
Linear regression model for the effect between the personality and mental health on BMI.

	Unadjusted model			Adjusted model			
	B	t	p-value	*B*	t	p-value	VIF
(Constant)	27.502	9.199	<.001	24.566	7.204	<.001	1.082
Extraversion	.044	.232	.817	.032	.174	.862	1.138
Agreeableness	−.026	−.138	.891	−.215	−1.142	.254	1.188
Conscientiousness	−.172	−.995	.320	−.313	−1.817	.070	1.173
Neuroticism	−.028	−.179	.858	.007	.045	.964	1.042
Openness	.136	.761	.447	.011	.065	.948	1.348
PANAS_SF_PA	−.176	−2.061	.040	−.096	−1.111	.267	1.118
PANAS_SF_NA	.192	2.339	.020	.172	2.136	.033	1.104
Q1 gender	–	–	–	1.056	1.755	.080	1.307
Q2 age	–	–	–	.995	4.311	<.001	1.076
Q5 education level	–	–	–	.180	.555	.579	1.082
ANOVA	F(7,375) = 1.471 p-value = .176			F(10,372) = 3.029 p-value<.001			
Adjusted-R^2	.027			.079			

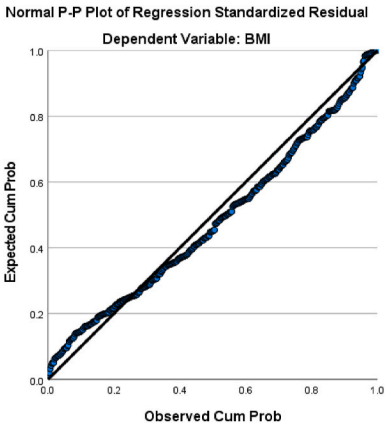

Fig. 1. P-P plot for normality of residuals.

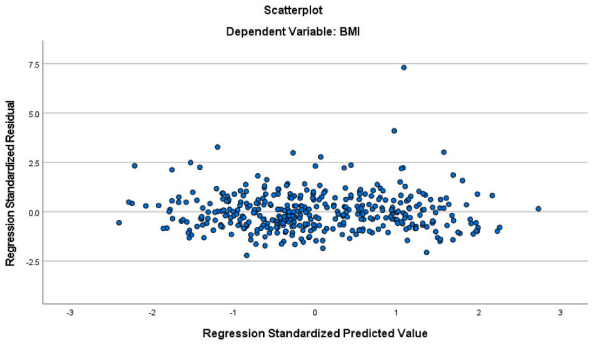

Fig. 2. Scatter plot between the fitted values and residuals.

4.2. Emotional experience (PANAS-SF)

The impact of emotion on people's well-being and happiness has been thoroughly investigated by the field of psychology over the last decades [38]. However, few studies have examined both PA and NA, especially in the Saudi Arabian context. In our study, PA was found to be at a lower level among Saudis residing in Riyadh during the COVID-19 pandemic, while NA was at a moderate level, both of which were lower than the findings in prior literature [14–16]. As observed in this study, concern regarding the pandemic seems to have influenced the feelings of the Saudi population. Due to social detachment, affects traditionally linked with social involvement, such as nervousness and upset, were exceedingly high. This might represent disappointment at the prospect of an unknown future and the stringent precautions implemented in response to the pandemic. Additionally, although PA was moderate (M = 9.61, SD = 3.33), it

was more prevalent in individuals who were active, attentive, and alert.

4.3. Obesity

Obesity is a significant public health concern in Saudi Arabia, with a high incidence rate among both genders. Obesity can increase the risk of developing non-communicable diseases that are associated with morbidity and mortality. Therefore, it is more critical than ever to increase the adoption of health-promoting practices to create effective measures [39]. The prevalence of obesity in this study indicates that 29.2 % of the survey participants were obese, which is consistent with Saudi Arabia's high obesity prevalence and demonstrates the importance of this study. Additionally, females had a higher rate of obesity and overweight than males, at 30.2 % and 39.7 %, respectively. The study findings corroborate those of previous research [39–42], which found a similar prevalence of obesity across Saudi Arabia, but contradicts results from a Riyadh-specific study on the obesity burden, which indicated that the obesity rate is roughly 7 % for both genders in the city [43].

4.4. Application of the socio-ecological model to further explain the findings

The findings of this study indicate that NA and age during the COVID-19 pandemic were significant predictors of obesity among Saudi adults when using multiple regression. These findings can be understood by applying the socio-ecological model [44], which is supported by aspects of the Health Belief Model [45] in explaining the adoption of health behaviors. While there are numerous hypotheses on how human behavior develops over time [46], ecological models provide a better and deeper understanding [47]. This study employed a socio-ecological model [44], which differs from previous models [48]; it is a concept that focuses on lifestyle behaviors and has demonstrated effectiveness since it encompasses several variables at various levels. Therefore, the influence of these variables affects human behavior [49]. This model has been applied in other studies to explain the significance of the findings [50,51].

