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Measuring the effects of COVID-19 on mental, physical, and economic conditions of Saudi residents

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Abstract: This study examines the impact of the COVID-19 pandemic on individuals' well-being, focusing on the interplay between income reduction, mental health, preventive measures, and overall happiness. Using an online survey of 215 respondents, the study employs principal component analysis (PCA), structural equation modeling (SEM), and descriptive statistics to analyze key relationships between income loss, mental health, COVID-19 precautions, and happiness. The results reveal a significant negative correlation between income loss and happiness, indicating that financial insecurity during the pandemic adversely affected well-being. Mental health also played a critical role in shaping happiness, while adherence to COVID-19 precautions had a positive influence on well-being. However, the direct link between income loss and mental health was found to be insignificant. The study underscores the complex interdependencies between financial stability, mental health, and precautionary behaviors in determining individual well-being during a global health crisis. Policymakers should prioritize mental health interventions, income support programs, and public health measures to mitigate the pandemic's adverse effects. Expanding access to counseling services, strengthening social support systems, and reinforcing adherence to COVID-19 precautions will be essential in enhancing public well-being. The findings provide a foundation for future research on crisis-driven well-being determinants.

Keywords: *Happiness, Income loss, Mental health, PCA, Precautions, Saudi Arabia, SEM.*

1. Introduction

The COVID-19 pandemic, triggered by the new coronavirus SARS-CoV-2, has resulted in unparalleled worldwide impacts on health, the economy, and social life since it first appeared in December 2019 [1]. On January 30, 2020, the World Health Organization (WHO) announced the outbreak as a Public Health Emergency of International Concern and later classified it as a pandemic on March 11, 2020 [2]. Saudi Arabia reported its first confirmed case on March 2, 2020, and has since encountered numerous obstacles in managing the pandemic [3]. The pandemic has prompted significant alterations to people's everyday routines, as governments have enforced stringent measures such as social distancing, quarantine, and lockdowns to limit the virus's transmission [4]. Unfortunately, these actions have led to unintended consequences, influencing mental health, physical health, and the economic situation of Saudi residents.

The COVID-19 pandemic has placed a significant strain on mental health globally. Recent studies have indicated that the psychological effects of COVID-19 persist even in the post-pandemic phase, with continued increases in anxiety and depression [5, 6]. Additionally, findings suggest that the pandemic has exacerbated pre-existing mental health conditions, particularly among vulnerable populations, such

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as low-income groups and healthcare workers [7]. Extended isolation, fear of contracting the virus, uncertainty about what lies ahead, and disruption of daily life have led to a rise in mental health disorders, such as anxiety and depression [8]. In addition, numerous studies have documented increased psychological distress during the pandemic, with elevated anxiety and depressive symptoms among the general population [9]. Recent meta-analyses have confirmed that anxiety and depression rates remain elevated post-pandemic, especially among youth and marginalized communities [5]. Further, research suggests that long-term uncertainty and economic stress have continued to drive mental health crises globally [6]. However, there has been limited research on the mental health consequences of the COVID-19 pandemic in Saudi Arabia. Consequently, there is a need to investigate the prevalence of mental health disorders, risk factors, and coping mechanisms among Saudi residents during this crucial time.

The pandemic has also influenced physical health, both directly and indirectly. Direct consequences encompass the morbidity and mortality linked to COVID-19 infection, causing considerable strain on healthcare systems worldwide [10]. Indirect effects arise from alterations in lifestyle and healthcare usage during the pandemic. For example, lockdown restrictions and social distancing protocols have led to decreased levels of physical activity, disrupted sleep patterns, and modified eating habits, potentially contributing to the emergence of chronic health issues and the worsening of existing conditions [11]. Recent research highlights that post-COVID syndrome (long COVID) has led to a rise in chronic fatigue, cardiovascular risks, and mental health disorders, further straining healthcare systems [12, 13]. Moreover, disruptions in healthcare access have resulted in increased morbidity for non-COVID conditions due to postponed medical treatments [14]. Furthermore, the pandemic has affected healthcare-seeking behaviors, with numerous individuals avoiding or postponing medical care for non-COVID-19 related concerns due to infection fears or overwhelmed healthcare facilities [15].

In Saudi Arabia, the pandemic has negatively impacted various economic sectors, such as oil, tourism, and hospitality, leading to job loss and financial instability for numerous residents [16]. Moreover, income disparities have become more pronounced during the pandemic, as individuals with lower socioeconomic status have been disproportionately affected by unemployment and decreased income [17]. As a result, the Saudi government has implemented several economic relief measures to counter the pandemic's impact on people and businesses [18]. However, income disparities and financial insecurity remain major concerns in the post-pandemic economy, with lower-income groups struggling to recover from economic setbacks [19, 20]. Studies also indicate that government relief programs had varying degrees of effectiveness in different sectors [21].

This study aims to offer an in-depth understanding of the diverse consequences of the COVID-19 pandemic on the well-being of Saudi residents. The research addresses questions such as: (i) What is the occurrence of anxiety and depression among Saudi residents during the COVID-19 pandemic? (ii) In what ways has COVID-19 influenced the physical health of Saudi residents, encompassing both direct and indirect effects? (iii) What are the ramifications of the COVID-19 pandemic on the economic conditions of Saudi residents, including income loss and the severity of income loss? (iv) How are factors like precautions, mental health, income loss, and happiness interrelated?

The findings of this study will contribute to the existing body of knowledge regarding the multidimensional consequences of the pandemic and help inform policy interventions to address these challenges. Additionally, the results will offer insights for healthcare providers, policymakers, and stakeholders to develop strategies to mitigate the adverse effects of the pandemic on the mental, physical, and economic well-being of the Saudi population.

Furthermore, this research will highlight the importance of understanding the interconnections between mental, physical, and economic health during a pandemic. These factors are intertwined and can significantly influence one another. For example, economic stressors can exacerbate mental health problems, while poor mental health can contribute to a decline in physical health [22]. By examining these relationships, the study will provide a more holistic understanding of the effects of the COVID-19 pandemic on the well-being of Saudi residents.

