Body Mass Index among Nepali Soldiers Serving in the Peacekeeping Mission of the United Nations: A Pre and Post Deployment Comparative Study

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Abstract

Introduction: Body mass index is a crucial anthropometric tool for the assessment of body composition and cardiovascular risk factors. Maintaining body mass index is essential to everyone including soldiers for preventing chronic diseases and promoting overall health. This study was conducted to evaluate the body mass index of Nepali soldiers deployed inthe United Nations Peacekeeping Mission to support their fitness and well-being.

Methods: A one-year longitudinal follow-up study was conducted among 351 Nepali soldiers deployed at the United Nations Disengagement Observer Force, Syria from November 2021 to November 2022. Body mass index was categorized based on the Centers for Disease Control and Prevention guidelines and the association between demographic variables and body mass index was determined using a chi-square test.

Results: Only 40.46% of the soldiers maintained their body mass index at the normal level. Body mass index changed slightly over the year from 19.27 to 31.62 kg/m² on day 1 to 18.80-33.10 kg/m² on day 365, with a significant association between units, height, weight, and body mass index category. The decreasing trend of body mass index was evident at the officers' rank whereas it was found to increase at other ranks.

Conclusions: The increasing trend of body mass index among soldiers, except officer rank, indicates the need for regular monitoring and intervention from educational, nutritional, and psychological aspects for the fitness of soldiers in United Nations Peacekeeping Missions. Similar types of interventions are needed throughout the tenure of soldiers, at their unit, as well.

INTRODUCTION

Body mass index (BMI) is the frequently used anthropometric measurement that is applied to evaluate body composition.[1] Assessment of BMI is crucial for determining cardiovascular risk factors, as individuals with high BMI are more prone to chronic diseases like diabetes, hypertension, and hypercholesterolemia.[2–5] Furthermore, as BMI indicates the nutritional status of the body, it sets the standard for body fitness for the quality of healthy life as well.[6] The functional limitation due to an obese body is another factor to be considered.[7,8] Overweight and obesity as a high-value BMI above the standard limit are now being considered a global public health threat.[9]

BMI maintenance is mandatory to prevent the incidence of chronic diseases.[10–12] Different organizations have classified the criteria for BMI.[6,13] However, due to the noteworthy variations in lifestyle, food habits, genetic factors, and geographical distribution; a gap may remain in characterizing body morphology and functioning. Moreover, higher values of BMI in certain population are well known factors such as in body–builders and athletes. This cannot be correlated to their status of health directly

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as they possess higher weight and muscle mass that may show a higher value of BMI.[14]

Soldiers are expected to meet strict guidelines for physical fitness and body composition that must comply with the expected physical demands and requirements for combat preparedness.[15] Moreover, the soldiers get deployed in the United Nations (UN) Peacekeeping Missions in different nations for a one-year duration where the changing scenarios such as places, meals, and nature of duty might cause differences in their status. Therefore, it is fundamental to maintain a suitable range of BMI for a healthy life. However, there is an extensive literature gap regarding the study of BMI among Nepali soldiers. In this regard, this study was conducted to evaluate the BMI among Nepali soldiers deployed inthe UN Peacekeeping Mission, United Nations Disengagement Observer Force (UNDOF), Syria. This study has been conceptualized with the intention that effective measures can be implemented from the policy-making level to their fitness and well-being.

METHODS

A descriptive type of one-year longitudinal follow-up study was carried out principally focusing on the comparison of BMI of day 1 and day 365 during the tour of duty (ToD) of the Nepali soldiers from three different units; Nepali Contingent (NEPCON), Nepali Mechanized Contingent (NMC), and Nepali Medical (NEPMED) Unit, deployed at the UNDOF, Syria from November 2021 to November 2022. The total number of the population i.e. 351 was used as a sample according to the census sampling method. Informed written consent from all participants and ethical approval from the IRC of NAIHS (Reg No 587) was taken for the conduction of the study. Administrative approval from the Unit Commanders were also taken. A proforma was developed comprising of demographics of participants. The face and content validity of the questionnaire was carried out by the two researchers at Shree Birendra Hospital, Kathmandu, Nepal. The reliability analysis yielded a Cronbach alpha value of 0.72. Manual measurements of the height and weight were taken by the two researchers at the beginning and the end of ToD and were compared for the analysis. BMI was categorized based on the Centers for Disease Control and Prevention (CDC) criteria.[6] Data analysis was carried out by IBM SPSS version 23. Frequencies and percentages were calculated for the demographic variables. The association of demographic variables with BMI was determined using a chi-square test.

