REVIEW ARTICLE

A Systematic Review on Precision Nutrition for Prevention and Management of Obesity during COVID-19 Health Crisis towards Restricted Movement Order

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ABSTRACT

The COVID-19 pandemic is now catching the country by surprise. The disease has had a huge influence worldwide, and the nation has been put in lockdown by this health crisis. The psychological health, physical health and economic condition of individuals are adversely impacted by quarantine and lockdown. As mobility is reduced, there will be a dramatic shift in the population's lifestyle, where the people's physical activity level will decrease. Low levels of physical exercise can lead to a large number of obesity cases. Therefore, steps for obesity prevention and management need to be taken. One approach is to administer nutrition with accuracy through precision nutrition. Therefore, this research aims to review articles on precision nutrition for the treatment and control of obesity towards a restricted movement order during the COVID-19 health crisis. The literature search was conducted from May 2020 until January 2021 using Scopus and Science Direct as the main databases. The articles included follow the inclusion criteria published in English language, including nutrition intervention for prevention and management of obesity, focus on health crisis, and no restriction of time and study design. Various studies show that precision nutrition has a potential benefit in preventing or controlling obesity prevalence due to restricted movement order or quarantine upon health crisis.
Keywords: Precision Nutrition, Obesity, Quarantine, Lockdown, COVID-19.

INTRODUCTION

Obesity has been a common chronic health problem worldwide. The rate of obesity worldwide has almost tripled since 1975 (WHO, 2020). Obesity could lead to other health problems such as hypertension, coronary heart disease and diabetes mellitus. It also has economic impacts on the country where it has increased its healthcare cost and medical cost. Obesity may also burden an individual's economic status to manage the disease's consequences (Apovian, 2016). Thus, preventing obesity is an important step to counter these upcoming problems. Obesity can be avoided by adequate physical activity, a balanced diet and healthy weight control (Lavie et al., 2018).

However, the pandemic of COVID-19 has taken the nation by surprise. It has led to global lockdown as the number of cases increased rapidly from day to day, and the virus is very spreadable through social contact. Quarantine and lockdown had a major effect on people's psychological well-being (Lee et al., 2018), physical health and even economically. As mobility is reduced, there will be a dramatic shift in the population's lifestyle (Jiménez et al., 2020), where the level of physical activity of the population will decrease and this may lead to a high number of obesity cases (Mattioli et al., 2020). Therefore, steps for obesity prevention and control need to be taken. There is an abundance of recommendations for obesity prevention and control. However, there is a lack of exploration of precision nutrition for obesity reduction in the sense of health emergencies.

Therefore, this study seeks to review papers on precision nutrition for the treatment and control of obesity towards a restricted movement order during the COVID-19 health crisis. Precision nutrition is based on the idea that an exact nutrient amount may alter disease risk depending on the DNA sequence of an individual (Ferguson et al., 2016). Precision nutrition occurs at three levels, which are: (1) personalized nutrition advice based on personalized dietary details such as age, gender and social life, (2) personalized nutrition advice based on individual phenotypic data such as anthropometric measures, biochemical measures, physical activities and metabolic analysis, and (3) personalized nutrition advice based on individual genomic data such as gene variation (Gibney et al., 2013).

This study reviews articles on precision nutrition based on social life and physical activity to prevent and manage the rising number of obesity during quarantine of COVID-19 pandemics. The findings of this comprehensive literature review may constitute an additional guide in the future for the prevention and control of obesity during the health crisis in the future.

