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Lifestyle Changes For People With Non Communicable Diseases In The COVID-19 era: A Survey Conducted Around The World

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Article Information

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ABSTRACT

In addition to its economic, psychological and social impact, the lockdown imposed in the era of the coronavirus pandemic (COVID-19) is a potentially risky situation for people with chronic diseases. In order to highlight the importance of food in the response to this virus, the objectives of this study were to explore the changes that accompanied the lockdown imposed by governments, as a protective measure to limit the spread of the COVID-19 virus. These changes concerned lifestyles including people's dietary habits and their level of physical activity. An online survey was launched around the world in April 2020, in two languages, to answer a questionnaire on eating habits, lifestyles and perceptions regarding the effect of home confinement during the COVID-19 era

Data collected from 219 respondents showed that confinement had a negative effect on lifestyle insofar as the level of physical activity decreased in 66.7% of the respondents; sleep duration and rhythm increased in 42.8% and 34.9% respectively and the number of cigarettes smoked increased in 24.1% of participants. The study also found that 17.6% of the respondents increased the number of meals consumed, 12.8% their consumption of sugary snacks and 16.89% of salty snacks at an average frequency of twice a day.

INTRODUCTION

Several combined approaches have been taken around the world to deal with coronavirus (COVID-19) infection to limit the pandemic [1]. Like other countries, Morocco has combined large-scale diagnostic testing, isolation and quarantine, alongside the adoption of preventive home containment [2,3]. The total containment of the Moroccan population was declared in 2020 on March 20th and lasted until June 24th. This preventive modality is reported to negatively affect people in very different ways and at several levels, economic, social and psychic [4,5].

On the health front, the containment measures limited access to prevention services, hospital treatment and drugs prescription [6]. In addition to travel restrictions, health systems around the world, including that of Morocco, have been oriented in this period towards the response to COVID-19 [7,8]. This fact has caused a major disruption of prevention, care and treatment services for diseases includ-

ing Non-Communicable Diseases (NCDs) which are considered a health problem, demonstrated by global estimates revealing that one in four suffer from at least one chronic disease [7,9].

In Morocco, due to the demographic transition, NCDs are experiencing a continuous increase with a prevalence of diabetes (10.6%), high blood pressure (29.3%) and obesity (20%) [10]. Data from the literature have shown that 30% of households have at least one member with chronic illness, 48% of them were unable to access health services during the lockdown for several reasons [11]. Among the reasons declared by the surveyed population, the fear of contamination by the virus was cited by 39.5%; difficulties in accessing medical offices by 16.1%; hospital reception difficulties by 23.8%; the high cost of the service was mentioned by 16.5% and various other reasons by 4.2% [11].

While NCDs require regular management, this population was at risk of complications and worsening of pre-existing conditions [7, 8,12]. This is likely to lead to a long-term upsurge in deaths from these diseases [12,13]. Indeed, death rates from COVID-19 in people with these chronic diseases were with increases of 5 to 10 times compared to people without pre-existing diseases [12,13]. Results of a survey conducted by World Health Organization showed that in Africa, people living with NCDs account for 85% of all deaths from COVID-19 [7]. Although smoking, alcohol, inadequate physical activity, and poor eating habits are the four main risk factors identified for NCDs, the literature has shown that containment during the COVID-19 era was associated with increased smoking, physical inactivity, unhealthy diet and intense fear of the potential impact of COVID-19 [7, 14]. Thus, people confined at home had physical and psychological discomfort [8,9]. This study was therefore carried out with the aim to exploring the changes in people's lifestyles in response to the confinement adopted in the era of COVID-19.

METHODS AND PARTICIPANTS

Data Collection Tool

A survey was conducted online from April 18th to June 24th, 2020. The sample selection was based on a non-probability sampling methodology. The sample consisted of people reached globally by email, social media (WhatsApp, Facebook), and via personal and professional networks of the study authors. The respondents to the survey questionnaire were encouraged to share the survey link with other members of their networks. Respondents who could not access the Internet were also encouraged to complete the survey by telephone. After the survey was closed on June 24th 2020, questionnaires with incomplete responses were discarded. The final sample size used for this study was 219.

