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Gender Variations in Wellbeing Indicators between Urban and Mountain Landscape Environments

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Abstract

The issue of variations in physiological indicators of wellbeing based on gender serves as incentive for natural landscape environment interactions. This study examined gender variations in blood pressure, pulse rate and respiratory rate between contact with low-altitude urban (pretest) and mountain landscape environments (posttest). To attain the goal of this study, 38 respondents (16 males, 22 females) participated in the seven-day experimental study. Pretest and posttest measures of blood pressure, pulse rate and respiratory rate were elicited from both male and female respondents at the urban environment within the first three days and at the mountain landscape environment the following three days. Results show that both male and female systolic blood pressure increased at the mountain landscape environment while their diastolic blood pressure reduced marginally. There was no difference in gender response in terms of pulse rate. Conversely, male respondents experienced reduction of respiratory rate at the mountain landscape environment while female respondents experienced increase. Findings suggest that the only apparent difference in gender response is in their respiratory rate. The extent to which gender might be related to physiological wellbeing through contact with natural mountain landscape environment is revealed. Hence, a platform is set for policy makers and governments for the creative harnessing of mountain landscape environments.

Keywords: stress, wellbeing, urban, mountain landscape, blood pressure, pulse rate, respiration, Nigeria

1. Introduction

Urbanization and job pressure constitute the main vehicles for stress in our modern day environments due to the absence of the calming and relaxing benefits of nature. Modern day environments are only created to suite everyday living and working which offer no restorative health benefits (Thompson, 2011). In contrast, nature related environments like forests, wilderness and mountains are considered to possess significantly the possibility of enhancing restoration from stress through passive and active contact. In landscape studies, stress is viewed in terms of the ameliorating potentials of nature related environments (Hartig, Mitchell, De Vries, & Frumkin, 2014). Indeed, the quest for attainment of physical and mental wellbeing through alternative medicine is a universal human goal. Quite a number of studies have been carried out in the area of effects of nature experience on mental wellbeing (Bratman, Hamilton, & Daily, 2012; Kaplan, 1992; Russell et al., 2013). Thus, a key element of the health benefits of nature may be its stress reducing effect. This assumption is premised on the assertion by promoters of the Stress Recovery Theory (SRT) that contact with natural landscape environments permit emotional and physiological stress reduction (Berto, 2014; Bratman et al., 2012; Ulrich et al., 1991).

There is a general consensus among researchers that mental stress results from interactions between persons and environments that are perceived as straining or exceeding adaptive capacities (Annerstedt et al., 2010). These adaptive capacities have been found to be influenced by the manipulation and reactions of the human physiognomy. Reactions of the human physiognomy are determined by the sympathetic nervous system (SNS) activation and release of hormones (e.g. adrenaline, testosterone and cortisol). It is consequent upon activation of the hypothalamic-pituitary adrenal axis (HPA) and the neuroendocrine system that regulates reactions to stress and body processes such as mood and emotions (Hey & Sghir, 2011). According to Kudielka and Wüst (2009), the HPA axis is a predominantly adaptive system typified by distinct inter and intra-individual variability (Kudielka & Wüst, 2009). In other words, when systems are efficiently and infrequently "turned on" and "turned off" the stress response is believed to be adaptive. On the whole, researchers have conceptualized the negative attributes of stress (e.g. forgetfulness, mistakes and illness) and also critically assessed the positive aspects of restoration linked to nature (e.g. feeling relaxed, effectiveness, and wellbeing) (Brady & Matthews, 2006).

However, studies that engaged physiological indicators of wellbeing (e.g. blood pressure, pulse rate and saliva amylase) in examining the effects of contact with environments involved forests, wilderness and urban field settings as study sites and stimuli (Hartig, Evans, Jamner, Davis, & Gärling, 2003; Horiuchi et al., 2014; Ochiai et al., 2015; Tsunetsugu et al., 2013). Whereas no study was found to have utilized mountain environment as study site and stimuli, very few have considered gender differences in physiological response to contact with varying urban settings (Beil & Hanes, 2013). To the authors' knowledge, no studies have compared gender differences in physiological response between urban and mountain landscape environment. The purpose of this study was to examine gender variations in blood pressure, pulse rate and respiratory rate between contact with urban (pretest) and mountain landscape environments (posttest) with regards to wellbeing.