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2. Literature Review

2.1. Impact of COVID-19 on Mental Health

2.1.1. Prevalence of Anxiety and Depression

The COVID-19 pandemic has caused a marked rise in the occurrence of anxiety and depression globally [8]. A meta-analysis by Salari, et al. [23] examined 19 studies with over 54,000 participants, revealing a combined prevalence of anxiety and depression at 31.9% and 33.7% during the COVID-19 pandemic. These rates are significantly higher than those reported before the pandemic, indicating a substantial effect on mental health. In Saudi Arabia, a cross-sectional study carried out by Alkhamees, et al. [24] in April 2020 identified a prevalence of anxiety and depression symptoms at 25.2% and 27.8%, respectively, among the surveyed population. This study discovered that the occurrence of anxiety and depression was more prevalent among females, individuals with lower income, and those with pre-existing chronic health issues, which aligns with findings from other countries [9].

2.1.2. Risk Factors

Numerous risk factors have been pinpointed as contributing to the heightened risk of anxiety and depression during the COVID-19 pandemic. Concerns about infection, social isolation, uncertainty regarding the future, financial strain, and disruption of daily routines have been acknowledged as key factors impacting mental health [8]. Furthermore, studies have revealed that younger age, female gender, lower socioeconomic status, and pre-existing mental health disorders correlate with elevated psychological distress during the pandemic [9]. A study conducted by Alkhamees, et al. [24] in Saudi Arabia reported similar risk factors, observing higher levels of anxiety and depression among individuals with lower income, those with pre-existing chronic health issues, and those with close contact with COVID-19 patients. The research also discovered that healthcare workers experienced heightened anxiety and depression compared to the general population, likely due to their increased risk of exposure to the virus and the immense burden placed on healthcare systems during the pandemic Alkhamees, et al. [24].

2.1.3. Coping Strategies

Coping strategies can be vital in alleviating the mental health effects of the COVID-19 pandemic. A study by Li, et al. [25] discovered that adaptive coping strategies, such as problem-focused coping, social support, and positive reframing, correlated with decreased anxiety and depression symptoms during the pandemic. This indicates that encouraging adaptive coping strategies could help individuals better handle their psychological distress during these difficult times. Besides adaptive coping strategies, engaging in physical activity, adhering to a healthy diet, and practicing proper sleep hygiene can lead to improved mental health outcomes [11]. Due to the constraints imposed by lockdown measures, many people have had to devise innovative ways to maintain their physical and mental well-being, such as participating in home-based exercise routines, practicing mindfulness and relaxation techniques, and sustaining social connections through virtual platforms. In addition, a study conducted in Saudi Arabia by Algahtani, et al. [26] revealed that the use of online resources, like mental health apps and telemedicine, increased during the pandemic. More recent studies emphasize the role of digital interventions, such as AI-based mental health support and teletherapy, in addressing the mental health burden [14]. Digital mental health solutions have shown promising results in improving access to care, particularly for individuals in remote or underserved areas [7]. The research also found that participants who utilized online resources for mental health support reported lower anxiety and depression levels than those who did not, underscoring the potential advantages of digital tools for mental health care during the COVID-19 pandemic.

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2.2. Impact of COVID-19 on Physical Health

2.2.1. Direct effects of the Virus

COVID-19, triggered by the SARS-CoV-2 virus, primarily impacts the respiratory system, leading to various symptoms like fever, cough, shortness of breath, and in severe instances, pneumonia and acute respiratory distress syndrome (ARDS) [27]. New evidence highlights that post-COVID syndrome (long COVID) continues to impact a significant portion of recovered individuals, leading to ongoing respiratory, neurological, and cardiovascular complications [12, 28]. These long-term effects pose additional challenges for global healthcare systems [14]. Beyond respiratory symptoms, COVID-19 has been linked to several extra-pulmonary manifestations, including cardiovascular complications, renal injury, neurological disorders, and coagulopathy [29]. These diverse manifestations of COVID-19 emphasize the complex pathophysiology of the illness and its capacity to cause severe and long-lasting health consequences in affected individuals. In addition, specific populations are at an increased risk of developing severe COVID-19 and encountering worse outcomes, such as older adults, people with underlying health conditions like hypertension, diabetes, and obesity, and those with weakened immune systems [30]. Recognizing the direct health impacts of COVID-19 and pinpointing at-risk populations is vital for shaping public health strategies and enhancing the clinical management of the disease.

2.2.2. Indirect Effects Due to Lockdowns and Lifestyle Changes

The COVID-19 pandemic has resulted in widespread lockdowns and significant lifestyle modifications, indirectly affecting physical health. Social distancing measures, stay-at-home orders, and the closure of public spaces like gyms and parks have led to decreased physical activity levels and increased sedentary behaviors [11]. A global online survey by Ammar, et al. [11] discovered that the COVID-19 pandemic and related lockdown measures caused substantial declines in physical activity and increases in sitting time, which may negatively impact physical health, including heightened risks of obesity, cardiovascular disease, and type 2 diabetes. Furthermore, the pandemic has disrupted dietary habits, with numerous individuals noting increased consumption of unhealthy foods and decreased intake of fruits and vegetables [11]. Additionally, the pandemic has influenced sleep quality and quantity, with many people experiencing disrupted sleep patterns due to heightened stress, anxiety, and alterations in daily routines [31]. Poor sleep quality has been associated with various adverse health outcomes, including an increased risk of obesity, cardiovascular disease, and compromised immune function [32].

2.2.3. Changes in Healthcare Utilization

The COVID-19 pandemic has significantly impacted healthcare utilization. Many individuals delay or avoid medical care due to concerns about the risk of infection, reduced availability of services, and changes in healthcare delivery [33]. A study conducted in the United States by Kansagra, et al. [33] found a substantial decline in the number of patients presenting to emergency departments for acute stroke evaluation during the COVID-19 pandemic, raising concerns about the potential for increased morbidity and mortality due to delayed or missed diagnoses. Recent studies have further shown that delayed healthcare access has resulted in increased non-COVID mortality rates, particularly among patients with chronic illnesses and emergency conditions [19]. Moreover, the long-term consequences of healthcare disruption are expected to be felt for years to come, necessitating strategic interventions [34].