Criteria for BMI[13]

< 18.5 kg / m^2 (Underweight)

≥ 18.5 to 24.9 kg / m^2 (Normal weight)

≥ 25 to 29.9 kg / m^2 (Pre-obesity)

≥ 30 kg / m^2 (Obesity)

≥ 30 to 34.9 kg / m^2 (Obesity class I)

≥ 35 to 39.9 kg / m^2 (Obesity class II)

≥ 40 kg / m^2 (Obesity class III)

RESULTS

The participants were from three units; NEPCON (37.32%), NMC (53.56%), and NEPMED (9.12%). The majority of the participants were non-commissioned officers (79.49%), from Combat / Combat support roles (84.33%), and were under 40 years of age (91.45%). Most of the respondents were 167 cm or taller in height (61.3%) and weighed 70 kg or more (55.84%). In terms of BMI, 46.44% of the respondents were healthy, whereas 53% were overweight, and 0.57% were from the class I obese category (Table 1).

Table 1: Background characteristics of the study participants

SN	Particulars / Characteristics	Frequency (%)
1	Unit NEPCON NMC NEPMED	131 (37.32) 188 (53.56) 32 (9.12)
2	Rank Officers JCO NCO	40 (11.40) 32 (9.12) 279 (79.49)
3	Trade Combat / Combat supports Technical (Combat service supports)	296 (84.33) 55 (15.95)
4	Age Below 40 40 and above	321 (91.45) 30 (8.55)
5	Height (cm) Below 167 167 and above	136 (38.7) 215 (61.3)
6	Weight Below 70 70 and above	155 (44.16) 196 (55.84)
7	BMI Underweight (< 18.5) Healthy weight (18.5 to < 25) Overweight (25 to < 30) Obese Class I obese (30 to < 35) Class II obese (35 to < 40) Class III obese; Severe (40 and above)	– 163 (46.44) 186 (53) 2 (0.57) – –

* NEPCON: Nepali Contingent, NMC: Nepali Mechanized Contingent, NEPMED: Nepali Medical Unit, NCOs: Non-commissioned officers, JCOs: Junior-commissioned officers. The BMI ranged from 19.27 to 31.62 kg / m^2 on Day 1,

with the mean and SD (24.89 ± 1.81), while on Day 365, it broadened to 18.80 - 33.10 kg / m², with the mean and SD rising to (25.41 ± 2.55) showing a slight increase in BMI over the year (Table 2).

Table 2: Background characteristics related to the BMI of the study participants

Variables / Characteristics		Day 365
Age Min - Max Mean ± SD	25–49 35.78 ± 3.40	26–50 36.78 ± 3.33
Weight (Kg) Min - Max Mean ± SD	46.30 - 91.00 69.86 ± 7.19	46.00 ± 95.00 71.19 ± 7.57
BMI (Kg / m2) Min - Max Mean ± SD	19.27 - 31.62 24.89 ± 1.81	18.80–33.10 25.41 ± 2.55
Height (m) Min - Max Mean ± SD	(1.45 - 1.82) (1.68 ± 0.06)	

Obesity was present in 0.57% of the participants on day one while it increased to 3.13% after one year. Similarly, the percentage of respondents with normal BMI decreased from 46.44% to 40.46%. However, none of the respondents were underweight and class II obese (Table 3).

Table 3: Categorization of BMI among participants

| BMI (Kg / m²)	Total Participants (N = 351)	
	BMI - I	BMI - II
Obesity absent	349 / 351 (99.43%)	340 / 351 (96.87%)
Underweight (< 18.5)	–	–
Normal (18.5 - 22.9) 163 (46.44) 142 (40.46)		
Overweight (23 - 24.9)	186 (52.99)	198 (56.41)
Obesity present	2 / 351 (0.57%)	11 / 351 (3.13%)
Obese I (25 - 29.0)	2 (0.57)	11 (3.13)
Obese II (> 30)	–	–

A significant association of BMI maintenance was evident in units (p = 0.001), height (p = 0.001), weight (p = 0.000), and BMI category (p = 0.000) (Table 4).