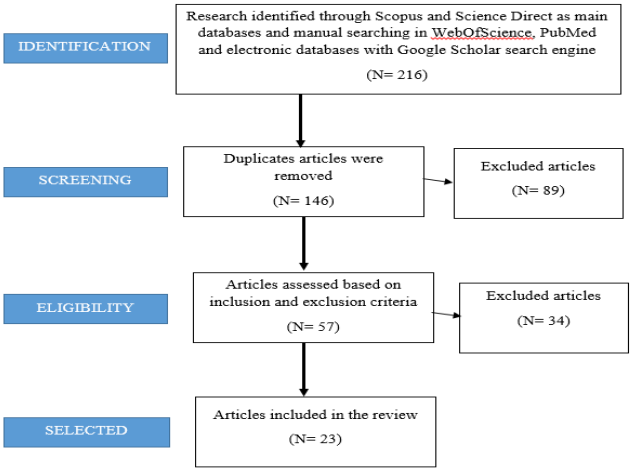
MATERIALS & METHODS

Exploration Resources: The literature search was conducted from May 2020 until January 2021 using Scopus and Science Direct as the main databases. The articles included follow the inclusion criteria published in English language, including nutrition intervention for prevention and management of obesity, focus on health crisis, and no restriction of time and study design. The terms used in the search included "precision nutrition", "personalized nutrition". "individualized nutrition", "obesity", "overweight", "excessive weight gain", "restricted movement order", "quarantine", "lockdown", "confinement", "self-isolation" and "COVID-19". The keywords were combined with the boolean operators "or" and "and" to narrow the searching.

The search is also carried out manually via Google Scholar, PubMed and Web of Science.

Study Selection and Data Extraction: Open accessed articles were reviewed and included for analysis based on following inclusion criteria: (1) Published in the English language, (2) Include nutrition intervention for prevention and management of obesity, (3) Focusing on health crisis, (4) No restriction of study design, (5) No restriction of time. Upon identification process, 216 articles were chosen in the first stage of the systematic literature review process. Then, the screening process was done to disqualify any duplicate articles. In this study, a total of 70 articles were excluded from the total findings after removing the duplicate articles, leaving 146 articles. Next, 57 articles were brought to the third process, the eligibility process, where each article was examined to meet this study's objectives completely. All in all, 34 articles were disqualified, leaving 23 articles to be reviewed and included in this study.

Fig. 1: Study selection process



RESULTS AND DISCUSSION

The articles selected for review are based on the inclusion criteria. First, the articles published must be in English language and easily accessible to researchers. Next, the articles must include nutrition intervention to prevent and manage obesity, focusing on the health crisis. The articles selected has no restriction on study design and no restriction of time. A total of twenty-three (23) articles were reviewed upon completion of this study. Eighteen articles focused on precision nutrition, and 15 articles focused on the relationship between lockdown and obesity.

Three studies were done in Italy (Pietrobelli et al., 2020; Pellegrini et al., 2020; Ruiz Roso et al., 2020), three studies were done in Switzerland (Gornicka et al., 2020; Visser et al., 2020; Marchitelli et al., 2020), two studies were done in Poland (Drywien et al., 2020; Aleksandra Sidor & Piotr Rzymski, 2020), two studies were done in Spain (Goni et al., 2015, Ruiz-Roso et al., 2020), three studies were done in Middle East region (Hussien et al., 2020; Alomari et al., 2020, Yousfi et al., 2020), two studies were done in United Kingdom (Robinson et al., 2021; Chris Baraniuk. 2020), one study was done in United States of America (Laddu & Hauser, 2019), one study was done in Netherland (Poelman et al., 2021), one study was done in China (Jia P et al., 2020) and one study was done in France (Flaudias et al., 2020).

Restricted Movement Order and Obesity: In response to the global coronavirus (COVID-19) outbreak along with the rise in the number of COVID-19 cases in Malaysia, the Malaysian Prime Minister has announced a Restriction of Movement Order (RMO) starting from 18th March 2020 with the order of staying at home or quarantine and to avoid any contact, especially mass gathering. Fourteen reviewed articles on the effects of quarantine on populations' weight show that eleven studies reveal quarantine or lockdown could lead to an increase in obesity cases (Pietrobelli et al., 2020; Aleksandra Sidor & Piotr Rzymski, 2020; Pellegrini et al., 2020; Zachary et al., 2020; Gornicka et al., 2020; Visser et al., 2020; Robinson et al., 2021; Marchitelli et al., 2020; Drywien et al., 2020; Jia P et al., 2020), one study reported that quarantine causes undernutrition (Chris Baraniuk, 2020), two studies show that quarantine causes both overnutrition and undernutrition (Ruiz-Roso et al., 2020; Flaudias et al., 2020,) and one study indicates that quarantine and lockdown do not give any impact on an individual's body weight (Poelman et al., 2021).