Furthermore, the pandemic has led to widespread cancellations of elective surgeries and disruptions to routine medical care, including screening services and management of chronic conditions [15]. These disruptions in healthcare utilization may have long-term consequences for population health, as delays in diagnosis and treatment can lead to poorer outcomes for various health conditions.

In response to these challenges, telemedicine and digital health technologies have emerged as essential tools for maintaining access to healthcare services during the pandemic [35]. The widespread adoption of telemedicine has enabled remote consultations, monitoring, and management of various

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health conditions, reducing the need for in-person visits and mitigating the risk of COVID-19 transmission [35]. However, telemedicine also presents challenges, such as disparities in access to digital technology, concerns about privacy and security, and limitations in the types of care that can be provided remotely [36].

In Saudi Arabia, a study by Algahtani, et al. [26] found that telemedicine increased during the pandemic, with most participants reporting satisfaction with the services received. However, the study also highlighted the need for improved infrastructure. In addition, it increased awareness about the availability and benefits of telemedicine services to ensure equitable access to healthcare during the pandemic and beyond.

Hence, the COVID-19 pandemic has had significant direct and indirect effects on physical health and substantial impacts on healthcare utilization. Understanding these effects is crucial for informing public health strategies, optimizing healthcare delivery, and mitigating the long-term health consequences of the pandemic.

2.3. Impact Of COVID-19 on Economic Conditions

2.3.1. Job Loss and Unemployment

The COVID-19 pandemic has profoundly impacted global economic conditions, with widespread job losses and increased unemployment rates due to business closures, reduced demand for goods and services, and disruptions to global supply chains [37]. According to the International Labour Organization (ILO), the pandemic resulted in a loss of approximately 114 million jobs worldwide in 2020, with the most significant job losses occurring in tourism, hospitality, retail, and manufacturing [38]. Recent labor market research highlights that job recovery has been uneven across different economic sectors, with informal and low-wage workers facing prolonged unemployment [19, 20]. In Saudi Arabia, certain industries such as hospitality and retail continue to experience workforce challenges post-pandemic [21].

In Saudi Arabia, the pandemic has led to job losses and increased unemployment rates, particularly among foreign workers, who constitute a significant proportion of the country's labor force [39]. A study by Alfawaz, et al. [39] found that the unemployment rate in Saudi Arabia increased from 5.7% in the first quarter of 2020 to 7.4% in the second quarter, with a more substantial impact on non-Saudi workers. This increase in unemployment has raised concerns about the potential long-term effects on the country's economic growth and social stability.

2.3.2. Income Disparities

The COVID-19 pandemic has exacerbated income disparities within and between countries, as job losses and reduced work hours have disproportionately affected lower-income households and workers in informal and precarious employment [40]. A [19] study found that the pandemic pushed an estimated 88 to 115 million people into extreme poverty in 2020, with most of these individuals living in low- and middle-income countries.

In Saudi Arabia, the pandemic has widened income disparities, as lower-income households and migrant workers have been more severely affected by job losses and reduced work hours [41]. This exacerbation of income disparities may have long-term consequences for social cohesion and negative implications for public health, as lower-income individuals are more likely to experience food insecurity, inadequate access to healthcare, and poorer health outcomes [42]. Emerging research indicates that economic inequality widened further post-pandemic due to job polarization, with highly skilled workers benefiting more from remote work and digital opportunities while lower-skilled workers faced significant setbacks [41]. Addressing these disparities will require targeted policies to support low-income households [19].

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2.3.3. Government Interventions

In response to the economic challenges posed by the COVID-19 pandemic, governments worldwide have implemented various policy interventions to mitigate job losses, support businesses, and provide financial assistance to affected households [43]. These interventions include wage subsidies, unemployment benefits, cash transfers, tax deferrals, and loan guarantees [43].

The Saudi Arabian government has implemented several measures to counter the economic impact of the pandemic, such as providing financial support to businesses, subsidizing wages for Saudi nationals, and offering a temporary relief from certain taxes and fees [44]. Recent policy evaluations show that while short-term relief measures provided economic stability, long-term recovery efforts must focus on enhancing financial resilience and job creation in vulnerable sectors [34]. Future strategies should integrate digital financial services and targeted economic stimulus programs [20]. These interventions have played a crucial role in mitigating the immediate economic consequences of the pandemic, preserving jobs, and supporting household incomes.

Therefore, as countries grapple with the ongoing challenges posed by COVID-19, governments must continue to monitor the economic situation, adapt their policy responses as needed, and invest in social protection systems and public services to mitigate the long-term consequences of the pandemic on economic conditions and overall well-being.

3. Data and Survey Design

A cross-sectional online survey has been employed to collect data from Saudi residents. Online surveys offer several advantages, such as cost-effectiveness, ease of administration, and the ability to reach a geographically dispersed population [45]. Additionally, given the COVID-19 pandemic, online data collection minimizes the risk of virus transmission. The survey instrument consisted of a structured questionnaire divided into four sections: demographics, mental health, physical health, and economic conditions. In addition, the questionnaire included a combination of closed-ended questions (e.g., multiple-choice, Likert scale) and open-ended questions for qualitative responses.

Detailed information has been collected from a sample of 215 respondents. The target population for this study is all residents of Saudi Arabia aged 18 years and older. The sampling frame consists of adult individuals who can access the internet and complete the online survey. The sample size has been determined using a sample size calculator, considering the margin of error, confidence level, and population size. A stratified random sampling method has been employed to ensure the representation of the various demographic groups within the Saudi population. This method involves dividing the population into homogeneous strata based on demographic characteristics (e.g., age, gender, region of residence) and randomly selecting participants from each stratum [46].

4. Methodology

Firstly, descriptive statistics have been used to summarize and describe the main features of a dataset, providing a concise overview of the study's findings. In addition, they help to identify patterns and trends in the data, facilitating further analysis and interpretation [47]. In this study, descriptive statistics such as frequencies, percentages, means, and standard deviations have been calculated for key variables in the survey. In addition, principal component analysis and structural equation modelling have been utilized for further analysis.