Table 4: Association of demographic variables with the BMI management

| SN	Particulars / Characteristics (N)	BMI management			P-value
		Maintained (N,%)	Not-maintained (N,%)	Total	
1	Unit NEPCON NMC NEPMED	108 (82.5) 137 (84.4) 32 (77.8)	23 (17.6) 51 (27.1) –	131 188 32	0.001
2	Rank Officers JCO NCO	33 (82.5) 27 (84.4) 217 (77.8)	7 (17.5) 5 (15.6) 62 (22.2)	40 32 279	0.577
3	Age Below 40 40 and above	251 (78.2) 26 (86.7)	70 (21.8) 4 (13.3)	321 30	0.277
4	Height (cm) Below 167 167 and above	95 (69.9) 182 (84.7)	41 (30.1) 33 (15.3)	136 215	0.001
5	Weight Below 70 70 and above	99 (63.9) 178 (90.8)	56 (36.1) 18 (9.2)	155 196	0.000
6	BMI category Healthy weight (18.5 to <25) Over weight (25 to <30) Class I obese (30 to <35)	95 (58.3) 180 (96.8) 2 (100)	68 (41.7) 6 (3.2) –	163 186 2	0.000

NEPCON: Nepali Contingent, NMC: Nepali Mechanized Contingent, NEPMED: Nepali Medical Unit, NCOs: Non-commissioned officers, JCOs: Junior-commissioned officers.

Across all ranks, BMI shifted from Day 1 (BMI-I) to Day 365 (BMI-II), showing a decrease in the number of officers and increases in both JCOs and NCOs (Figure 1).
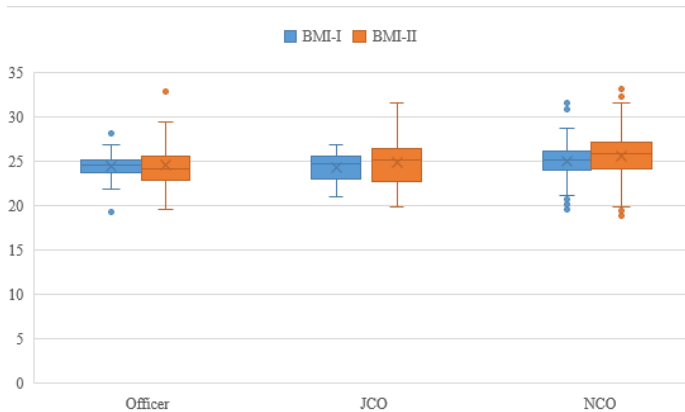
Fig 1: Box plot showing the rank-wise distribution of BMI

The BMI categories of the participants changed over the course of one year, showing a decrease in the "Normal" category and an increase in both the "Overweight" and "Class I Obese" categories (Fig 2).
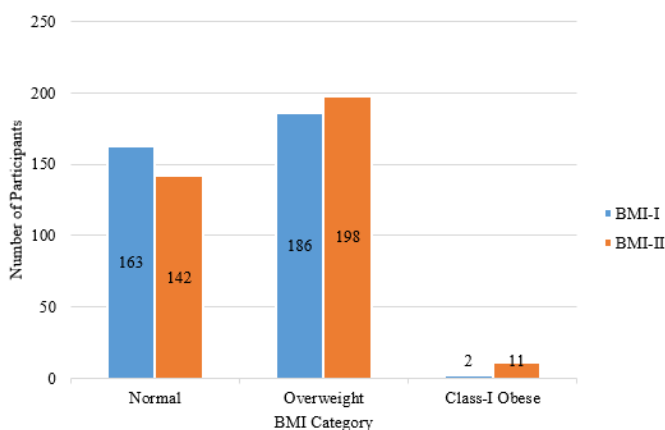
Fig 2: BMI changes during the one-year stay

DISCUSSION

Overweight and obesity are becoming a major emerging health problem in many countries. In our study, almost half of the participants had normal weight (BMI 18.5 to <25), more than one-fourth had overweight (BMI 25 to <30), and less than one percent had obesity. The finding is in contrast to the results of a study done among United States (US) soldiers which showed that more than half of participants were overweight, followed by more than one-fourth with normal weight, almost one-fifth with obesity, and less than one percent with underweight in BMI category.[16] The difference may be attributed to diet, nutrition, physical activity, training, and lifestyle differences.

