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# Nutritional Status among Scholars and Employees during Compulsory Confinement Due to COVID-19

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**Abstract**: ***Background: beyond genetics, nutritional status depends on rational dietary and regular practice of physical activity and exercises. Thus, we evaluated nutritional status of scholars and employees subjected to four-weeks confinement due to COVID-19. Material and Methods: we conducted a cross-sectional study in a Middle Institute and University. We applied systematic casual sampling technique to screen 534 participants from whom anthropometric measures were taken followed by a questionnaire. Results: 41.5% (n=206) participants have weight outside the referred range before confinement. Body mass index (BMI) mean after deconfinement is 22.6 kg.m$^{-2}$ (min. 13.5 and max. 39.7 kg.m$^{-2}$). The majority are eutrophic (60.2%, n=322), but significant number (39.8%, n=212) was diagnosed with a sort of malnutrition, either underweight (13.8%, n=74), overweight (17.2%, n=92) or obesity (8.8%, n=47). Nutritional status of males and females show no significant difference (p.=0.301; CI: 95%, SE: 0.0893), although males tended to have relatively high weight abnormalities. As associated factors, we found relative increment of food intake, low frequency of physical activity and exercises, and lower family income. Conclusion: COVID-19 restrictions have led to significant sort of malnutrition events in participants due to irrational food intake and increased sedentary lifestyle.***

**Keywords**: COVID-19, Meals, Physical activity, Nutritional status

## 1.Introduction

Outbreak of coronavirus disease 2019 (COVID-19) caused by infection with a novel strain of SARS-CoV-2 [1] has triggered worldwide unprecedented health, economic, educational, sociocultural and geopolitical changes. Assorted measures to curtail rapid spread of the virus were widely adopted, including closure of daily public activities. Compulsory confinement and restrictions on free movement likely influenced citizens' lifestyle [2] because it implies disruption of daily activities. Hence, level of physical activity and exercises [3] and dietary profile [4] are affected in different magnitudes. Interruption of work routine could result in boredom [5]. Boredom is associated with greater energy intake [6]. Furthermore, hearing or reading about COVID-19 pandemic may be stressful. Stressful situations are favourable to excessive consumption of sugars, mostly the so called comfort foods [5]. On the other hand, mandatory confinement has caused loose of employment reducing household income. These factors are prone to trigger nutritional abnormalities such as overnutrition and undernutrition, particularly for children [7]. Moreover, in such conditions adolescents are remarkably susceptible to acquiring bad eating habits. Poor dietary habits increase the risk to develop primary undernutrition, and degenerative diseases such as obesity, diabetes and cardiovascular pathologies [4] which often affect their performance and productivity. It should be noted that rational way of nourishment combined with adequate physical activity and exercise, are basic components for maintaining proper body condition [8,9]. Although social distancing and confinement have shown to be fundamental in tackling the spread of the virus, its side-effects should be timely addressed. However, to the best of our knowledge, nutritional profile during confinement due to COVID-19 pandemic in Nampula is not yet explored. Thus, we aimed to evaluate nutritional status of scholars and employees subjected to four-weeks confinement.

## 2.Literature Survey

Coronavirus disease 2019 (COVID-19) emerged in Wuhan, Hubei province by mid-December, 2019 and officially reported in December, 31 [10–12] has affected more than 250 countries and regions within two months [13]. The pandemic has triggered unprecedented worldwide humanitarian crisis. The atypical pneumonia caused by infection with a novel strain of coronavirus [14] SARS-CoV-2, has the potential to rapidly spread and affect large number of people. Eastern Europe, Japan and United States are the most affected areas, and lowest rate is registered in Africa, Central America and South-western Asia [15]. Although Africa is reporting relatively low prevalence, one of basic measures widely implemented is limiting social contact to curb the chain of transmission of the virus [16]. The measure has contributed to controlling the spread of the virus, but has side-effects which are highly debated, as other public health problems and economic pressure may rise [17]. For instance, confinement considerably limits physical activity, and may lead to mental disorders [18] including state of depression, cardiovascular disease, emotional imbalance due to the 'alarm situation' [19]. In addition, food intake disorders are likely to increase. In fact, one of major public health problems in developing countries relates to malnutrition, either duo to nutrient deficits or nutrient excesses. Malnutrition has for long caused death of children and adolescents. Although the causes of malnutrition are multifactorial, COVID-19 pandemic has triggered nutritional risk due to economic crisis, food irrationality and health disruption as result of social distancing, full or

partial lockdown and confinement [7]. In turn, literatures state that previous history of malnutrition predisposes patients to severe COVID-19 in an age-dependent way [20]. This is of great concern bearing in mind that COVID-19 seems to be far from its complete eradication.