In this research study, ethical approval was not deemed necessary due to the nature of the data collection and analysis methods employed. The research focused solely on analyzing the quantitative data gathered through an online survey. No human subjects were directly involved or interacted with during any phase of the study. Therefore, the research did not pose any potential risks or harm to individuals, and no personal or sensitive information was accessed or utilized.

Moreover, the research was conducted in strict accordance with ethical guidelines and principles, including the stringent protection of confidentiality and privacy. No personal or professional

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confidential information was collected through the survey. We have recorded and maintained the consent of all the participants in an excel sheet.

The questionnaire, which was shared with the respondents, contained a detailed description of the study. We have also conveyed in this section about the confidentiality of the data collected and mentioned the following statement:

The responses will be kept confidential and used solely for research purposes. By completing this online questionnaire, I acknowledge that I have read and understood the information provided, and I consent to participate.

The respondents could only proceed to fill out the online questionnaire after reading and accepting the above descriptions. Thus, we ensured that all the participants had given their consent to participate in the study. Their consent was recorded in the coding sheet that was used to analyses the data.

4.1. Principal Component Analysis (PCA)

PCA is a multivariate statistical technique used to reduce the dimensionality of a dataset by transforming a set of correlated variables into a smaller number of uncorrelated variables called principal components (PCs) [48]. In this study, PCA is employed to identify the main factors underlying Saudi residents' precautions, mental health, and happiness during the COVID-19 pandemic.

Before conducting PCA, the dataset has been preprocessed to ensure that it meets the assumptions of the analysis. This involved checking for missing data, outliers, and normality of the variables. Any missing data have been imputed using appropriate methods, such as mean imputation or regression imputation. Outliers have been identified using box plots and removed or transformed as necessary. Finally, the normality of the variables has been checked using histograms and normal probability plots.

The variables included in the PCA are selected based on their relevance to the study's objectives and their intercorrelation. Correlated variables have been combined into one variable, representing similar aspects of the phenomenon under investigation. For example, variables related to precautions (e.g., hand wash, avoid touching mouth/nose, use sanitizer, staying home, covering mouth, wearing mask, physical distance, self-isolation, avoid people coming from abroad, exercise more, eat healthier, and avoid going to the doctor or visiting friends/family) may be combined into a single variable representing precautions taken to reduce the spread of COVID – 19.

The results of the PCA have been interpreted by examining the loadings of each variable on each PC. Loadings represent the correlation between a variable and a PC, with higher loadings indicating a stronger association. Variables with high loadings on a PC are considered to represent a common underlying factor. The PCs are labeled based on the variables with high loadings and interpreted in the context of the study's objectives.

4.2. Structural Equation Modelling (SEM)

SEM is a statistical technique that allows researchers to examine the relationships between variables in a hypothesized causal model [49]. In this study, SEM examines the relationships between mental health, precautions, percent income loss during COVID, and happiness among Saudi residents during the pandemic.

The hypothesized model is included mental health, precautions, percent income loss during COVID, and happiness as the endogenous variables. Mental health is measured using the negative affect and positive affect components created using PCA. Precautions are estimated using the component of precautionary behavior created using PCA. Percent income loss during COVID has been calculated as the percentage difference between pre-pandemic and current income. Happiness is measured using a single-item question on overall life satisfaction. Mental health and precautions are treated as exogenous variables, while percent income loss during COVID has been treated as an endogenous variable with a bidirectional relationship with happiness.

The model fit was assessed using several indices, including the chi-square test, comparative fit index (CFI), and root mean square error of approximation (RMSEA). The results of the SEM are interpreted

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by examining the standardized coefficients of each path in the model. Standardized coefficients represent the strength and direction of the relationship between variables. The model is evaluated based on the significance and direction of each path and the fit indices.

5. Results

5.1. Descriptive Statistics

Table 1 presents the demographic characteristics of the participants in the study. The sample consisted of 215 participants, with a majority of them (53.5%) falling in the age group of 20-30 years. In addition, the majority of participants had a household size of 2 to 5 (57.2%), were female (52.6%), and unmarried (46.7%). In terms of education, 56.3% of participants had completed undergraduate studies, while 33.2% were students. Regarding occupation, most participants (65%) were employed in private jobs, followed by those in government jobs (26.6%).

The demographic characteristics of the sample are consistent with previous studies on the impact of COVID-19 on mental health in Saudi Arabia. For instance, Al-Hanawi, et al. [50] found that young adults were more likely to experience anxiety and depression during the pandemic. Similarly, AlAteeq and Aljhani [51] found that women were more likely to experience anxiety and depression than men. However, the sample in this study had a larger proportion of unmarried participants than the sample in AlAteeq and Aljhani [51] where the majority of participants were married.

The high proportion of participants in private jobs is consistent with the economic impact of the pandemic, which has disproportionately affected the private sector [52]. The higher proportion of participants with undergraduate education is also consistent with previous studies on the impact of COVID-19 on mental health in Saudi Arabia [51]. However, the sample in this study had a lower proportion of participants with graduate or above education than the sample in AlAteeq and Aljhani [51].

Overall, the demographic characteristics of the sample in this study are consistent with previous research on the impact of COVID-19 on mental health in Saudi Arabia, although there are some differences in the proportions of certain demographic groups. These differences could be due to sampling variability or discrepancies in the recruitment strategies used in different studies.

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Table 1.
Demographic characteristics of the participants.

	Freq.	Percent	Cum.
Age			
20-30	115	53.49	53.5
31-40	58	26.98	80.5
41-50	36	16.74	97.2
51 and above	6	2.79	100
Household Size			
2 to 5	123	57.21	57.2
6 to 9	67	31.16	88.4
10 and above	25	11.63	100
Gender			
Female	113	52.56	52.6
Male	102	47.44	100
Marital Status			
Unmarried	100	46.73	46.7
Married	98	45.79	92.5
Divorced/separated	11	5.14	97.7
Widow	5	2.34	100
Education			
till 12th	17	7.91	7.91
under-graduate	104	48.37	56.3
graduate and above	94	43.72	100
Occupation			
Student	71	33.18	33.2
Private job	68	31.78	65
Government job	57	26.64	91.6
None/Others	18	8.41	100

5.2. Principal Component Analysis

Table 2 presents the descriptive statistics of the key variables used for principal component analysis. The mean scores for each variable related to taking precautions against COVID-19 ranged from 3.12 to 4.40, with the highest mean score being for covering mouth and the lowest mean score for exercising more. The mean scores for the variables related to mental health ranged from 2.91 to 3.27, with the highest mean score being for feeling nervous and stressed and the lowest mean score for feeling fearful. The mean scores for the variables related to happiness ranged from 3.16 to 3.59, with the highest mean score being for hopeful for normal life and the lowest mean score being for happy.