Few factors influence the weight increments and the rise of obesity cases during quarantine or lockdown upon COVID-19 pandemic. One of the factors is the increasing consumption of snacks. Seven studies disclosed that increased snacking during quarantine or lockdown of COVID-19 pandemic contributes to weight gain, which leads to increase in obesity prevalence (Pietrobelli et al., 2020; Aleksandra Sidor & Piotr Rzymski, 2020; Pellegrini et al., 2020; Zachary et al., 2020; Visser et al., 2020; Robinson et al., 2021; Ruiz-Roso et al., 2020). Besides, eight studies exposed that decrease in physical activity due to quarantine upon COVID-19 pandemic causes weight increments that could lead to obesity (Pietrobelli et al., 2020; Pellegrini et al., 2020; Zachary et al., 2020; Gornicka et al., 2020; Visser et al., 2020; Alomari et al., 2020; Drywien et al., 2020; Jia P et al., 2020). Next factor that causes an increase in body weight during quarantine is quarantine-induced depression, anxiety and stress. Five studies mentioned that quarantine-induced depression, anxiety and stress are the sources of weight increments (Pellegrini et al., 2020; Zachary et al., 2020; Flaudias et al., 2020; Robinson et al., 2021; Ruiz-Roso et al., 2020). Higher adherence to meat was also said to be one of the factors causing obesity during COVID-19 pandemic. Two studies show that increased meat consumption increased body weight during quarantine of COVID-19 pandemic (Pietrobelli et al., 2020; Aleksandra Sidor & Piotr Rzymski, 2020). Apart from that, elevated screen time such as watching television, facing electronic gadgets such as phone and laptop, scrolling on social media induce higher energy consumption and thus leads to increase body weight, and this factor has been explained in four studies by Pietrobelli et al., 2020; Gornicka et al., 2020; Alomari et al., 2020 and Drywien et al., 2020.

Despite that, there are contrasting results between the study conducted by Aleksandra Sidor & Piotr Rzymski and Ruiz-Roso et al. Aleksandra Sidor & Piotr Rzymski stated that fast food consumption among populations is high, leading to increased body weight during the

quarantine. Fruits and vegetable consumption are also low, indicating that the population gets insufficient nutrition that may disturb health during quarantine of COVID-19 pandemic. Meanwhile, Ruiz-Roso et al. declared that fast foods consumption among the population is low during quarantine of COVID-19 pandemic. Fruits and vegetable consumption are also high among the quarantine population as they have more time to prepare foods. Thus, this may indicate that further study should investigate the relationship between fast food, fruits and vegetable consumption and quarantine or lockdown.

Precision Nutrition for Prevention & Management of Obesity during Health Crisis: Precision nutrition or personalized nutrition is an adaptation of a diet according to an individual's genetic information (Ferguson et al., 2016) which occurs at three levels, which are: (1) precision nutrition based on an individual's personalized dietary details such as age, gender and social, (2) precision nutrition based on an individual's phenotype such as anthropometric measurements, and (3) precision nutrition based on an individual's genomic data such as gene variation.

When reviewing the articles, I identified very few studies delving into the precision nutrition for preventing and managing obesity upon health crisis. However, five articles show suitable precision nutrition that could be the solution for the problem due to quarantine/lockdown upon the COVID-19 health crisis, which is the rising number of obesity cases. From these five articles, there are two articles obtained from books (De Moraes Lopes et al., 2020; Chatelan et al., 2019), one pilot study (Heroux et al., 2017), one observational study (Laddu and Hauser, 2019) and one cross-sectional study (Goni et al., 2015).