In the current study, less than one percent of the participants with obesity during day one increased to 3.13% after one year of deployment in the UN Mission. Similarly, 52.99% of the participants classified as overweight during day one changed to 56.41%, while the percentage of participants with normal BMI decreased from 46.44% to 40.46%. This may have been resulted due to the unawareness and the lack of educational, nutritional, and psychological interventions. Like wise, a study done among US soldiers during the COVID-19 pandemic showed that 15.60% of military personnel who were overweight at the start of the COVID-19 pandemic changed to obesity and 26.70% of soldiers who were classified as healthy weight changed to overweight during the pandemic.[17] In contrast, in the study done in the Republic of Korea, during the service, the mean BMI of the underweight group increased by 5.87 kg / m[2], while the normal weight group increased by 1.18 kg / m[2].[19] On the other hand, the mean BMI decreased by 5.47 kg / m[2] in the overweight group.[18] These differences among various nations may have been cause by the difference in diet, nutrition as well as exercisces in different geographical conditions.

BMI is a standardized tool for assessing body fat in soldiers, contributing to early intervention and reducing chronic diseases.[19] It also aids in operational readiness, as optimal BMI improves performance and endurance.[20] BMI is cost-effective, suitable for resource-limited settings, and serves as a benchmark for determining if soldiers are fit to undergo the physically and mentally demanding conditions of peacekeeping missions.[21] On the other hand, BMI has disadvantages such as inaccurate fitness representation, limited scope, and potential psychological impact. It doesn't differentiate between muscle mass and fat as soldiers with high muscle mass may be classified as overweight or obese based on BMI, despite being physically fit. It also overlooks other health indicators, and may overlook ethnic and genetic differences.[21-23] Additionally, labeling soldiers as underweight or overweight could negatively affect their morale, even if they are physically capable of performing their duties.

In body-builders, if weight and height are only taken as references, though they are fit, they may be indentified as high BMI. In such context, the waist-hip ratio also (WHR) needs to be considered.[24]

Though the fitness tests are done regularly, proper educational, nutritional, and psychological counseling from the intake level by the related experts is needed. The soldiers must remain motivated, otherwise, BMI taken during the yearly fitness tests or during the courses or UN deployment may bring out physical as well as psychological issues in them. Rigorous exercise for a month only and no food intake may harm their health,

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so counseling must be done everytime to keep them fit. Counseling is needed, both in the field in the Nation and outside the Nation, especially during the UN posting.

The study is the first of its kind comparing soldiers' BMI before and after deployment in the UN Peacekeeping Mission. The findings could influence policies regarding soldier health management before and after deployment, improving their preparedness and recovery. This study could contribute valuable data to the global military and health organizations, shedding light on the physical impact of peacekeeping missions. The study concludes that regular monitoring and intervention as essential tools for maintaining healthy BMI levels among soldiers. Dietary, medical, psychological, and fitness support is crucial. Also, physical activity programs, nutritional education, stress management workshops, personalized health plans, and post-deployment follow-up health assessments are necessary to address any ongoing BMI-related issues. Such activities are to be continued at the national and international levels as well. However, the study is limited due to its inability to consider environmental factors and the limited sample size of the soldiers of the few units. The study may not account for the long-term effects on soldiers' health, especially if data is collected immediately after the mission. To better understand the impact of peacekeeping missions on soldiers' health, additional health metrics and long-term follow-up are needed.

CONCLUSIONS

The BMI value was found to be increased among most of the Nepali soldiers after one year of deployment in the UN Peace-keeping Mission. Only officers maintained their BMI during their tour of duty. A significant association of BMI maintenance was found with units, height, weight, and BMI category.

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