## 3.Methods and Materials

### 3.1 Study Design and Participants

We conducted a cross-sectional study in a Middle School and University in Nampula, Northern Mozambique. Participants included students and employees subjected to four-week confinement due to COVID-19 pandemic. We applied systematic casual sampling technique to screen 534 students and employees of both sexes, aged from 18 to 50+. To prevent diagnostic bias and misinterpretation, anthropometric measures were taken within the first two weeks of deconfinement. Weight was measured, with minimum clothing possible (Weighing scale SECA, max weight: 150 kg, Mfd. 2016) and height (Stadiometer, Electromed Ltd, precision 0.1, max height: 210 cm). Although skin folds may be important for discerning the contribution of fat mass from lean mass to an individual's overall body weight, this measure was not taken due to social distancing associated to COVID-19. We then, applied questionnaire to collect data related to physical activity and exercises, dietary profile, economical history, previous body weight and emotional state in the face of COVID-19 pandemic.

Our sample included individuals from 18 to 50+ years old, but only for individuals' aged 18 body weight was categorized based on the international sex-specific cut-off points for BMI stablished by the World Health Organization (WHO) standards. An individual from 19 to 50+ years old, BMI was not adjusted.

Data collection tools were calibrated to ensure reliability. Ethical procedures were observed based on the World Medical Association Declaration of Helsinki Ethical, Principles for Medical Research Involving Human Subjects, 2013. In addition, COVID-19 prevention measures were strictly observed during the data collection.

### 3.2 Data Analysis

Data were treated using descriptive and inferential statistics. Frequencies were calculated and graphs constructed using a statistical package, Jamovi version 1.2.27. A confidence level of 95% was set, and a cut-off value of 0.05 for the p-value. For inferences, Shapiro-Wilk normality test, Pearson's test, independent T-test, Paired samples T-test, Simple Linear Regression and Correlation Matrix were performed.

## 4.Results and Discussion

We aimed to evaluate nutritional status of scholars and employees subjected to four-week confinement due to COVID-19. Thus, we assessed nourishment and practice of physical activity and exercises before and during confinement period. Total sample size was 534 of which, 253 are males (47.3%) and 282, females (52.7%). Students represents 77.9% (n=417) and 22.1% (n=118) employees. Participant's age group ranges from 18 to 50+ years old. The most represented age group was 18 to 25 years with 78.7% (n=421), followed by 36 to 40 years (8.4%, n=45) and 31 to 35 years (6.0%, n=32).

**Participants are Mostly Unemployed and Direct Sources of Income being Scarce**

Those who stated that have actually a work (56.8%, n=67 males, and 43.2%, n=51 females) were asked about their previous work experience. Before confinement period, only 5.2% (n=28) was working and mostly, self-employment. Worldwide, employment opportunities have drastically dropped. However, we found here a hint of slight increment of employment in the confinement period, although it represents self-employment in low profit commerce. Unlikely, Blundell & Machin, 2020 [21] report loss of work of around three quarter in their respondents duo to COVID-19 restrictions.

We questioned whether or not participants have another source of income, and 5.8% (n=31) answered affirmatively, while the majority 503 (94.2%) was negatively. Major source of income includes working as trader, reported by 59.4% (n=19). The other percentages are distributed to working as locksmith, barber, coffee maker, auto mechanic, decorator, singer and journalist.

**Scholars and Employees' Body Weight Before Confinement**

Participants were asked to assign their body weight interval prior to this study for comparison with recent body weight. Height was not asked because it is consensual that the speed of growth of individuals from the school stage onwards is practically constant [22]. Data have shown that most of participants had weight (kg) between 51 and 55 (29.2%, n=196), followed by 46 and 50 (18.2%, n=97) and, 56 and 60 (16.7% n=89) (Figure 1). According to respondents, the weights were taken between the years 2018 and 2020. The majority have weighed in 2020 (70.1%, n=375), followed by 2019 (22.7%, n=121) and 2018 (7.1%, n=38) hinting that their height might not have had drastic variation.