The questionnaire used to collect information from the survey participants included questions on socio-demographic characteristics; lockdown due to COVID-19, information on dietary habits and lifestyle.

ETHICAL CONSIDERATIONS

Study participants were also informed about the purpose of the survey and were assured that all the data would be used for research purposes only. In addition, participants' responses were anonymous and confidential. Finally, the respondents gave their prior and voluntary consent to participate in this anonymous study.

RESULTS

Sociodemographic Characteristics

The Table 1 shows that the majority of the study respondents was Moroccan (77.2%), female (59.36%), aged 18 to 50 (73.06%), married (63%), with a high level of education (78.1%) and a public occupation (63.5%).

Table 1: Sociodemographic characteristics of survey respondents

Characteristics	N	%
Sex		
Female	130	59.36
Male	89	40.64
Age		
[18 – 50 ans [	160	73.06
>=50 ans	59	26.94
Family status		
Married	138	63.3
Singles	60	27.5
Divorced	14	6.4
Widowers	6	2 .8
Level of education		
University	171	78.1
Secondary	27	12.3
College	12	5.5
Primary	2	0.9
No	7	3.2
Occupation		
Public function	139	63.5
workers	29	13.2
Liberal function	31	14.2
Without	16	7.3
Training	4	1.8
Country of residence		
Morocco	169	77.2
Germany	3	1.4
USA	3	1.4
Ivory Coast	1	0.5
Italy	5	2.3
France	2	0.9
Tunisia	3	1.4
Spain	4	1.8
Algeria	9	4.1
Iraq	17	7.8
United Arab Emirates	1	0.5
Belgium	2	0.9
Area of Residence		
Urbain	195	89
Rural	24	11

HEALTH STATUS OF THE RESPONDENTS AND THEIR DEGREE OF COMPLIANCE WITH CONTAINMENT DURING COVID-19

The Table 2 shows that 10% of the respondents reported having fatty liver disease, 11.4% diabetes, 13.7% hypertension and 10%

a thyroid problem. Hyperlipidemia was also found in the respondents with 5.9% for hypertriglyceridemia and 8.7% for hypercholesterolemia.

The table shows also that the respondents with chronic illnesses adhered to the containment in varying degrees. In addition, the use of Chi-square test revealed that except for hypertension, all other non-communicable diseases were significantly associated with the degree of containment.

The Table 3 presents the respondents weight status according to their compliance with containment in the pandemic period. BMI was calculated as the ratio of the respondent's weights in kg before and during confinement to the height in m2 squared (BMI1 = P1 / T2, BMI2 = P2 / T2). It was categorized as BMI < 18 for underweight; between 18 and 25 for normal weight; between 25 and 30 for overweight and greater than or equal to 30 for obese people. Among the respondents, 1.8%, were underweight,31.5% normal weight, 42.9% overweight and 23.7% were obese. The change in

weight status assessed by calculating the difference between the body mass index (BMI) during confinement and BMI before confinement showed that people who were underweight and normal weight had not changed but varied in 2.8% of those with overweight and obese respondents. Thus, the average change in BMI was 0.35 Kg / m2 ± 1.29.

The table shows that in the total sample, containment was fully met by 66.2% and partially by about 31%. The data reveal that more than 65% of the respondents who fully or partially respected the containment were overweight or obese. There was a significant association between weight status and degree of containment adherence.

The data revealed also that according to their perception, there was an underestimation of the respondents weight. Indeed, the obesity rate reported by respondents during confinement was lower (11.87%) compared to the actual rate based on the calculation of BMI (23.7%) (Table 4).