Goni et al. (2015) examined through his study on the genetic factors of a population. This study was aimed to study the relationship between one's nutritional intake, his/her gene expression and the gaining of body fat mass. This study can prevent and manage obesity due to quarantine/lockdown upon COVID-19 pandemic because the results of nutritional interventions are compatible with the factors causing the obesity cases. This study's findings show that individuals who have high genetic risk of obesity tend to gain body fat mass upon excessive energy, protein, carbohydrate, and fat intake. Thus, in preventing or managing obesity, an individual should control energy intake, protein, carbohydrate and fat intake. Excessive these intakes could increase the percentage of body fat mass and leads to obesity.

From the five articles reviewed, three studies show the successfulness of the use of Artificial Intelligence (AI) in conducting nutritional intervention (Heroux et al., 2017; De Moraes Lopes et al., 2020; Chatelan et al., 2019). These three studies show the same findings where AI is used to deliver the precision nutritional intervention to the population that can be used to reduce weight, manage or prevent obesity. Heroux et al. (2017) stated that web-based multi-platform coaching program might benefit during quarantine upon COVID-19 pandemic as social-distancing is practised. Meanwhile, Chatelan et al. (2019) and De Moraes Lopes et al. (2020) revealed the effectiveness of precision nutritional intervention installed into a smartphone application could help manage or prevent obesity through the web-based coaching program. Upon this pandemic, it does not need physical attendance and could control the spreading of Coronavirus, avoiding and managing self from obesity.

Two reviewed articles show the same idea of precision nutrition in managing and preventing obesity upon health crisis, Chatelan et al. (2019) and Laddu and Hauser (2019). These two studies show that precision nutrition in managing and preventing obesity can be increased by improving the basic nutritional interventions such as Dash diet, Mediterranean diet and healthy vegetarian diet. Thus, obesity can be avoided by applying a high fibre diet consisting of fruits and vegetables, moderate fat intake with high Polyunsaturated fat (PUFA) and Monounstaurated fat (MUFA), and low red meat and low sodium intake.

Precision Nutrition for the Environment and Social Influenced Obesity during Restricted Movement Order of Health Crisis: Restricted movement order or quarantine due to health crisis influenced the increments in the prevalence of obesity. Factors influencing the rise of the obesity prevalence includes environment-influenced and social-influenced. During restricted movement order, the Malaysian Government has limited social contact and restricts populations' movement to crowded places. Hossain et al. (2020) supported that quarantined or restricted mobility individuals are prone to have mood disorders, anxiety, loneliness, boredom, lack of control, and insomnia.

Two reviewed studies showed that quarantine/lockdown during COVID-19 pandemic reported that quarantine caused boredom, elevated depression, anxiety and stress occurrence, leading to weight increments (Pellegrini et al., 2020; Hussien et al., 2020). Thus, precision nutrition intervention should focus on countering these problems. Upon reviewing the articles, four articles reported a precision nutrition intervention plan that could resolve this problem (Yousfi et al., 2020; Heroux et al., 2017; De Moraes-Lopes et al., 2020; Chatelan et al., 2019). Yousfi et al. (2020) suggest home-based exercise to maintain physical activity. This is because physical activity is proven to reduce oxidative stress. Three reviewed articles show that the use of artificial intelligence in conducting exercise and coaching program could promote weight loss and, at the same time, could reduce stress, depression and anxiety (Heroux et al., 2017; De Moraes-Lopes et al., 2020; Chatelan et al., 2019).

Table 1 Summary of How Restricted Movement Order of Health Crisis Could Lead to Obesity