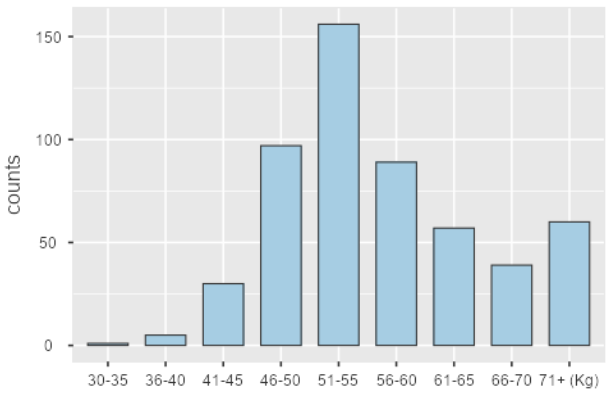


**Figure 1:** Participant's previous weight ranging from 30 to 70+ kg. Most of participants had weight between 51 and 55 kg.

**Nutritional Status of Scholars and Employees after Deconfinement**

Anthropometric measures (weight and height) were taken within two weeks of deconfinement. The mean of recent body weight and height is 59.3 kg (min. 37 and max. 114 kg) and 1.62 m (min. 1.36 and max. 1.89 m) respectively. The measures were used for calculation of body mass index [BMI, defined as $w.h^{-2}$ ($kg.m^{-2}$)]. We performed a Paired Sample T-test and showed significant difference of weight before and during deconfinement ($p.<0.001$).

In this study, BMI was fixed between 13.5 and 39.7 $kg.m^{-2}$ (mean, 22.6 $kg.m^{-2}$). Of 534 participants screened, most are eutrophic (60.2%, n=322). However, a significant number (39.8%, n=212) was diagnosed with a sort of malnutrition, either underweight (13.8%, n=74), overweight (17.2%, n=92) or obesity (8.8%, n=47) (Figure 2). Then, we compared the participants' current weight with their previous weight to find out how many individuals weighed in or out of the referred weight range before confinement to predict or confirm recent nutritional status. Consistently, 41.5% (n=206) participants have recent weight outside [either above (39.6%) or below (1.9%)] the reported weight range before confinement, confirming our diagnosis.

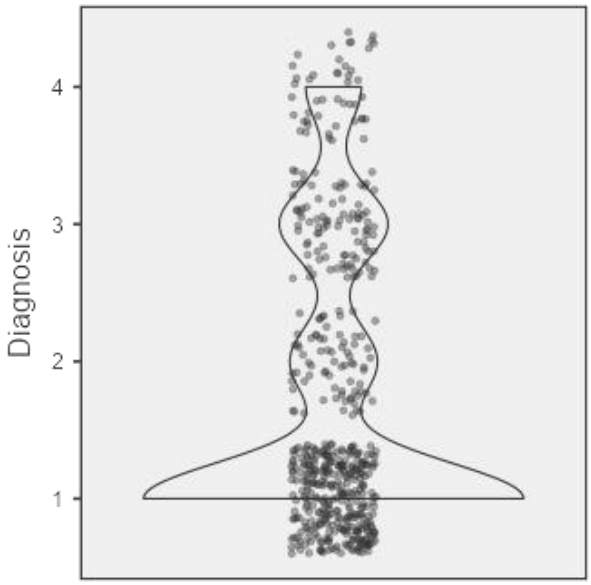


**Figure 2:** Overall nutritional status based on the BMI fixed within two weeks of deconfinement. #1, 2, 3 and 4 represents eutrophic, undernourished, overweight and obese individuals, respectively

We checked sex-dependence of nutritional status among participants. We found that females tended to be more eutrophic (33.1%, n=177) than males (27.2%, n=145). The other parameters showed no relevant differences (Figure 3). To assess whether or not the difference is significant, we performed an independent sample T-test and found no significant difference in overall nutritional status among males and females ($p.=0.301$; CI: 95%, SE: 0.0893). Our results are consistent with Slowki and co-workers, 2019 [8] when they worked with children from 7 to 18 years old with different level of physical activity. These authors found that overweight and obesity were most common among younger children, particularly boys.