Table 2: Distribution of the respondents by chronic disease and degree of confinement

	NAFLD n= 22	Diabetes n=25	HTA n= 30	HTG n=12	Dyslipidemia n=11	HCHOL n=18	Thyroid problem n=21
Confinement							
Totally	8(36.36)	13(52)	16(53.33)	7(58.34)	6(54.55)	9(50)	13(61.91)
Partially	10(45.5)	8 (32)	12(40)	4(33.33)	3(27.27)	5(27.78)	6(28.57)
Rarely	4(18.18)	4 (16)	2(6.67)	1 (8.33)	2(18.18)	4(22.22)	2(9.52)
Not at all	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Chi2 test	32.54	24.5	9.66	13.78	17.16	35.44	55.22
p- value	0.001	0.003	0.139	0.032	0.046	0	0

Table 3: Distribution of respondents according to their weight status and during confinement

	Underweight	Normal weight	Overweight	Obesity	Total n(%)
Totally	2 (1.4%)	51(35.2%)	65(44.8%)	27(18.6%)	145(66.2 %)
Partially	2(3%)	18(26.9%)	29(43.3%)	18(26.9%)	67(30.59%)
Rarely	0(0%)	0(0%)	0(0%)	5(100%)	5(2.28%)
Not at all	0(0%)	0(0%)	0(0%)	2(100%)	2(0.91%)
Total	4(1.8%)	69(31.5%)	94(42.9%)	52(23.7%)	219(100%)

Table 4: Respondents' perception of their weight status during confinement

Weight status	Underweight 4(1.8%)	Normal weight 69(31.5%)	Overweight 94(42.9%)	Obesity 52(23.7%)	Total 219	%
Weight perception						
Normal weight	2(1.6%)	60(49.2%)	50(41.0%)	10(8.2%)	122	55.71%
Underweight	2(8.7%)	6(26.1%)	4(17.4%)	11(47.8%)	23	10.50%
Obesity	0(0%)	0(0%)	12(46.2%)	14(53.8%)	26	11.87%
Abdominal obesity	0(0%)	3(6.3%)	28(58.3%)	17(35.4%)	48	21.92%

Prevalence of COVID-19 Infection

Infected with COVID-19 was declared by 8.22% of the survey respondents of which 55.6% were males and 44.4% were females. Males are 1.93 times more likely to be infected than females with CI [0.73-5.10]). The results show also that 44.4% were of 18 to 50 years old and 50% were over 50 years old. In addition, us in the chi2 test revealed a significant association between age and infection with COVID-19.

The results revealed also that the majority (80%) of the COVID-19

infected respondent did not comply with the containment against only 20% who did. A significant association between compliance with containment and infection with COVID-19 was also found. On the other hand, the respondents infected with COVID-19 were mostly obese (83.3%), 16.7% were overweight, 66.7% were diabetics, 66.7% hypertensive, 38.9% were with dyslipidemia, 16.7% hyper-triglyceridemia, 61.11% hyper-chlolesterolemia, 77.8% were with hepatic steatosis and 33.3% had thyroid problems (Table 5).

Table 5: Percentage of respondents with non-communicable diseases and COVID-19 infection

non-communicable diseases	No COVID-19 infection	COVID-19 Infection	Total	Chi2 test
Overweight	91(45.3%)	3(16.7%)	94 (42.9%)	39.01
Obesity	37(18.4%)	15(83.3%)	52 (23.7%)	
Diabetes	13(6.5%)	12(66.7%)	25 (11.4%)	84.39
Hypertension	18(9%)	12(66.7%)	30 (13.7%)	48.04
Dyslipidemia	4(2%)	7(38.9%)	11(5%)	60.43
Hyper triglyceridemia	10(5%)	3(16.7%)	13(5.9%)	31.84
Hyper-cholesterolemia	8(4%)	11(61.11%)	19(8.7%)	76.78
No alcoholic fatty liver	8(4%)	14(77.8%)	22(10%)	102.85
Thyroïd Problem	16(8%)	6(33.3%)	22(10%)	62.4

Furthermore, a significant association of infection with COVID-19 of respondents and the area of residence, the education level, the family situation and the occupation was found. Indeed, the survey results show that 61.1% of the infected were from urban areas (vs. 38.9% from rural areas) with those living in urban area exposeed to a risk of infection by COVID-19 1.5 times than their rural counterpart. Also, 1% of the respondents were at elementary school or illiterate, while 50% of them had a middle school education level, 27.8% secondary level and 11.1% were academics. Regarding the family situation, 38.9% were divorced, 33.5% married, 16.7% single and 11.1% widowers. More than half (55.6%) exercised a liberal profession, 33.3% the public service and 11.1% were unemployed. People undergoing academic training and those in private employment were not infected.