2. Method

2.1 Respondents

A non-probability convenience sampling method was deployed in determining the study sample. Because of the experimental nature of the study and following the idea of Creswell (2012), only individuals who volunteer and agreed to be studied made up the sample. A few of the volunteers who were known acquaintances at the Benue State University, Nigeria were initially co-opted by the authors. These initial volunteers then co-opted others to make up the sample. Also, individual's behaviour was a determinant in the selection of volunteers (Weathington, Cunningham, & Pittenger, 2010) who eventually constituted the sample for the experiment. Only individuals who were non-smokers (Lee et al., 2013), not on any form of cardiovascular related drug and not at the time of experimentation suffering from any acute illnesses were selected (Abdulla & Taka, 1988). This process was done through verbal interview (Okada & Kakehashi, 2014). Forty respondents comprising lecturers, students and public sector workers between the ages of 20 to 40 years were recruited from the urban environment of Makurdi, Benue State, Nigeria. A day before commencement of the experiment, two of the respondents opted out. One due to time factor and the other admitted not being psychologically stable for the experiments. Thirty eight respondents including 16 males and 22 females gave informed written consent to participate in the study at no fee. The informed consent addressed ethical issues. All the thirty eight respondents formed a single within group experimental study sample involving pretest and post-test protocols.

2.2 Study Sites and Stimuli

The study involved comparison between contact with urban and mountain landscape environment with regards to gender variations in physiological indicators of wellbeing. Makurdi urban environment is the capital city of Benue State, Nigeria. It was used as the pre-test environment. Its choice as a study location was due to its urban character. Figure 1 show photos of Makurdi urban environment features and character. It has a tropical savannah climate with annual average high temperature of 32.6°C and annual average low temperature 21.8°C. Makurdi with its characteristic urban features of hardscapes, population density, commercial activities and heavy traffic lies on an altitude of about 104m above sea level. The aforementioned characteristics constitute sources of stress for individuals.

The post-test environment was the Obudu mountains in Obanliku local government area of Cross River State, Nigeria. It has a semi temperate mountain climate and an altitude of between 1700m to 1765m above sea level. During the dry season of November to January, temperature is between 26°C to 32°C. The rainy season starting from June to October is colder with temperatures as low as 4°C and usually not higher than 10°C. Temperatures between February and May fluctuate between night time lows and day time highs. It is characterized by diverse landscape attributes such as water fall, grotto, river, forest reserve, 70m long canopy walkway, bird watching platform, cable car ride. The cable car ride affords a motion view of prominent undulating mountain formations covered by near dense but fascinating green vegetation. Hence, the environment offers serene ambience suitable for stress mitigation and enhancement of wellbeing. Figure 2 show photos of the Obudu mountain landscape environment features and character.

Figure 1. Photos of Makurdi urban environment features and character

Figure 2. Photos of some Obudu mountain landscape environment features and character

2.3 Measures and Instruments

The measures that were taken include; blood pressure, pulse rate and respiratory rate of respondents. Blood pressure measurement was performed by volunteer medics using the standard mercury sphygmomanometer and the auscultatory technique. The standard mercury sphygmomanometers used in this study were properly checked and found to be free of leakages to ensure accuracy of measurements (De Greeff et al., 2010). Its simplicity and lack of major difference between models makes it more accurate than other types of manometers, hence, its choice as the blood pressure measuring device (Pickering et al., 2005). To reduce possible errors in measurements and obtain a valid and reliable blood pressure data, the procedure followed recommendations of O'Brien et al. (2003) and Pickering et al. (2005). The process of measuring pulse rate involved the use of a clock with a functional second hand. Respondents' pulse which is the throbbing of the artery signifying the rate of heart beats and flow of blood through the body was felt at the wrist. The pattern of respiration was visually counted on the basis of the 60 seconds count method (Cretikos et al., 2008). This process was carried out in a way that the respondent being observed was unaware their respiration was being observed (McFadden, Price, Eastwood, & Briggs, 1982). This was to ensure that respondents do not manipulate their breaths. Recording respiratory rate involves observation of the respiratory circle which is made up of an inhalation and exhalation period (Plarre et al., 2011).

2.4 Data Analysis

Physiological responses were analysed using the paired sample t-test to determine whether the effect of contact with the pretest and post-test environments differ between gender. Statistical analysis was performed using statistical package for the social sciences (SPSS version 19.0) software.

2.5 Procedure

The experimentation was carried out between 28th January and 3rd February 2014. The experimental protocol spanned 7 days as shown in Figure 3. Pretest measures were carried out at the urban environment on the 28th, 29th and 30th January which represent the first three days of the study. Posttest measures were carried out at the mountain landscape environment the following three days, 1st, 2nd and 3rd February. Three qualified medics assisted in carrying out measurements at the urban environment while two assisted at the mountain landscape environment. The respondents were verbally briefed at the beginning of the study on the measures to be taken. This briefing was done in order to alleviate fear and anxiety of the respondents concerning the procedure (O'Brien et al., 2003).