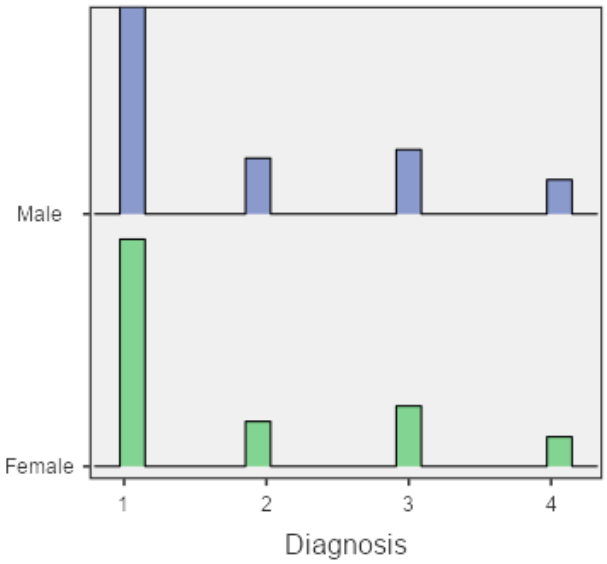


**Figure 3:** Nutritional status of participants by sex**.** #1, 2, 3 and 4 represents eutrophic, undernourished, overweight and obese individuals, respectively. Females appeared to be more eutrophic than males, while other parameters show no significant differences. #BMI-for-age was adjusted only for individuals aged 18. Eutrophic or Normal BMI-for-age ($\geq$-2 and $\leq +1\ SD$) ; Overweight BMI-for-age (> +1 and $\leq +2\ SD$ ) and Obesity BMI-for-age) (> +2 SD). Source: WHO, 2007; adapted by the Ministry of Health of Mozambique, 2018. *Undernutrition (ranging from Severe Acute Malnutrition to Moderate Acute Malnutrition) BMI-for-age (< -2 SD).

Data suggest that confinement due to COVID-19 contributed to people's abnormal body weight, probably due to irrationality on food intake and lack of or inadequate physical activity and exercise. To assess contribution of the two potential causal factors, we made a systematic comparison regarding to daily meals and physical activity and exercise before and during confinement periods.

**Meals Intake Have Increased During Confinement Period Due to COVID-19 Pandemic**

We analysed meal pattern among participants. Regarding to breakfast, 69.5% (n=371) answered that used to take the meal before confinement period, while 30.5% (n=163), answered negatively. Compared to the confinement period, 80.7% (n=431) reported to have taken the meal, while 19.3% (n=103) did not take, showing that breakfast intake has increased during confinement period. Relating to lunch, most of participants (86.1%, n=460) had the meal before confinement period, while 13.9% (n=74) said did not often take. During confinement period, 92.5% (n=495) participants have had, and 7.3% (n=39) said did not often have the meal. Only one participant answered sometimes took the meal. Before confinement period, 89.1% (n=477) participants did not have snack, and only 10.9% (n=58) did have. Conversely, during confinement period, most of them (63.7%, n=341) had snack, while only 36.3% (n=194) did not have, showing a drastic increase. All

participants (100%, n=534) used to have dinner before confinement period, while during confinement those who had dinner represent 95.7% (n=511). Finally, supper was not common among participants in both periods. Before confinement most of them (98.5%, n=526) did not have the meal, while during confinement period the number of those who answered negatively slightly decreased to 91.0% (n=487) (Table 1).

Although irregularities were found in the pattern of consumption of the five meals, overall food intakes have increased during confinement period. Discretions found between the two moments are not entirely related to the main meals such as lunch and dinner. Due to low purchasing power among participants, breakfast, snack and supper are often deemed secondary meals. But staying longer at home may have induced to frequent consumption of the meals, probably explaining the fluctuation. The other reason why students had irregular meal intake before confinement rely on the fact that some were in school at meal time (46.5%, n=249). We verified whether or not there are significant differences in meals intake pattern before and during the confinement period. Paired sample T-test showed significant differences (p.<0.001) for breakfast, snack and supper. Simple linear regression test indicates that recent nutritional status could be explained ($R^2$=0.362) by pattern of breakfast (p.=0.003), snack (p.=0.009) and supper (p.=0.018), but not explained by the pattern of lunch (p.=0.814) and dinner (p.=0.128). But relationship between recent nutritional status with prior meal profile was not found (p.=0.269).