The socio-ecological model, as depicted in Fig. 3, has five layers that describe why a person adopts a healthy behavior: intrapersonal, interpersonal, institutional, community, and policy [44]. The intrapersonal aspects include recognition, attitudes, and health status, whereas interpersonal elements involve the impact of other individuals, such as friends and parents [52]. Institutional factors relate to those that are institutional and Institutional in nature and can influence behavior, such as the availability of favorable work environments [53]. Community factors refer to the impacts generated by the physical environment in which an individual lives, whereas policy factors refer to the rules that may affect behavior [54].

By applying the socio-ecological model in this study, we can better understand the complex interplay of factors that may have been affected by obesity during the COVID-19 pandemic in the Saudi Arabian context. These findings highlight the need for targeted interventions that address multiple levels of influence, including intrapersonal, interpersonal, institutional, community, and policy factors, to promote healthy behaviors among the obese population. Further studies can then be conducted to better understand causal ties between these factors.

At the intrapersonal level, this study examined the components of age, gender, and Big Five personality traits. The findings indicated that the 30–39 age cohort constituted a greater proportion of the participants, and most respondents in this age category are at risk of becoming obese. The study's results also indicated that older individuals were more likely to be obese and deal with higher levels of NA factors. These results are consistent with previous research that demonstrated the risk of obesity increases with age in both sexes [42]. In most cultures, the elderly are associated with obesity; thus, it will be critical to develop solutions that fulfil both their subjective demands and other health-related concerns [55].

Regarding gender, the study investigated the relationship between gender and obesity and found that female participants were more likely to be grossly obese than male respondents. Although there was no statistically significant relationship between gender and BMI, this outcome is in contrast to previous research that demonstrated the significance of gender and obesity, indicating that females are more susceptible to obesity than males [42], which is possibly due to environmental, community, and cultural variables [56]. Women in the Kingdom of Saudi Arabia may be at an increased chance of physical inactivity, which is a major cause of obesity, due to a variety of variables peculiar to this country, including the severe environment, transportation constraints, and cultural traditions [56].

Furthermore, this study examined the magnitude of emotional experience, and the findings showed a significant association

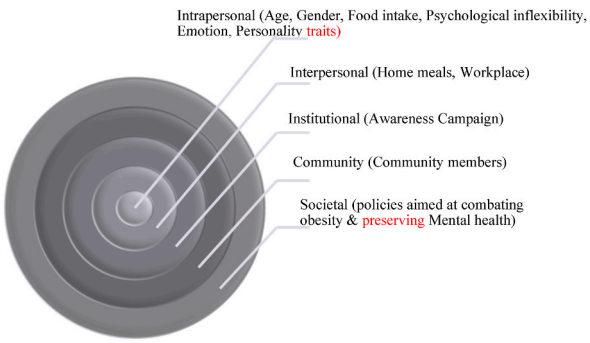

Fig. 3. Socio-ecological model framework for obesity.

between NA and BMI. Negative emotion was strongly related to obesity, which suggests that the more obese a person is, the more negative emotional affects they tend to have. This association may be explained in part by the urge to consume high-calorie meals and sweets when a person is depressed, resulting in obesity [25,26].

These findings have important implications for the development of effective interventions to prevent and manage obesity among the Saudi Arabian population. Interventions should be designed to address multiple levels of influence, including intrapersonal, interpersonal, institutional, community, and policy factors, to promote healthy behaviors. Additionally, interventions should focus on addressing NA and encouraging physical activity among all age groups and genders.

The final intrapersonal component investigated in this study was the Big Five personality traits, and the findings of the regression model with and without control variables suggested that neither model revealed a significant correlation between obesity and personality traits. These findings are somewhat surprising given that other research shows that most of the personality traits are associated with obesity [22–24]; however, the discrepancy in findings may be explained by differences in the personality assessments, sample type, or study methodologies employed.

In conclusion, this study highlights the complex interplay of factors that were associated with obesity in the Saudi Arabian population during the COVID-19 pandemic. The findings suggest that targeted interventions addressing multiple levels of influence, including intrapersonal, interpersonal, institutional, community, and policy factors, could promote healthy behaviors among the obese population. By addressing these factors, we can create sustainable solutions to prevent and manage obesity in Saudi Arabia while also preserving the emotional health and wellbeing of the population.

4.5. Implications for public and health promotion practice

The findings of this study have important implications for public and health promotion practice. To support people with obesity, public health specialists and health promoters can develop programs using the socio-ecological model as a guide to address the important factors that affect this population at every level of the model.

