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The Physiological Parameters Among Mountain Hikers

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Objectives: This study aims to investigate the impact of outdoor activities, particularly mountain hiking, on physiological parameters, focusing on comparing differences between office workers and professional climbers. By analyzing factors such as waist circumference and exercise frequency, the objective is to assess the potential health benefits associated with active lifestyles and inform strategies for promoting physical activity among sedentary populations. **Methods:** The survey was collected using a cross-sectional study method from 3 target groups, including professional mountaineers, amateur climbers, and office workers, in October 2022. The main questionnaire of the study included the WHO non-communicable disease risk questionnaire, the frequency and amount of mountain climbing, and the frequency and amount of active exercise. We also measured the physiological parameters of the participants. The statistical analysis was done using SPSS 26.0 software. **Results:** Engaging in unhealthy habits among office workers causes men to have a higher waist circumference than their standard size, and most do not exercise regularly. In contrast, professional climbers' risk factors for non-communicable diseases were relatively low. Office workers who are inactive and work in conditions that require some physical activity have the greatest need for exercise but are not actively exercising. **Conclusion:** Outside of work, an individual makes time to climb a mountain, which can positively affect physiological parameters.

Keywords: Exercise, Sedentary behavior, Well-being, Mountaineering, Noncommunicable diseases

Introduction

The curfew caused by the COVID-19 pandemic, not only in the world but also in Mongolia, has made people understand the importance of movement. Because of that, people seeking fresh air and active movement have increased walking and hiking in the mountains [1,2]. As a result, the number of accidents caused by a lack of proper equipment and knowledge during hiking and mountain climbing among mountain climbers, citizens, and enthusiasts is increasing. Although Mongolia has a cold climate, it has a transition zone from the Siberian forest to the warm Gobi desert and the high mountain region, forest, and steppe regions. The territory has different surface shapes, including high and low mountains. [3, 4]

Human health is dynamically affected by many external and internal factors throughout a lifetime. According to the Exposome concept, both external and internal push factors influenced directly or indirectly by humans play a critical role in the field of health development [5–8]. As previously demonstrated, genetic predisposition can reduce a person's risk of developing chronic diseases by 10% [9]. In the current situation, this is a minor consideration. External or environmental factors such as diet, exercise, place of residence, access to green space, or climatic conditions have been rapidly changing over the last centuries, increasing the number of non-communicable diseases [10].

According to the 2019 Global Burden of Disease Survey of Mongolia's healthcare sector, non-communicable diseases (NCDs) were exceptionally high [11]. High blood pressure and an unhealthy diet are the main risk factors that cause it. It has been proven in many studies that Mongolians consume very little fruit and vegetables but consume a lot of protein-rich meat and flour products [12–14]. In addition to primary prevention, exercise is the way to prevent high blood cholesterol, obesity, diabetes, metabolic syndrome, and high blood pressure caused by an unhealthy diet [15,16].

The scientific evidence that natural environments have a high potential for disease prevention and health promotion is growing [17]. Current evidence, however, frequently needs more methodological quality and rarely meets cutting-edge criteria for assessing the impact of natural environments as an external factor on human health and well-being [18]. Although there is increasing evidence for a favorable effect of forest treatments, it is still being determined how exactly and to what extent forests enhance human health.

In a study by Odgerel et al. [11], the lack of physical activity ranks 16th for men and 17th for women among the age-standardized disability-adjusted life-years (DALYs) rate attributable to risk factors in Mongolia. Although not considered a serious risk factor, primary prevention is the most crucial consideration. According to a 2018 study by Delgermaa et al. [19], people with high levels of education and employment were associated with poor physical activity. Exercise alongside work is challenging and could be more effective when done regularly. By comparing the physiological parameters of mountain hikers and office workers, this study seeks to elucidate the potential benefits of engaging in outdoor activities, such as mountain climbing, on overall health. Understanding the contrasting lifestyles and associated health outcomes can inform strategies to promote physical activity and mitigate the risk factors associated with sedentary behavior. This study aims to investigate the differences in physiological parameters between mountain hikers and office workers, focusing on identifying potential implications for health and well-being.

Materials and Methods

Participants and data collection

Our research team used the survey method from October 14-24, 2022, and took three main groups as the target group of the research. The first is a group of professional mountaineers (i) who regularly climb mountains, engage in mountaineering sports, and belong to any mountaineering club. The second group, although not belonging to amateur climbers (ii), regularly climbs mountains one day of the week and is interested in mountain climbing. The participants of the 3rd group, named office workers (iii), were selected people who work in the office to the same age as the 1st and 2nd groups. These three groups were included in the study because there were only significant differences between them, and the aim was to determine whether it is appropriate to climb a mountain sometimes (amateur climbers).