Study	Author(s), publication date, country	Setting and Characteristics	Study Design	Findings
1	Pietrobelli et al., 2020, Italy.	Children and adolescents with obesity. (n=41)	Longitudinal observational study	Lockdown shows increments in consumption of potato chip, red meat and sugary drink. Time spent on sports activities decreased during the lockdown. Sleep time during lockdown is increased. Screen time during lockdown is increased. These effects of lockdown may have a lasting effect on child's and adolescent's adiposity level.
2	Aleksandra Sidor & Piotr Rzymski, 2020, Poland.	Adult with Polish nationality who are under a nationwide quarantine. (n=1097)	Cross-sectional study	Respondents reported eating and snacking more during the lockdown, especially among obese and overweight individuals. Overweight, obese and older respondents tend to gain more weight. Less frequent consumption of vegetables, fruits and legumes during the lockdown. Higher adherence to meat, dairy and fast foods during the lockdown. Increase in alcohol consumption, especially among alcohol addicts. Increase in smoking frequency during the lockdown.
3	Pellegrini et al., 2020, Northern Italy.	Outpatients of Obesity Unit who are under lockdown during COVID-19 pandemic in Northern Italy. (n = 150)	Observational retrospective study	The study shows weight increments during COVID-19 lockdown. Lower exercise, self-reported boredom/solitude, anxiety/depression, enhanced eating, consumption of snacks, unhealthy foods, cereals, and sweets are correlated with a significantly higher weight gain. Increased education, self-reported anxiety/depression and not consuming healthy foods lead to weight gains.
4	Zachary et al., 2020.	n=1200	Quantitative descriptive	This study shows weight increments during the lockdown of COVID-19, where the participants experienced a weight gain of 5–10 pounds. Increased eating in response to sight and smell, eating in response to stress, and snacking after dinner. Inadequate sleep, snacking after dinner, lack of dietary restraint, eating in response to stress, and reduced physical activity may cause weight gain during COVID-19 lockdown.
5	Gornicka et al., 2020, Switzerland.		Cross-sectional online survey	Decreased physical activity, increased screen time, increased food consumption upon lockdown of COVID-19 increase the prevalence of obesity.
6	Poelman et al., 2021, Netherlands	Sample of adult populations in the Netherlands (n = 1030), five weeks into lockdown.	Cross-sectional study	Most of them did not change their food behaviour or amount of food purchases during the lockdown. Participants who are overweight and obese are more likely to eat unhealthier foods during lockdown than those with a healthy weight. Participants with high educational level tend to eat unhealthier compared to participants with low educational level. Participants who are obese were more likely to buy more chips/snacks and more non-alcoholic beverages during the lockdown than participants with a healthy weight. The study also shows that the use of meal delivery services increases during the lockdown.
7	Flaudias et al., 2020, France.	Undergraduate French students (n=5783)	Cross-sectional study	COVID-19 lockdown influences students' eating behaviour. COVID-19 lockdown induces stress and is more likely to increase binge eating, intention to binge eat, dietary restriction, and intention to restrict diet. Binge eating and dietary restriction were associated with risk factors such as female gender, low impulse regulation, high body dissatisfaction and an existing eating disorder. The study suggests that providing targeted interventions it may help to decrease problematic eating behaviour.
8	Visser et al., 2020, Switzerland.	Dutch older adults who live independently (n=1119)	Cross-sectional study	Half of the sample reported a reduction in physical activity and exercise upon pandemic COVID-19 quarantine. Overnutrition is more likely to occur upon quarantine of pandemic COVID-19 due to increased snacking.