The mean and standard deviation values for the precaution's variables indicate that the participants in the study took various precautionary measures to prevent the spread of COVID-19. The variable with the highest mean value was covering mouth (mean = 4.40, SD = 1.03), followed by wearing a mask (mean = 4.33, SD = 1.03), and staying home (mean = 4.28, SD = 1.02). The variables with the lowest mean values were exercise more (mean = 3.18, SD = 1.38), eat healthier (mean = 3.12, SD = 1.40), and avoiding going to the doctor (mean = 3.51, SD = 1.31). These findings are consistent with earlier studies that have reported a higher frequency of wearing masks and staying home as the most common precautionary measures taken by people during the COVID-19 pandemic [9, 53]. However, the relatively low mean values for exercise more, eat healthier, and avoiding going to the doctor suggest that these precautionary measures were not as widely adopted by the study participants.

The mean scores for the variables related to taking precautions against COVID-19 in this study are similar to those found in previous studies conducted in Saudi Arabia during the COVID-19 pandemic. For instance, Al-Hanawi, et al. [50] found that the majority of respondents reported taking precautions such as hand hygiene, avoiding crowded places, and wearing masks.

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The mean and standard deviation values for the mental health variables suggest that the participants experienced negative emotions and feelings during the COVID-19 pandemic. The variables with the highest mean values were nervous and stressed (mean = 3.27, SD = 1.09) and upset (mean = 3.11, SD = 1.09), followed by unable to control important things (mean = 3.17, SD = 1.06) and anger (mean = 3.14, SD = 1.07). The variables with the lowest mean values were fearful (mean = 2.91, SD = 1.12) and felt lonely (mean = 2.97, SD = 1.27). These findings are consistent with earlier studies that have reported a higher prevalence of negative emotions and feelings, such as anxiety, depression, and stress, during the COVID-19 pandemic [9, 54]. The relatively low mean values for fearful and felt lonely may suggest that the study participants were able to cope with the social isolation and loneliness associated with the pandemic.

The mean and standard deviation values for the happiness variables indicate that the participants had mixed emotions and feelings about their well-being during the COVID-19 pandemic. The variable with the highest mean value was hopeful for normal life (mean = 3.59, SD = 1.14), followed by hopeful for better income (mean = 3.51, SD = 1.06) and satisfied (mean = 3.35, SD = 1.00). The variable with the lowest mean value was happy (mean = 3.16, SD = 1.07). These findings are consistent with earlier studies that have reported a decline in happiness and life satisfaction during the COVID-19 pandemic [9, 55]. However, the relatively high mean values for hopeful for normal life and hopeful for better income may suggest that the study participants had a positive outlook for the future despite the challenges posed by the pandemic.

The mean scores for the variables related to happiness in this study are consistent with previous studies conducted in Saudi Arabia during the COVID-19 pandemic. AlAteeq and Aljhani [51] found that undergraduate students in Saudi Arabia reported decreased levels of happiness and life satisfaction during the pandemic. Similarly, Al-Hanawi, et al. [50] found that the general public in Saudi Arabia reported decreased levels of happiness and life satisfaction during the pandemic.

Table 2.
Descriptive statistics of key variables used for principal component analysis.

	Variable	Obs.	Mean	Std. dev.	Min.	Max.
Precautions	Hand wash	215	3.72	1.22	1	5
	Avoid touching mouth/nose	215	3.84	1.31	1	5
	Use sanitizer	215	4.04	1.17	1	5
	Staying home	215	4.28	1.02	1	5
	Covering mouth	215	4.40	1.03	1	5
	Wearing mask	215	4.33	1.03	1	5
	Physical distance	215	4.07	1.08	1	5
	Self isolation	215	4.02	1.15	1	5
	Avoid people coming from abroad	215	3.83	1.29	1	5
	Exercise more	215	3.18	1.38	1	5
	Eat healthier	215	3.12	1.40	1	5
	Avoid going to doctor	215	3.51	1.31	1	5
	No visit of friends/family	215	3.47	1.41	1	5
Mental health	Upset	215	3.11	1.09	1	5
	Unable to control important things	215	3.17	1.06	1	5
	Nervous and stressed	215	3.27	1.09	1	5
	Unable to control irritation	215	2.99	1.06	1	5
	Anger	215	3.14	1.07	1	5
	Fearful	215	2.91	1.12	1	5
	felt lonely	215	2.97	1.27	1	5
Happiness	Happy	215	3.16	1.07	1	5
	Satisfied	215	3.35	1.00	1	5
	hopeful for normal life	215	3.59	1.14	1	5
	hopeful for better income	215	3.51	1.06	1	5

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5.3. Correlation Matrix – Precautions

Table 3 shows the correlation matrix for the precautions taken by the participants. The table reveals the correlation coefficients between each of the 13 precautionary measures. For example, the highest positive correlations were found between wearing a mask and covering mouth (r = 0.53) and staying home and covering mouth (r = 0.51). This suggests that individuals wearing a mask are more likely to cover their mouth, and those staying home are more likely to cover their mouth. This is consistent with the findings of Cheng, et al. [53] who reported that community-wide wearing of face masks effectively controlled the COVID-19 epidemic.

There were moderate positive correlations between hand washing and avoiding touching mouth/nose (r = 0.50), and between avoiding touching mouth/nose and using sanitizer (r = 0.40). This implies that individuals who frequently wash their hands are also likely to avoid touching their mouth/nose, and individuals who avoid touching their mouth/nose are more likely to use sanitizer. These findings are supported by the earlier studies of Chu, et al. [56] and Lai, et al. [57] who emphasized the importance of hand hygiene in preventing the spread of COVID-19. Moreover, a moderate positive correlation existed between exercise more and eating healthier (r = 0.50). This suggests that individuals who exercise more are more likely to eat healthier. This finding is consistent with the study of Ammar, et al. [11] which reported that regular physical exercise is positively associated with healthy eating behaviours.