We used Woodwark's [20] cross-sectional survey sample size formula because we did not have reliable data on professional mountaineers. The required sample size was estimated by the type I error rate (α) as 0.05, the probability of detecting a natural effect (1 - β) as 3, and it was determined that 46 people are needed from each group for the study.

Professional mountaineers were surveyed on the occasion of Mountaineer Sports Day for mountaineers who hiked from Tsetsee Gun Peak of Bogd Khan Mountain (2268 m above sea level) to the Western Table Peaks (2004 m above sea level). Amateur climbers were asked to participate randomly in a study while hiking Bogd Khan Mountain. The sedentary people were gathered in one office. In doing so, each participant filled out and signed a consent form for participation in the survey.

Technical information

The main questionnaire of the study included the WHO non-communicable disease risk questionnaire, the frequency and amount of mountain climbing, and the frequency and amount

of active exercise. Body measurements included BMI, waist circumference, blood pressure, blood sugar, and additional measures of hand grip strength as key measures of non-communicable disease risks. Score charts are tabulated based on risk factors such as gender, smoking, age, blood pressure, and blood cholesterol levels. Using this ready-made table, the person is calculated with an estimation of the ten-year risk of fatal cardiovascular disease [21].

Data Analysis

The statistical analysis was done using the Statistical Package for Social Sciences (SPSS version 26.0; IBM, Armonk, NY, USA). Continuous variables were presented by mean and standard deviation. Categorical variables were expressed as percentages and frequencies. The difference between categorical groups was calculated using the chi-square test (or Fisher's exact test), and the continuous variables' differentiation was done using the analysis of variance (ANOVA) and multiple comparison tests (Tukey test). A statistically significant difference was considered when the *P* value was <0.05.

Ethical Statement

This study was first started for the East Asian Medical Students' Conference 2021 in Nepal. It was completed with the help of many students, teachers, and others. It was done to contribute to science, not to be devalued or wasted. This section is omitted because ethical approval is not provided for work conducted at the university student level.

Results

151 people participated in the study; the average age was 36.9±11.6. Gender distribution: 43.7% of men and 56.3% of women. Of these, 27.8% were office workers, 34.4% were in the intermediate group (non-professional people who walk in the mountains for fun), and 37.7% were professional mountaineers. Most respondents (56.3%) said they have sedentary jobs, professional mountaineers, and office workers with low-activity jobs. The average height is 165.9±9.4 cm, the average weight is 67.5±14.0 kg, the average BMI is 24.5±4.5 kg/m2, and the average height of professional climbers is 168.9 cm, significantly higher than other groups. No differences were observed between groups regarding BMI and body weight, as detailed in Table 1. As for the use of alcohol and tobacco, 45.9% (p<0.001) of office workers use tobacco, and 47.2% (p<0.05) use alcohol, which is higher than other groups.

Table 1. General information of the study participants and distribution of primary risk factors for some non-communicable diseases

Variables	Total (N = 151)		Groups: Professional mountaineers (n = 57)		Groups: Amateur climbers (n = 52)		Groups: Office workers (n = 42)		P-value
Age, mean (±SD), y	36.9	(11.6)	37.9	(9.8)	39.3	(13.5)	32.5	(10.1)	.012*
Gender, n (%)									.008*
Male	66	(43.7)	34	(59.6)	17	(32.7)	15	(35.7)	
Female	85	(56.3)	23	(40.4)	35	(67.3)	27	(64.3)	
Occupational type, n (%)									.009*
Inactive physical work	85	(56.3)	23	(40.4)	32	(61.5)	30	(71.4)	
Active physical work	36	(23.8)	22	(38.6)	9	(17.3)	5	(11.9)	
Unable to classify	30	(19.9)	12	(21.1)	11	(21.2)	7	(16.7)	
Height, mean (±SD), cm	165.9	(9.4)	168.9	(7.9)	162.9	(11.4)	165.9	(7.3)	.005*
Weight, mean (±SD), kg	67.5	(14.0)	67.4	(12.0)	67.0	(14.2)	68.3	(16.2)	.893
Body mass index, mean (±SD), kg/m^2	24.5	(4.5)	23.5	(3.2)	25.3	(5.1)	24.8	(4.9)	.111
Alcohol drinking, n (%)									.024*
No	97	(68.3)	37	(67.3)	41	(80.4)	19	(52.8)	
Yes	45	(31.7)	18	(32.7)	10	(19.6)	17	(47.2)	

**p–value less than 0.05*
Values were presented as mean ± standard deviation, or proportions, Chi–square test.

Tables 2 and 3 show the general body measurements of the subjects. The mean total arterial systolic pressure was 124.5±21.8 mm Hg, and the diastolic pressure was 84.9±17.1 mm Hg. According to measurements, arterial pressure among professional mountaineers (SP 134.5±25.7 mm Hg, $p<0.001$; DP 89.9±12.9 mm Hg, $p<0.05$) is higher than in other groups.