The effect of containment in the COVID-19 era

The data concerning the responses on how the confinement affected the respondents are presented in Table 6. The results show that 12.3% of the participants declared having better performance and productivity, 37.9% had more availability for their families, 31.3%

that they had enough time to carry out activities such as cooking at home and reading, and 20.5% said they had better organization of their daily activities. Negative effects of containment have also been declared. Indeed, 63% of the respondents said they had stress since the onset of COVID-19. Among the multiple reasons for stress declared by the respondents, health problems (39.7%), lack of drugs against COVID-19 (28.3%), lack of performance (no professional exercise due to the pandemic) (21.5%), financial problems (17.4%), the lack of adherence to the containment by other people and the fear of being contaminated (1.8%), the closure of shopping areas (14.6%) and finally 13.2 % of respondents raised concerns about eating habits because of the limitations of food ordered from outside the home as a source of stress.

Causes of non-adherence to total containment

The causes of non-adherence to total confinement as cited by the survey participants were, the obligation to go for grocery shopping for 25%, stress at home for 21%, social work for 15%, the perception of non-dangerousness of COVID-19 for 15% and physical activity in 4% (Figure 1).

Table 6: Effect of containment in the COVID-19 era

	N	%
Better performance and productivity	27	12.30%
More family availability	83	37.90%
More time to carry out activities (cooking at home, reading, etc..)	68	31.30%
Better organization of daily activities	45	20.50%
No existing drugs against COVID-19	62	28,3
Wasting time (unemployment due to COVID-19	47	21,5
Concern for eating habits	29	13,2
Closure of shopping areas	32	14,6
Financial problems	38	17,4
Health issues	87	39,7
Environment in general	3	1,4
No respect for confinement by others and fear of being contaminated	4	1,8

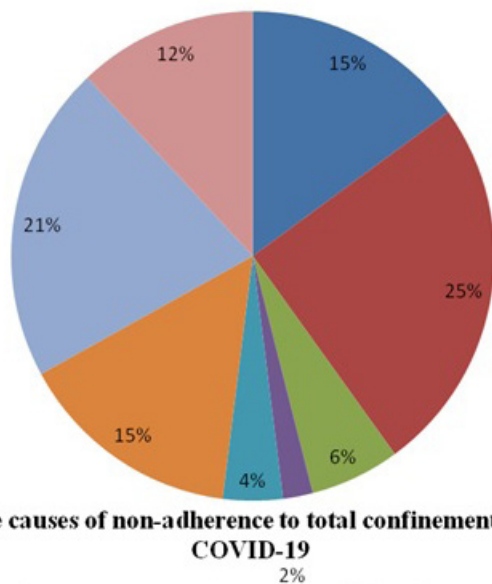**Figure I: the causes of non-adherence to total confinement in the era of COVID-19**

- ■ Social work
- ■ medical visit
- ■ Physical activity
- ■ Stress at home
- ■ Shopping races
- ■ Parents visit
- ■ Perception of no dangerousness of COVID-19
- ■ Various

Table 7: Respondents proportion who twice increased their food consumption frequency

Foods	%
Meats	15,98
fish	9
Eggs	10,50
Dairy products	18,26
vegetables	30,7
Fruits	30,59
Cheeses	15,52
Pastries	5,9
Sweet snacks	12,8
Salty snacks	16,89

Table 8: Foods ordered outside of home during confinement

Most Ordered Out-of-Home Foods During Confinement	N	%
Bread	15	21.74
Pastries	1	1.45
Preserves	2	2.9
Ice cream products	30	43.48
Dairy products	5	7.25
Traditional foods	6	8.69
Fast food	1	1.45
Out-of-home consumption (traditional and / or rapid)	9	13.04
Total	69	100

LIFESTYLE DURING CONFINEMENT

Physical Activity, Sleep, Tobacco and Alcohol

Sedentary lifestyle and low levels of Physical Activity (PA) can have negative effects on health. The present study revealed that during the confinement 66.7% of the respondents decreased their level of physical activity (4:05 / d +2.42) against 10% only who increased it (5 h / d+3.34); while 23.3% said that they kept the same number of PA hours.