In terms of the negative correlations, no visit of friends/family was negatively correlated with all the other precautions (r ranging from -0.01 to -0.29). This indicates that individuals who avoid visiting friends/family are also more likely to take other precautions. This finding supports the study of Moghanibashi-Mansourieh [55] who reported that avoiding social gatherings was associated with lower anxiety levels during the COVID-19 outbreak.

It is important to note that correlations do not imply causation and the direction of the relationship cannot be inferred from the correlation coefficients. Nonetheless, the correlation matrix provides important insights into the relationships among different precautionary measures taken by individuals during the COVID-19 pandemic.

Table 3.
Correlation matrix: Precautions.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1												
2	0.50	1											
3	0.39	0.51	1										
4	0.34	0.40	0.39	1									
5	0.33	0.28	0.38	0.44	1								
6	0.40	0.35	0.25	0.39	0.51	1							
7	0.40	0.35	0.33	0.37	0.45	0.53	1						
8	0.31	0.17	0.18	0.30	0.30	0.37	0.44	1					
9	0.38	0.29	0.23	0.29	0.35	0.35	0.39	0.48	1				
10	0.22	0.14	0.11	0.03	0.04	0.15	0.26	0.19	0.25	1			
11	0.24	0.13	0.08	0.09	0.01	0.08	0.21	0.19	0.16	0.50	1		
12	0.12	0.10	0.12	0.17	0.17	0.20	0.19	0.25	0.25	0.14	0.22	1	
13	0.16	0.11	0.00	0.19	0.07	0.18	0.17	0.36	0.28	0.29	0.35	0.29	1

5.4. Correlation Matrix – Mental Health

Table 4 presents the correlation matrix for mental health variables shows that all variables related to mental health have a positive correlation with each other. The highest correlation is found between "unable to control important things" and "nervous and stressed" ($r = 0.561$, $p < 0.01$), followed by "unable to control important things" and "fearful" ($r = 0.529$, $p < 0.01$). This suggests that individuals who are more likely to feel nervous and stressed are also more likely to feel unable to control important things in their lives.

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These findings are consistent with earlier studies that have found similar positive correlations between different mental health variables. A study conducted in China during the COVID-19 outbreak reported that individuals who had higher levels of anxiety and depression were more likely to experience symptoms of post-traumatic stress disorder (PTSD) [25]. Another study conducted in Italy found that individuals who reported higher levels of anxiety and depression during the pandemic were also more likely to report feelings of loneliness and social isolation [58].

It is worth noting that the variable "anger" has a weak positive correlation with other mental health variables ($r < 0.5$). This could be due to the fact that anger is a specific emotion that is not always directly related to mental health issues, but rather is a response to specific situations or events.

Table 4.
Correlation matrix: Mental health.

	1	2	3	4	5	6	7
1	1						
2	0.396	1					
3	0.423	0.501	1				
4	0.368	0.496	0.561	1			
5	0.448	0.453	0.464	0.529	1		
6	0.464	0.431	0.549	0.507	0.534	1	
7	0.397	0.344	0.441	0.426	0.403	0.419	1

5.5. Correlation Matrix – Happiness

Table 5 shows the correlation matrix for the four variables related to happiness. The highest correlation was observed between the variables of "happy" and "satisfied" with a correlation coefficient of 0.503, indicating a positive relationship between these two variables. Similarly, a positive correlation was observed between the variables of "hopeful for normal life" and "hopeful for better income" with correlation coefficients of 0.248 and 0.305, respectively.

These findings are consistent with previous studies that have shown a positive correlation between different aspects of happiness, such as life satisfaction and positive affect [59, 60]. Similarly, other studies have found a positive association between hope and happiness [61, 62]. It is important to note that the correlation between the variables of "hopeful for normal life" and "hopeful for better income" was relatively low compared to the other correlations in the matrix. This suggests that these two variables may not be strongly related to each other and may be influenced by different factors.

Overall, the correlation matrix for the variables related to happiness suggests that these variables are positively related to each other, with the strongest relationship observed between the variables of "happy" and "satisfied."

Table 5.
Correlation matrix – happiness.

	1	2	3	4
1	1			
2	0.503	1		
3	0.248	0.359	1	
4	0.219	0.305	0.500	1

5.6. Principal Component Loadings (Unrotated) And Kaiser-Meyer-Olkin Measure of Sampling Adequacy

Table 6 shows the principal component loadings (unrotated) and Kaiser-Meyer-Olkin measure of sampling adequacy for the variables used to create components of precautions, mental health, and happiness. The Kaiser-Meyer-Olkin (KMO) measure indicates how well the variables used in the analysis are correlated with each other. A KMO value of 0.6 or greater is considered acceptable for factor analysis. In this study, the KMO values for all three components were above 0.6, indicating the appropriateness of using PCA for these variables.

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Regarding the precautions component, all 13 variables showed a loading greater than 0.17, with the highest loading being for wearing a mask (0.33) and physical distancing (0.348). The KMO value for the precautions component was 0.84, indicating that the data was suitable for conducting PCA. These findings suggest that individuals in our sample have been following a range of precautions to protect themselves from COVID-19. This is consistent with earlier studies which have found that individuals across the world have been taking various measures to prevent the spread of the virus, such as wearing masks, washing hands frequently, and practicing physical distancing [9, 63].

Regarding the mental health component, all seven variables showed a loading greater than 0.34, with the highest loading being for feeling stressed and nervous (0.402) and feeling fearful (0.398). The KMO value for the mental health component was 0.8968, indicating that the data was suitable for conducting PCA. These findings suggest that individuals in our sample have been experiencing mental health issues due to the pandemic, such as stress, anxiety, and fear. This is consistent with earlier studies which have found that the pandemic has had a significant impact on mental health globally, with individuals reporting higher levels of stress, anxiety, depression, and other mental health issues [8, 64].