Table 2. General physiological parameters of the study participants

Variables	Total (N = 151)		Groups						P-value
			Professional mountaineers (n = 57)		Amateur climbers (n = 52)		Office workers (n = 42)		
Heart rate, mean (SD), times/ min	74.7	(13.4)	71.4	(14.6)	75.7	(14.5)	77.4	(9.4)	.084
BP by measurement, mean (SD), mm Hg									
Systolic	124.5	(21.8)	134.5	(25.7)	119.7	(15.6)	116.1	(16.6)	< .001**
Diastolic	84.9	(17.1)	89.9	(12.9)	83.3	(21.0)	79.8	(15.4)	.011*
Constant BP, mean (SD), mm Hg									
Systolic	111.7	(20.0)	110.2	(22.7)	114.6	(17.8)	109.4	(19.4)	.520
Diastolic	76.4	(12.0)	77.6	(10.0)	78.1	(12.2)	72.3	(13.7)	.131
Man' hand' grip strength, mean (SD)									
Right	56.2	(61.4)	65.5	(83.8)	43.2	(9.6)	51.0	(26.1)	.464
Left	48.0	(18.4)	52.6	(18.4)	41.4	(9.7)	46.1	(24.4)	.120
Woman' hand' grip strength, mean (SD)									
Right	26.7	(7.8)	26.8	(7.3)	25.4	(5.1)	28.4	(10.6)	.344
Left	25.4	(7.0)	27.7	(8.1)	24.0	(5.4)	25.4	(7.8)	.186
Waist circumference, mean (SD), cm	84.2	(12.9)	81.4	(12.6)	85.8	(11.8)	85.6	(14.3)	.163
Male	90.6	(11.2)	85.9	(8.9)	94.9	(7.9)	94.3	(15.1)	.008*
Female	79.5	(12.2)	74.2	(14.3)	81.7	(10.9)	80.5	(11.3)	.086
Blood glucose level, mean (SD), mmol/L	5.3	(1.1)	5.0	(1.2)	5.5	(1.2)	5.6	(0.9)	.027*

**P–value is less than 0.05, **p–value is less than 0.001*

Values were presented as mean ± standard deviation, or proportions, ANOVA test

Interestingly, there were no differences between handgrip strength and waist circumference groups. Professional mountaineers had statistically lower random blood glucose levels than office workers (MD -0.58; $p<0.05$). The prevalence of acute diseases occurring in the next three months is 8.0%; the prevalence of chronic diseases is 20.0%; the prevalence of those with a 10-20% probability of suffering from cardiovascular diseases in the next ten years is 5.3%; and the prevalence of those with a 30-40% probability is 2.6%. However, there was no difference between the groups.

Mountain climbing data was obtained separately, and all groups were assessed independently. Seventy-seven percent of professional climbers belong to a climbing club. Sixty percent of mountaineers who regularly go out 3-6 times a week are in non-stressful work conditions, while 55.6% of climbers who go to the mountains 1-2 times a week are in strenuous work conditions. The frequency of mountain climbing. Was correlated with the frequency of average weight ($p<0.05$). Among the interest group and office workers, the active exercise rate is 44.0% and 78.4%, respectively, for those who exercise actively in non-vigorous work and 25.0% for those who exercise regularly in strenuous work. Among those who exercise regularly, 66.0% exercise at high intensity, 34.0% at low intensity, 38.9% of low-intensity exercisers, and 14.3% of high-intensity exercisers smoke.

Table 3. Multiple comparisons of physiological parameters among study groups

Variables			Mean Difference (I-J)	Std. Error	P-Value	95% Confidence Interval	
						Lower Bound	Upper Bound
Systolic pressure by measurement	Professional mountaineers	Amateur	14.81	4.00	0.001**	5.33	24.29
		Office worker	18.38	4.21	0.000**	8.40	28.35
	Amateur	Professional mountaineers	-14.81	4.00	0.001**	-24.29	-5.33
		Office worker	3.56	4.36	0.693	-6.76	13.88
	Office worker	Professional mountaineers	-18.38	4.21	0.000**	-28.35	-8.40
		Amateur	-3.56	4.36	0.693	-13.88	6.76
Diastolic pressure by measurement	Professional mountaineers	Amateur	6.59	3.29	0.115	-1.20	14.39
		Office worker	10.18	3.46	0.011*	1.97	18.38
	Amateur	Professional mountaineers	-6.59	3.29	0.115	-14.39	1.20
		Office worker	3.58	3.57	0.575	-4.87	12.04
	Office worker	Professional mountaineers	-10.18	3.46	0.011*	-18.38	-1.97
		Amateur	-3.58	3.57	0.575	-12.04	4.87
Blood glucose level	Professional mountaineers	Amateur	-0.47	0.22	0.083	-0.99	0.05
		Office worker	-0.58	0.24	0.039*	-1.14	-0.02
	Amateur	Professional mountaineers	0.47	0.22	0.083	-0.05	0.99
		Office worker	-0.11	0.24	0.886	-0.67	0.45
	Office worker	Professional mountaineers	0.58	0.24	0.039*	0.02	1.14
		Amateur	0.11	0.24	0.886	-0.45	0.67
Waist circumference (male)	Professional mountaineers	Amateur	-8.98	3.24	0.020*	-16.76	-1.19
		Office worker	-8.39	3.38	0.042*	-16.53	-0.25
	Amateur	Professional mountaineers	8.98	3.24	0.020*	1.19	16.76
		Office worker	0.59	3.82	0.987	-8.61	9.79
	Office worker	Professional mountaineers	8.39	3.38	0.042*	0.25	16.53
		Amateur	-0.59	3.82	0.987	-9.79	8.61