The results showed also an increase of 2:05 + 0.28 in sleep duration in 42.8% and in sleep rhythms in 34.9% of respondents. On the other hand, tobacco consumption increased in 24.1% while consumption of alcoholic beverages decreased in 33.3% of the study participants during confinement.

Eating Habits

As shown in Table 7, during confinement, the frequency of food consumption increased to 2times / day for meats in approximately 16% of the respondents, for cheeses in 15.52%, for other dairy products in 18.26 %, for eggs in 10.50%, for fish in 9%, for vegetables in 30.70% and for fruits in 30.59%. The frequency increased to 2 times / day also for pastries consumption in 5.9%, for sweet snacks in 12.8% and for salty snacks in 16.89% of the respondants. However, the frequency of bread consumption remained unchanged during confinement at a rate of more than 3 times / day in 28.77%.

On the other hand, some of the respondents also reported consuming out-of-home food during confinement. The most ordered foods during this period were ice cream followed by bread (Table 8).

DISCUSSION

The present investigation examined the effect of home confinement due to the COVID-19 pandemic on people's lifestyles. The particular information collected in this study concerned eating habits, level of Physical Activity (PA), smoking, sleep and stress. The majority of respondents (77.2%) were Moroccans, females (60%) and over the age of 18.

A rate of 8.22% among the survey respondents were infected with COVID-19, mostly male with half of them over the age of 50. Statistical analysis reveals also that COVID-19 infection was associated with age, place of residence, education level, family situation, occupation and the degree of compliance with confinement of the respondents. The survey data showed, in fact, that 80% of the respondants infected with COVID-19 did not comply with the containment. Furthermore, the majority of those infected participants were from urban areas with a risk of infection by COVID-19 of 1.5 times that of those from rural areas. All these results converge towards the deduction of the great interest of confinement for the protection of individuals against the covid-19.

Although confinement is a protective measure against COVID-19, it was fully respected by only 66.2% of the respondants sample, the data show that respondents with chronic illnesses adhered to confinement at varying degrees. Indeed, 44.8% only of the respondents with overweight, 18.6% of obese people, 9% of diabetics, 11% of hypertensives and by only 5% of people with non-alcoholic fatty liver disease respected fully the confinement. Also a significant association of non-communicable diseases with the degree of confinement was found.

Therefore, among the participants infected with COVID-19, the majority (83.3%) were obese, 16.7% overweight; 66.7% of diabetics, 38.9% had dylipidemia, 16.7% hypertriglyceridemia, 61.11% hypercholesterolemia, 77.8% hepatic steatosis and 33.3% had thyroid problems.

This is consistent with previous studies reporting that comorbidities such as hypertension, diabetes and coronary heart disease increases in patients with COVID-19 were frequent and that older patients were at greater risk for the progression of the infection severity [16, 17]. Another study in China carried out on 366 patients with COVID-19 and hospitalized in 47 regions of Sichuan, had chronic NCDs.The best known of these NCDs were hypertension in 32.6%; cardiovascular disease in 16.3%; diabetes in 14.0%; chronic liver disease 9.3%; and chronic kidney disease7% in those patients [18]. Likewise, a study on deaths from COVID-19 in Italy found that 98.8% of patients who died had at least one chronic disease and that 48.6% had at least three comorbidities, the most common being hypertension in 73.8%; diabetes in 33.9% and chronic liver disease in 3.7% of the patients [19]. The same results were reported by another study in New York showing also that 72% of patients with COVID-19 had at least one chronic disease, with 44.6% of them having cardiovascular disease; 31.8% diabetes and 39.8% obesity. This study revealed also strong associations particularly between advanced age, obesity, heart failure and chronic renal failure [20].