At the intrapersonal level, preventative strategies could involve education and health messaging aimed at changing harmful health behaviors within the Saudi Arabian population. Awareness programs regarding nutritious foods and how to preserve mental health, as well as the hazards linked with obesity, should be addressed to the community. Such programs may be delivered through various channels, such as social media, community events, and educational materials.

For the interpersonal level, preventive interventions may include the involvement of family and colleagues in health education programs concerning the risks of obesity and the benefits associated with weight reduction as well as how to maintain mental health and well-being during a crisis. These programs can be delivered through various channels, such as workplace wellness programs, family-centered health promotion programs, and community-based health education initiatives.

At the institutional level, preventive initiatives could include delivering approaches by the government to promote psychological stability and introducing potential benefits to the target population in terms of enhancing the overall quality of life. This may include policies that support mental health services, workplace wellness programs, and other initiatives that promote healthy behaviours and reduce the risk of obesity.

Regarding the community level, health initiatives might be facilitated by encouraging community leaders to promote awareness of the influence of obesity on the body and to alter lifestyles and adopt healthy alternatives. Community-based interventions may include exercise programs, healthy eating initiatives, and mental health support groups, among others.

5. Limitations and recommendations

The current study had several strengths, including a large sample size and the use of the socio-ecological model to examine several influencing variables that are associated with obesity; however, as with every study, several limitations appeared during this research.

The most evident disadvantage was the reliance on online self-reporting techniques for data collection. Self-reported data may be subject to social desirability bias, recall bias, and other biases that may influence the accuracy of the results. Additionally, since this was a cross-sectional study with individuals answering the survey all at once, additional variables, such as experiencing an unforeseen difficulty on the day the survey was completed, may have influenced their results.

The utilization of a convenience sampling method in this study limits the generalizability of the results to the wider Riyadh community. Riyadh, Saudi Arabia, accommodates approximately 8.6 million individuals, with a gender distribution of 62.6 % male and 37.4 % female. Nonetheless, the study's outcomes lack generalizability due to the convenience sampling methodology that does not fully represent the Riyadh community. The sample might have exhibited bias towards individuals with internet access, potentially deviating from a comprehensive reflection of the total population. As a result, interpreting the findings of this study should be approached with caution.

Another limitation is the use of a short personality inventory which may limit the breadth and depth of personality assessment in our study. Longer inventories often provide a more comprehensive examination of personality traits, allowing for a more robust characterization of individuals' personality profiles. The trade-off between brevity and psychometric robustness in choosing the inventory was a calculated choice in this study; however, future research should incorporate longer inventories to provide a more comprehensive understanding of personality traits in relation to the study variables.

Future studies could also employ a longitudinal technique, which could reveal more about the association between these predictors and obesity over time. Additionally, the use of a real BMI measurement would help researchers extract more accurate results. Future research might explore these indicators in a clinical population to further validate their accuracy.

6. Conclusion

In conclusion, obesity has become increasingly complicated in recent years as it has progressed during the pandemic. This study used a cross-sectional design guided by the socio-ecological model of public health and health promotion to investigate personality and emotional experience measurements during the COVID-19 pandemic in Riyadh. This is one of the first studies examining personality and emotional experience concurrently and analyzing their associations with obesity using regression analysis. Additionally, this study is unique in that it not only identified these variables and their relationship to obesity but also explored personality traits and emotions in detail using a variety of questionnaires with Likert-scale measures. The study findings revealed that the incidence of obesity was high among participants, and there was no association between personality and BMI. On the other side, there was a relationship between NA and obesity, as well as age and obesity. These findings indicate that the risks of obesity may present in different communities. Additionally, the study uncovered many noteworthy findings that suggest obesity is a very complicated and multifaceted disease.

Therefore, fully understanding the effect of the studied predictors on obesity among the Saudi Arabian population will help other researchers and clinicians to support this population. It is clear that supporting people with obesity requires interventions that that account for multiple factors of influence, including intrapersonal, interpersonal, institutional, community, and policy factors. By implementing programs and policies that address these factors, we can create sustainable solutions to emotionally support people with obesity in Saudi Arabia while promoting overall health and well-being. Future research should employ longitudinal strategies and clinical BMI measurements to further validate the accuracy of the findings.

CRediT authorship contribution statement

Rayan Almazroo: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Hiya Almazroa:** Writing – review & editing, Validation, Supervision, Software, Funding acquisition.

Informed consent

Not Applicable.

Ethics declarations

This research received ethical clearance reference 1810 21, from the CHHS-REC at Swansea University to ensure that ethical standards were adhered to throughout the procedure.

Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request**.**

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used POE in order to improve readability and language. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:Hiya Almazroa reports financial support was provided by Princess Nourah bint Abdulrahman University (PNU). None. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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