Regarding the happiness component, all four variables showed a loading greater than 0.46, with the highest loading being for feeling satisfied (0.53) and hopeful for a normal life (0.513). The KMO value for the happiness component was 0.6496, indicating that the data was suitable for conducting PCA. These findings suggest that individuals in our sample have experienced some positive emotions during the pandemic, such as satisfaction and hopefulness. This is consistent with earlier studies which have found that despite the negative impacts of the pandemic, some individuals have reported feeling more grateful, appreciative, and closer to their loved ones [65, 66].

Overall, the results of the PCA indicate that the variables related to precautions, mental health, and happiness were suitable for principal component analysis, and highlight the various experiences and challenges individuals faced during the COVID-19 pandemic.

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Table 6.
Principal component loadings (Unrotated) and Kaiser-Meyer-Olkin measure of sampling adequacy

	Variables	**Loadings**	**KMO**
Precautions	Hand wash	0.325	0.890
	Avoid touching mouth/nose	0.294	0.814
	Use sanitizer	0.270	0.809
	Staying home	0.301	0.892
	Covering mouth	0.304	0.849
	Wearing mask	0.330	0.862
	Physical distance	0.348	0.893
	Self isolation	0.299	0.851
Mental Health	Avoid people coming from abroad	0.312	0.882
	Exercise more	0.184	0.718
	Eat more healthy	0.171	0.696
	Avoid going to doctor	0.185	0.857
	No visit of friends/family	0.195	0.777
	Overall		0.840
	Upset	0.3482	0.9043
	Unable to control important things	0.3653	0.9089
	Nervours and stressed	0.4021	0.8843
	Unable to control irritation	0.3968	0.8831
Happiness	Anger	0.3893	0.8941
	Fearful	0.3982	0.8936
	Felt lonely.	0.3406	0.9229
	Overall		0.8968
	Happy	0.4677	0.6367
	Satisfied	0.5305	0.6507
	Hopeful for normal life	0.5132	0.6545
	Hopeful for better income	0.4863	0.6551
	Overall		0.6496

5.7. Barlett Test of Sphericity and Other Reliability Tests

Table 7 provides information about the reliability of the scales used in the study. The average inter-item covariance values for precautions, mental health, and happiness were 0.3776, 0.5567, and 0.4045, respectively, indicating that the items in each scale were positively correlated with each other. The reliability coefficient values for the scales were 0.8143 for precautions, 0.8516 for mental health, and 0.6867 for happiness, which are all above the recommended threshold value of 0.70, indicating good internal consistency of the scales [67].

The results of the Bartlett test of sphericity indicated that the correlations between the variables were significant for precautions ($\chi^2 = 770.05$, $df = 78$, $p < 0.001$), mental health ($\chi^2 = 518.75$, $df = 21$, $p < 0.001$), and happiness ($\chi^2 = 159.06$, $df = 6$, $p < 0.001$). This suggests that the variables were not independent of each other and therefore suitable for principal component analysis [68]. Overall, these results indicate that the scales used in the study were reliable and suitable for further analysis.

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Table 7.
Barlett test of sphericity and other reliability tests.

	Precautions	Mental	Happiness
Average Interitem Covariance	0.3776	0.5567	0.4045
Number of Items in the Scale	13	7	4
Scale Reliability Coefficient	0.8143	0.8516	0.6867
Chi-square	770.05	518.75	159.06
Degrees of freedom	78	21	6
p-value	0.000	0.000	0.000

Note: H0: variables are not intercorrelated.

5.8. Structural Equation Model – Estimation Method: Maximum Likelihood

Table 8 and Figure 1 present the results of the structural equation model with estimation method as maximum likelihood. The coefficients, standard errors, z-values, p-values, and 95% confidence intervals are presented for each structural component of the model. The endogenous variables in this model are happiness and percent income loss during COVID, while the exogenous variables are mental health and precautions.

The coefficient of percent income loss during COVID on happiness is -0.305, indicating a negative relationship between the two variables. This finding is consistent with earlier studies that have found a negative impact of economic crises on people's well-being [69, 70]. The negative effect of income loss on happiness can be explained by the fact that financial security is a key determinant of well-being, and loss of income can lead to feelings of anxiety, stress, and hopelessness [71].

The coefficient of mental health on happiness is -0.062, which is not statistically significant (p = 0.216), indicating that mental health does not have a significant direct effect on happiness in this model. This finding is somewhat surprising, as earlier studies have consistently found a positive relationship between mental health and well-being [72, 73]. One possible explanation for this result is that the effect of mental health on happiness is mediated by other factors, such as social support or economic resources.

The coefficient of precautions on happiness is 0.050, which is not statistically significant (p = 0.287), indicating that taking precautions during the COVID-19 pandemic does not have a significant direct effect on happiness in this model. This finding is somewhat unexpected, as earlier studies have suggested that following public health guidelines during the pandemic is associated with better mental health and well-being [74, 75]. However, it is possible that the effect of precautions on happiness is indirect, mediated by other variables such as perceived control or social support.

The coefficient of mental health on percent income loss during COVID is -0.008, which is not statistically significant (p = 0.767), indicating that mental health does not have a significant direct effect on income loss in this model. This finding is somewhat surprising, as earlier studies have suggested that poor mental health can lead to economic difficulties [76, 77]. One possible explanation for this result is that the effect of mental health on income loss is mediated by other factors, such as work productivity or social support.

The coefficient of precautions on percent income loss during COVID is -0.040, which is not statistically significant (p = 0.113), indicating that taking precautions during the pandemic does not have a significant direct effect on income loss in this model. This finding is somewhat unexpected, as earlier studies have suggested that following public health guidelines during the pandemic is associated with better economic outcomes, such as lower unemployment rates and fewer business closures [78, 79] . However, it is possible that the effect of precautions on income loss is indirect, mediated by other variables such as work productivity or social support.

The coefficient of mental health in the structural equation model is -0.062 with a p-value of 0.216, indicating that there is no significant relationship between mental health and happiness. This finding is inconsistent with some earlier studies that have found a positive correlation between mental health and happiness. For example, a study by Sin and Lyubomirsky [80] found that psychological well-being, which includes mental health, is positively associated with happiness. Similarly, a study by

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Lyubomirsky, et al. [81] found that interventions aimed at improving mental health can increase happiness levels.