However, 63% of respondents declared that they could not comply with containment because of stress since the appearance of COVID-19 for many reasons, health problems in 39.7%, non-existence of drugs against COVID19 in 28.3%, for financial problems in 17.4%, concern for eating habits as ordering food outside the home was limited to few products, mostly ice cream products and bread in 13.2%, the closure of commercial surfaces in 14.6% and for unemployment in 21.5%.

In addition to the psychological and economic effect of confinement, the effect on health was exacerbated by life style factors such as the increase in the sleep duration and rate, the decrease in physical activity in addition to the changes of the number of cigarettes smoked and the consumption of alcoholic beverages among the respondents. Add to that the doubling of the frequency of food consumption. Indeed, a sharp reduction in physical activity of two weeks associated with overeating has a negative influence on blood sugar and lipid profile. It causes an increase in abdominal fat, liver fat, as well as an increase in blood cholesterol and triglyceride levels [22, 23]. On the other hand, a study on COVID-19 patients, reported an association of smoking with immune system weakeness and development of severe symptoms. The same study found also that 25% of the patients who died were on mechanical ventilation in intensive care [21].

Consistently with the literature, the present survey results showed

also that, although confinement is a protective measure against COVID-19 and an opportunity for a better organization of daily activities, this measure had negative effects on health. Indeed, data from the HCP (High Commission for Planning) study on the impact of confinement on households in Morocco, highlighted that 30% of the households have at least one member suffering from chronic illness with no access, during the confinement period, to health services for 48% of them. The reasons mentioned were the fear of being contaminated with the virus, the difficulties to access medical offices, hospital reception difficulties and the high cost of the service [11]. The psychological impact of the epidemic was also rated as moderate or severe by more than half of the participants in another online study in China, who also reported moderate to severe symptoms of depression, anxiety and stress [15].

All the information brought by these findings have potential implications that could help with lifestyle recommendations, including dietary habits, to maintain good health status during the COVID-19 pandemic. Accordingly, recommendations to mitigate the effects of containment in the COVID-19 era on health, are to ensure a daily diet with adequate intake of energy while respecting the requirement. Eat a healthy diet with carbohydrates of low glycemic index such as vegetables, fruits, legumes, and foods high in protein and unsaturated fatty acids, drinking of enough water and unsweetened beverages, and balanced and diversified food. Another recommendation coming from these study data is to avoid stress, anger and anxiety; get enough and restful sleep. In addition, other recommendations such as practicing daily physical activity, limiting or avoiding smoking and alcohol consumption are key elements of a healthy lifestyle. This way of living could strengthen the immune system against COVID-19 [24].

The strengths of this study resides in the quality of the survey questionnaire administered in two languages to people from many countries who cooperated to bring this research to fruition. However, there were also limitations mainly the difficulties related to the control of sampling and the representativeness of the sample since the size of the sample varies from one country to another and the respondents to this survey are not representative of the general population.

CONCLUSION

Despite being considered a protective measure against COVID-19, the results of the present study indicated that confinement has a negative impact on people's lifestyle, including their eating habits and level of physical activity. In fact, short-term physical inactivity and overeating can have several negative health consequences linked to an increase in body and central fat, a risk factor for obesity, diabetes, fatty liver disease and hypertension. Recent data has also reported a high risk of serious complications from COVID-19 in people with these chronic conditions.

From the present study, it is recommended to pay attention to nu-

trition and adequate energy intake, as well as physical activity and restful sleep to improve immunity against infections such as the COVID-19 pandemics.

References

1. Lai CC, Wang CY, Wang YH, Hsueh SC, Ko WC, Hsueh PR. Global epidemiology of coronavirus disease 2019 (COVID-19): disease incidence, daily cumulative index, mortality, and their association with country healthcare resources and economic status. Int J Antimicrob Agents. 2020; 55(4): 105946.

2. Nani S. Le Maroc face au COVID-19. Revue Marocaine de Santé Publique. 2020. 7(10).

3. Maladie due au nouveau Coronavirus: la veille sanitaire au Maroc. 2020.

4. Sobia H. Coronavirus Disease (COVID-19): Psychological Impact. Current Opinions in Neurological Science. 2020; 35-6.

5. Pagel JI, Chouker A. Effects of isolation and confinement on humans-implications pour les explorations spatiales habitées. J. Appl Physiol. 2016; 120: 1449-57.