**Table 1:** Type and frequencies of meals intake Before (B) and During **(**D**)** confinement period due to COVID-19

| | Breakfast (%) | Lunch (%) | Snack (%) | Dinner (%) | Supper (%) |
|---|---|---|---|---|---|
| Yes (B/D) | 69.5/80.7 | 86.2/92.5 | 10.8/63.7 | 100/95.5 | 1.5/9.0 |
| No (B/D) | 30.5/19.3 | 13.8/7.3 | 89.2/36.3 | 0/4.3 | 98.5/91.0 |
| Sometimes (B/D) | – | 0/0.2 | – | 0/0.2 | – |

**Participants Practiced Less Physical Activity and Exercises During Confinement period**

Adequate physical activity and exercises is also important for maintaining good health, as it contributes to energy balance [25,26]. Thus, we explored practice of physical activity and exercises among participants. We found that 51% (n=273) did not practice before confinement period, 45% (n=241) practiced, and 3.7% (n=20) said sometimes practiced. Compared to the period of confinement, the majority (69.2%, n=370) reported that did not practice physical activity and exercises. A small number 22.4% (n=120) practiced, and 8.2% (n=44) sometimes practiced. Inactivity was equally found by Ammar et al., 2020 & Zachary et al., 2020 [17,27] in an international online survey conducted to identify risk factors for the psychosocial strain during COVID-19 outbreak.

We, then explored frequency of physical activity and exercise before confinement period. Of those who practiced physical activity and exercises (n=262), the majority reported to have practiced once a week (45.8%, n=120), other 32.4% (n=85) practiced every day, and the remaining said practiced two times a week (8.4%, n=22), sometimes (12.9%, n=34) and more than two times a week (0.4%, n=1). Frequency of physical activity and exercise worsened during confinement period. Of 164 practitioners in this period, 20.7% (n=34) practiced every day, 14.6% (n=24) once a week, 38.4% (n=63) said sometimes, and only 26.2% (n=43) more than once a week. Paired Sample T-test indicates that there is significant difference on the practice of physical activity and exercises among participants before and during confinement period (p.< 0.001). Practice of physical activity and exercise during period of confinement did not depend on the sex (p.=0.940). Contrarily, the frequency of physical activity and exercise had dependence on the sex (p.=0.007). Simple linear regression test indicates that participant's current weight (82.3% Yes and Sometimes) could be explained by the frequency of physical activity and exercise during confinement period ($R^2$=0.0123; p.=0.025). However, there is practically no relationship between the current weight and physical activity and exercise before confinement period for 99.4% of participants ($R^2$=6.2.$10^{-4}$; p.=0.579). For verification, we assessed whether the observed nutritional status could be explained by the degree of physical activities and exercises during confinement period. Pearson's test showed a positive correlation between the two variables (p.=0.016). In fact, low physical activity and exercises and irregular food intake found in the studied group are important factors for weight increment malnourishment, as observed. Degree of physical activity and exercises played a role on the observed weight, especially for malnutrition by excess of nutrients, as equally reported by Castañeda-Babarro et al., 2020 [23]. On the other hand, malnutrition by deficit of nutrients may have been caused by low purchasing power, leading to irregularity of food intake, in line with a study by Akpan, 2016 [24] which points poverty as one of the factors for malnutrition.

Finally, panic may lead to stress. Stressful situations trigger harmful biochemical and physiological responses. The responses may differ from individual to individual; some may react by overeating or refrain from eating, as hormonal mechanisms controlling appetite are affected. Confinement forces one to interrupt work routine what may result in boredom. Boredom has been associated with high energy intake [5,6] and sedentary lifestyle. In fact, both conditions may lead to nutritional abnormalities. Thus, we sought to explore the emotional state among participants in the face of COVID-19 pandemic. Most of participants were panicked (29.2%, n=156), others were frightened (32.0%, n=171) and 19.9% (n=106) gained the desire to overeat. Only 18.9% (n=101) said the situation made no that much difference. In fact, all these parameters may, theoretically, push people toward sleep disorders and unhealthy nutritional habits such as food craving and sedentariness, as reported by Zachary et al., 2020 [27].

## 5.Conclusion and Future Scope

Confinement due to COVID-19 has triggered changes on people's lifestyle, consequently on their nutritional status. Lack of dietary restraint as well as decline of physical activity and exercises have led to weight increment. On the other hand, low purchasing power may have contributed to occurrence of under nutrition. Although overall nutritional status did not show significant differences among males and females, males tended to have increased weight abnormalities. Finally, it could be of great interest to undertake a longitudinal study to explore fluctuations of nutritional status among scholars and employees on the basis of the sort of food taken and physical activity and exercise.

## 6.Conflict of Interest

The authors declare no conflict of interest regarding the publication of this paper.

## 7.Acknowledgments

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