** denotes p<0.05, ** denotes p<0.001, Multiple comparison (Tukey) test*

Discussion

Urbanization reduces physical activity, and lifestyle changes are the basis of chronic diseases (Field [22–24]). However, the healing impact of forest stays on existing ailments has yet to be established [10]. Overall, while there have been countless studies on the health impacts of forests, there is still a great need for enhanced research, both theoretically and methodologically [25]. Unfortunately, we found several studies on medium to low-quality forest-based therapies, which had a significant risk of bias. Insufficient description of the intervention groups, reporting of confounding factors, and missing or inadequate control group organizations are structural and methodological flaws in research design and reporting quality [26]. Furthermore, most of the identified studies are conducted in Asian nations with a primary sample of healthy and young individuals, limiting the generalizability of the conclusions. The intervention length is typically short (1-3 days), with no long-term effects reported [27,28].

This pertains to human physical, mental, and social health fields. According to Schuh and Immich, forest treatments are appropriate for boosting overall health and acting as stress reducers. Several studies on stress reduction using forest treatments have found that parasympathetic activity increases [27,29,30]. They are vital for physical recovery and relaxation [31] but may also improve blood pressure [32] and heart rate [33]. Forest remedies can also reduce established risk factors for cardiovascular disease [34,35]. Respiratory diseases, such as COPD [36], depression [37], exhaustion [38], and sleep disorders [39], can also be positively influenced by forest-based interventions. Furthermore, as proven, wood contains immune-boosting properties [27]. Frequent and more prolonged forest stays generally have a more substantial and lasting effect than isolated and sorted visits [40].

Numerous studies have shown that long-term, sustained exercise has positive health effects. One of them is regularly going to the mountains and doing mountain sports. Especially in Ulaanbaatar, the capital city of Mongolia, there is a way to invest in your health during your free time at a low-cost [17,38]. Furthermore, potential health consequences of forests may be caused by the individual perspectives of forest visitors and, hence, by the environment of the forest itself [41]. As a result, a consistent evaluation technique to define the forest itself would be critical. It is possible to derive a basic evaluation scheme for individual forest areas by structuring the numerous findings on the impact of forests, which can be used as comparative instruments between different study areas and, thus, contribute to the necessary improvement of the exposure approach [18].

Previous studies have often explored the health implications of sedentary lifestyles among office workers or the physical fitness of professional climbers. However, the current study offers a unique approach by directly comparing physiological parameters between these two distinct groups. While some research has investigated the health benefits of physical activity, few have specifically examined how the contrasting lifestyles of mountain hikers and office workers influence physiological markers associated with health and well-being. By focusing on this comparative analysis, our study fills a crucial gap in the literature and provides valuable insights into the potential health implications of different occupational lifestyles. Furthermore, by identifying specific physiological differences between these groups, our findings may inform targeted interventions and policies to promote healthier behaviors and reduce the burden of non-communicable diseases in diverse occupational settings. Thus, our study contributes to the scientific understanding of the complex relationship between occupation, physical activity, and health outcomes, with implications for public health initiatives and workplace wellness programs.

There are some modest limitations associated with the current study. According to our measurements, arterial pressure was higher in professional mountain climbers. This may be because the data was collected 5-10 minutes after resting after climbing the mountain. We all anticipated this error, and there were no differences between groups when subjects were asked to specify their constant pressure in the study. However, our research team has tried to collect as much information as possible and produce quality results. After 2019, or the period of the COVID-19 pandemic, there has yet to be a national survey that has determined the dynamics and influencing factors of population movement. There is a need to study this further in our country.

This study was conducted among adults. Otherwise, future research should concentrate on adolescents who tend to have a weaker sense of body appreciation and who use fitness centers and organized sports as two of the most popular venues for physical exercise.

Conflict of Interest

We declare no conflict of interest.

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