9	Alomari et al., 2020, Jordan.	Participants are Jordanians who are regularly involved in physical activity (n=1844).	Cross-sectional study	The study reported that participants show a decrease in physical activity such as walking, jogging and sports upon confinement of COVID-19 pandemics, and no change in sports such as swimming, cycling and weightlifting Most participants recorded an increase in sedentary behaviour such as watching TV, using electronics and logging in to social media upon confinement of COVID-19 pandemics. The decrease in physical activity is associated with gender, job type, age and obesity.
10	Robinson et al., 2021, United Kingdom.	UK adults who are on lockdown during April-May 2020 of COVID-19 (n=2002)	Cross-sectional study	This study measures how the COVID-19 pandemic lockdown could influence physical activity, diet quality, overeating, and mental and physical health. Most participants reported negative changes in eating and physical behaviour, such as snacking more frequently and were hard to manage weight upon the COVID-19 pandemic lockdown. Depletion in mental health due to COVID-19 crisis does not influence higher BMI, but it predicts greater overeating and low physical activity during the lockdown.
11	Marchitelli et al., 2020, Switzerland.	Participants are obese/overweight patient with a psychiatric diagnosis and no psychiatric diagnosis. (n=110)	Cross-sectional study	This study shows an increment in weight gain among overweight and obese patients with a psychiatric diagnosis and no psychiatric diagnosis during the lockdown of COVID-19 pandemic. Patients with psychiatric diagnosis tend to increase weight due to binge eating, while patients with no psychiatric diagnosis tend to increase weight due to night eating episodes.
12	Drywien et al., 2020, Poland.	Polish women (n=2575)	Cross-sectional study	This study shows that more women in Poland gained weight during lockdown than lose weight. Some women who are obese before pandemic COVID-19 increased their body weight during the lockdown; meanwhile, most women underweight before pandemic COVID-19 decreased their body weight. Weight gain during lockdown occurs due to an increase in screen time and decrease in physical activity.
13	Ruiz-Roso et al., 2020, Italy, Spain, Chile, Colombia and Brazil.	Adolescents aged 10-19 years old that were involved in COVID-19 confinement. They were from Spain, Italy, Brazil, Colombia and Chile (n=820)	Cross-sectional study	Lockdown due to COVID-19 pandemics influences dietary habits such as fried food, sweet food, legumes, fruits and vegetables, thus affecting one's nutritional adequacy, either overnutrition or undernutrition. Other factors that influence nutrition adequacy during a lockdown of COVID-19 pandemic are gender, family members at home, watching TV during mealtime, country residence and maternal education. Legumes, vegetables and fruit intake increased during the lockdown of COVID-19 pandemic as the population has more time to cook. Fast food intake is lower during the lockdown of COVID-19 pandemic due to the population having more time to cook. Fried and sweet food intake increase during lockdown upon COVID-19 pandemic due to frequent snacking due to boredom and stress. This leads to higher calorie intake and increased risk of obesity.
14	Jia P et al., 2020, China.	Participants are high schools students, college and graduate schools aged around 19.	Cross-sectional study	Lockdown of COVID-19 pandemic affects youth's activity pattern and obesity status. Youth's average BMI increase upon lockdown of covid-19 pandemic. Frequency of engaging in active transport decreased. Sleep time and sedentary time increases upon lockdown of COVID-19 pandemic.
15	Chris Baraniuk, 2020, United Kingdom.	UK populations upon lockdown of COVID-19 in the UK.	Observational study.	Most UK populations experienced food insecurity or food poverty upon lockdown of COVID-19 pandemic, which may be due to loss of work and income. This study shows a decline in fruit and vegetable consumption among UK children aged 9-12. Following school closure due to lockdown, UK children also tend to skip meals. It also observes the rise in food banks' needs, which indicates an increase in food insecurity. It shows that children are more likely to be undernutrition, leading to a decrease in educational performance.

Table 2 Summary of The Precision Nutrition for Prevention and Management of Obesity During Health Crisis

Study	Author(s), publication date, country	Setting and Characteristics	Study Design	Findings
1	Heroux et al., 2017	28 women	Pilot study	This study shows that personalized web-based multi-platform nutrition, exercise, and lifestyle coaching programs succeed in promoting weight loss and reducing chronic disease risk factors in overweight or obese women.
2	De Moraes Lopes et al., 2020.	-	Book	This study shows the success of the use of artificial intelligence in nutrition precision and fitness
3	Chatelan et al., 2019.	-	Book	This article shows that precision nutrition could supplement the traditional way of delivering nutritional intervention through artificial intelligence involvement, such as smartphone applications. Precision nutrition measures dietary intake, eating behaviour, physical activity, deep phenotyping such as body composition and nutritional status, nutrigenetic, metabolomics, and microbiomics to develop an individualized diet that may help prevent and manage obesity due to environmental and social influences.
4	Laddu and Hauser, 2019, United States of America.		Observational study	Successful precision nutrition in managing and preventing obesity can be increased by improving the basic nutritional interventions such as Dash diet, Mediterranean diet and healthy vegetarian diet.
5	Goni et al., 2015, Spain.	Caucasian ancestry population who attend Nutrigenetic Service in 7 regions of Spain (n=718)	Cross-sectional study	High genetic risk group has higher values in obesity-related traits & higher risk of being obese. High energy intake is associated with an increased percentage of body fat mass in the high genetic risk group. High protein intake is associated with an increasing percentage of body fat mass in both genetic risk group. High animal protein intake leads to an increase in the percentage of body fat mass. High fat intake is associated with increased body fat mass in the high genetic risk group. High carbohydrate intake associated with an increasing percentage of body fat mass in the high genetic risk group. High fibre intake associated with a lower percentage of body fat mass in a low genetic risk group.