6. Demaio A, Jamieson J, Horn R, de Courten M, Tellier S. Non communicable diseases in emergencies: a call to action. PLoS Curr. 2013; 6(5).

7. Covid-19-significantly-impacts-health-services-for-non communicable. 2020.

8. Lim MA, Huang I, Yonas E, Vania R, Pranata R. A wave of non-communicable diseases following the COVID-19 pandemic. Diabetes & metabolic syndrome. 2020; 14(5): 979-80.

9. Herbert K, Plugge E, Foster C, Doll H. Prevalence of risk factors for non-communicable diseases in prison populations worldwide: a systematic review. The Lancet. 2012; 379(9830): 1975-82.

10. Rapport de l'Enquête Nationale sur les Facteurs de Risque communs des Maladies Non Transmissibles.2017– 2018. Stepwise. 2020.

11. Enquête sur l'impact du coronavirus sur la situation économique, sociale et psychologique des ménages. Documents. 2020.

12. Gupta R, Misra A. Contentious issues and evolving concepts in the clinical presentation and management of patients with COVID-19 infection with reference to use of therapeutic and other drugs used in Co-morbid diseases (Hypertension, diabetes, etc) Diabetes Metab Syndr Clin Res Rev. 2020; 14: 251-4.

13. Gopalan HS, Misra A. COVID-19 pandemic and challenges for socio-economic issues, healthcare and National Health Programs in India. Diabetes Metab Syndr. 2020; 14(5): 757-9.

14. Narici M, De Vito G, Franchi M, Paoli A, Moro T. Marcolin, G.& Maganaris, C. Impact of sedentarism due to the COVID-19 home confinement on neuromuscular, cardiovascular and metabolic health: Physiological and pathophysiological implications and recommendations for physical and nutritional countermeasures. European journal of sport science. 2020; 1-22.

15. Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS, Ho RC. Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. International journal of environmental research and public health. 2020; 17(5): 1729.

16. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet. 2020; 395(10229): 1054-62.

17. Yang J, Zheng Y, Gou X, Pu K, Chen Z, Guo Q, Zhou Y. Prevalence of comorbidities in the novel Wuhan coronavirus (COVID-19) infection: a systematic review and meta-analysis. Int J Infect Dis. 2020; 10.

18. Zhou Y, He Y, Yang H, Yu H, Wang T, Chen Z, Liang Z. Development and validation a nomogram for predicting the risk of severe COVID-19: A multi-center study in Sichuan, China. PLoS One. 2020; 15(5): e0233328.

19. Gujski M, Raciborski F, Jankowski M, Nowicka PM, Rakocy K, Pinkas J. Epidemiological analysis of the first 1389 cases of COVID-19 in Poland: A preliminary report. Medical science monitor: international medical journal of experimental and clinical research. 2020; 26: e924702-1.

20. Petrilli CM, Jones SA, Yang J, Rajagopalan H, O'Donnell L, Chernyak Y, et al. Factors associated with hospital admission and critical illness among 5279 people with coronavirus disease 2019 in New York City: prospective cohort study. BMJ. 2020; 22-369.

21. Alhazzani W, Møller MH, Arabi YM, Loeb M, Gong MN, Fan E, et al. Surviving Sepsis Campaign: guidelines on the management of critically ill adults with Coronavirus Disease 2019 (COVID-19). Intensive care medicine. 2020; 1-34.

22. Martinez-Ferran M, de la Guía-Galipienso F, Sanchis-Gomar F, Pareja-Galeano H. Metabolic impacts of confinement during the COVID-19 pandemic due to modified diet and physical activity habits. Nutrients. 2020; 12(6): 1549.

23. Knudsen SH, Hansen LS, Pedersen M, Dejgaard T, Hansen J, Hall GV, et al. Changes in insulin sensitivity precede changes in body composition during 14 days of step reduction combined with overfeeding in healthy young men. Journal of applied physiology. 2012; 113(1): 7-15.

24. Guide de nutrition durant la pandémie de COVID-19. 2021.