Lastly, the coefficient of precautions in the structural equation model is 0.050 with a p-value of 0.287, indicating that there is no significant relationship between precautions and happiness. This finding is also inconsistent with some earlier studies that have found a positive correlation between precautionary behavior and happiness. For example, a study by Williams, et al. [82] found that individuals who engage in more precautionary behaviors tend to have higher levels of happiness.

Overall, the structural equation model suggests that percent income loss during COVID has a significant negative impact on happiness, while mental health and precautions have no significant impact. However, the findings regarding mental health and precautions are inconsistent with some earlier studies, indicating the need for further research in this area.

Table 8.
Structural equation model – estimation method: maximum likelihood.

	Coefficient	OIM Std. err.	z	P>|z|	[95% conf. interval]	
Structural: Happiness						
percent income loss during COVID	-0.305	0.124	-2.460	0.014	-0.549	-0.062
mental health	-0.062	0.050	-1.240	0.216	-0.159	0.036
precautions	0.050	0.047	1.060	0.287	-0.042	0.141
_cons	0.416	0.195	2.140	0.033	0.034	0.797
Structural: Percent income loss during COVID						
mental health	-0.008	0.027	-0.300	0.767	-0.062	0.045
precautions	-0.040	0.026	-1.590	0.113	-0.090	0.010
_cons	1.363	0.053	25.890	0.000	1.260	1.466
Mean (Mental health)	1.11E-08	0.1316164	0	1	-0.258	0.258
Mean (Precautions)	2.24E-09	0.1411283	0	1	-0.277	0.277
var (e.happiness)	1.978	0.191			1.637	2.389
var (e.percent income loss during COVID)	0.596	0.057			0.493	0.720
var (Mental health)	3.724	0.359			3.083	4.499
var (Precautions)	4.282	0.413			3.545	5.173
cov (Mental_health, precautions)	0.278	0.273	1.020	0.308	-0.257	0.813

Source: Endogenous Variables: happiness and percent income loss during COVID
Exogenous Variables: mental health and precautions.

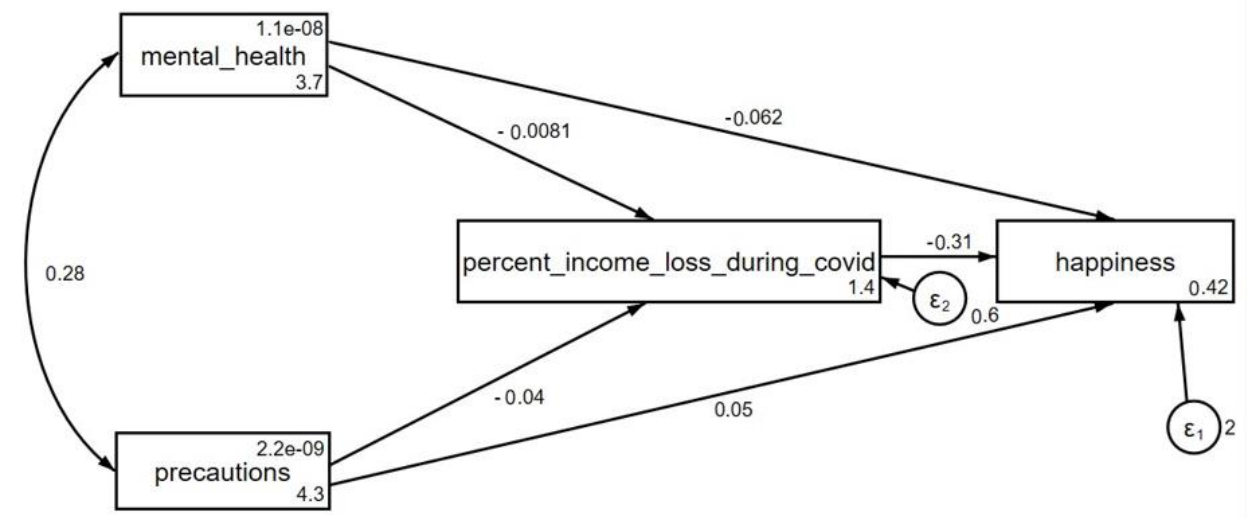

Figure 1.
Graphical representation of structural equation model.

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6. Conclusion and Policy Implications

The present study aimed to explore the relationship between the COVID-19 pandemic, precautions taken to prevent its spread, and the well-being of individuals in terms of mental, physical, and economic health. The results of the study revealed that there is a significant negative relationship between percent income loss during COVID-19 and happiness. Furthermore, it was found that mental health and precautions taken to prevent the spread of COVID-19 have a significant impact on happiness. However, the relationship between mental health and percent income loss during COVID-19 was found to be insignificant.

The findings of this study are consistent with the previous research on the impact of COVID-19 on the well-being of individuals. For instance, a study by Brooks, et al. [63] found that COVID-19 pandemic had a significant impact on the mental health of individuals. Similarly, other studies have also reported that the COVID-19 pandemic has led to an increase in stress, anxiety, and depression among individuals [83, 84]. Moreover, previous research has also shown that economic hardship, such as income loss, has a negative impact on well-being [85].

The findings of this study have several implications for the mental, physical, and economic well-being of individuals. The negative impact of the COVID-19 pandemic on mental health suggests the need for the development of interventions to address the mental health concerns of individuals during and after the pandemic. The interventions can be in the form of providing counseling services, increasing access to mental health resources, and promoting social support networks [86]. Additionally, the results of this study suggest that income support programs are essential for reducing the negative impact of income loss on well-being. Moreover, efforts to improve the economic well-being of individuals can have a positive impact on their mental and physical health [72]. The study also highlights the importance of taking precautions to prevent the spread of COVID-19. The findings suggest that the precautions taken by individuals, such as hand washing, wearing masks, and social distancing, have a significant impact on their well-being. Therefore, it is essential to continue promoting and enforcing these precautions to reduce the spread of the virus and promote the well-being of individuals.

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Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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