Table 3: Summary of Precision Nutrition For The Environment And Social Influenced Obesity During Restricted Movement Order Of Health Crisis

Study	Author(s), publication date, country	Setting and Characteristics	Study Design	Findings
1	Pellegrini et al., 2020, Northern Italy.	Outpatients of Obesity Unit who are under lockdown during COVID-19 pandemic in Northern Italy. (n = 150)	Observational retrospective study	The study shows weight increments during COVID-19 lockdown. Lower exercise, self-reported boredom/solitude, anxiety/depression, enhanced eating, consumption of snacks, unhealthy foods, cereals, and sweets are correlated with a significantly higher weight gain. Increased education, self-reported anxiety/depression and not consuming healthy foods lead to weight gains.
2	Hussien et al., 2020, middle east region.	Participants are from Egypt, Jordan and Saudi Arabia (n=704).	The descriptive and cross-sectional study	Egyptian participants showed significantly high scores of Depression, Anxiety, Stress Scale (DASS) upon COVID-19 pandemic compared to other participants. Female participants with inappropriate housing conditions, unemployed, young, widowed and school educated show higher mean DASS. High mean DASS score is significantly associated with sleep disturbances, sexuality disturbances and social communication disturbances, changes in working schedule, inability to concentrate on positive thoughts and inability to empty their mind upon quarantine of pandemic COVID-19. Quarantine upon COVID-19 pandemic is associated with a mild level of depression, stress and anxiety.

3	Yousfi et al., 2020, Tunisia.			Fasting and intermittent fasting shows beneficial effects in patients with various chronic diseases and healthy subjects. It reduces oxidative stress and inflammations. Physical activity also reduces oxidative stress and inflammations. Individuals in quarantine or self-isolation should expose themselves to the sun daily (if possible) to get vitamin D to produce inflammatory cytokine. Home-based exercise to maintain physical activity.
4	Heroux et al., 2017	28 women	Pilot study	This study shows that personalized web-based multi-platform nutrition, exercise, and lifestyle coaching programs succeed in promoting weight loss and reducing chronic disease risk factors in overweight or obese women.
5	De Moraes Lopes et al., 2020.	-	Book	This study shows the success of the use of artificial intelligence in nutrition precision and fitness
6	Chatelan et al., 2019.	-	Book	This article shows that precision nutrition could supplement the traditional way of delivering nutritional intervention through artificial intelligence involvement, such as smartphone applications. Precision nutrition measures dietary intake, eating behaviour, physical activity, deep phenotyping such as body composition and nutritional status, nutrigenetic, metabolomics, and microbiomics to develop an individualized diet that may help prevent and manage obesity due to environmental and social influences.

CONCLUSION

The reviewed studies showed that precision nutrition has a potential benefit in preventing or controlling obesity prevalence due to restricted movement order or quarantine upon health crisis. Very few studies delve into the relationship of fast food, fruits and vegetable intake, and quarantine upon COVID-19 pandemics to prevent and manage obesity upon health crisis. Therefore, further study could focus on the relationship between fast food, fruits and vegetable consumption, quarantine, or lockdown.

This review would help nutritionists, dietitians, and healthcare sectors overcome obesity during a health crisis, especially during the COVID-19 health crisis. The reviewed article also showed the factors causing the rise in the number of obesity cases in response to quarantine. This may help the future researcher to conduct a study to solve those problems.

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