The pretest centre for the measurements was set at the Benue State University Makurdi medical school private dining hall which was within a 10 km radius and about fifteen-minute drive from the location of each respondent. Measurements were carried out between 6 pm and 8 pm during the three day period at the urban environment. Each respondent was allowed to rest in a seated position on arrival at the pretest centre for at least five minutes before their blood pressure, pulse rate and respiratory rate were taken. Respondents were asked to put off their phones to avoid distraction and disturbance. Systolic blood pressure (BP), diastolic blood pressure (BP), pulse rate and respiratory rate of each respondent were recorded for the three consecutive days.

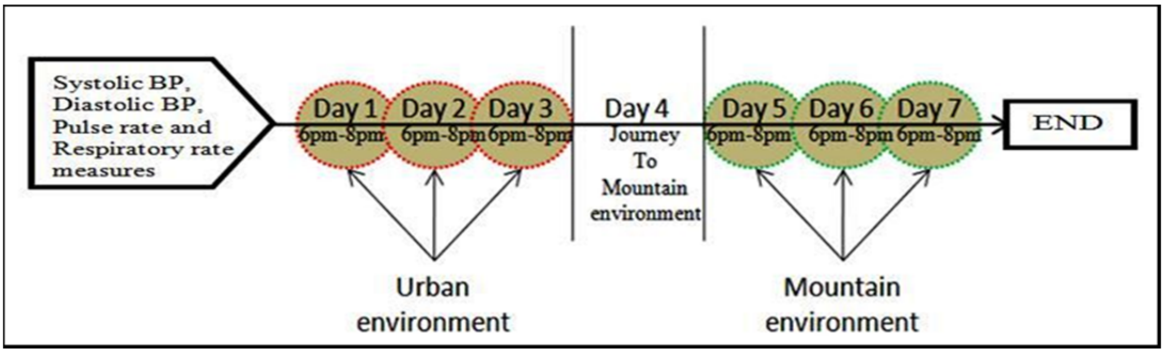

Figure 3. The 7-day experimental protocol showing measurement time

Respondents were transported by road on a journey that lasted 4 hours to the Obudu mountain landscape environment on the 31st of January 2014. They were allowed to take a rest and interact freely with the mountain landscape on arrival but measurements were not taken that day in order to check the effect of 'travel fatigue' (Waterhouse, Reilly, & Edwards, 2004). Systolic BP, diastolic BP, pulse rate and respiratory rate measures were also carried out every day throughout the three day period at the mountain landscape environment using the same equipments and process as obtained in the urban environment. Similar to the procedure in the urban environment, measures were carried out between 6 pm and 8 pm each day. This was to ensure that respondents have had considerable contact with features of the Mountain landscape environment which included waterfall, river, forest and visual experience of the undulating mountains before measures were taken. The post-test measures were also carried out within the same time frame (6pm to 8pm) in order to check the influence of circadian effect (Ochiai et al., 2015). The pulse rate and respiratory rate measurements immediately followed the blood pressure measurement in a consecutive pattern.

3. Results and Discussion

It could be seen from Table 1 that there was significant difference between gender systolic BP (urban $t = 2.05$, $P < 0.05$; mountain $t = 0.03$, $P < 0.05$), and diastolic BP (urban $t = 3.49$, $P < 0.05$; mountain $t = 0.77$, $P < 0.05$). Whereas pulse rate was not significant (urban $t = 4.76$, $P > 0.05$; mountain $t = 0.25$, $P > 0.05$), respiration was significant in the urban environment but not in the mountain landscape environment (urban $t = 0.23$, $P < 0.05$; mountain $t = 2.63$, $P > 0.05$). This means that gender significantly differ with regards to systolic blood pressure (BP), diastolic blood pressure (BP) and respiratory rate response while pulse rate do not. Although Jiang, Chang, and Sullivan (2014) used cortisol and skin conductance level to measure stress responses, their study also revealed significant difference in gender with regards to physiological stress responses.

Table 1. Gender difference in physiological response

Environment	Vital signs	Gender	F	Sig. (2-tailed)
Urban	*SBP (mm Hg)	Male Female	2.050	.000
Mountain	*SBP (mm Hg)	Male Female	.039	.007
Urban	**DBP (mm Hg)	Male Female	3.496	.007
Mountain	**DBP (mm Hg)	Male Female	.775	.014
Urban	Pulse rate (bpm)	Male Female	4.760	.739
Mountain	Pulse rate (bpm)	Male Female	.259	.361
Urban	Respiration (c/m)	Male Female	.231	.005
Mountain	Respiration (c/m)	Male Female	2.638	.490

*Systolic blood pressure **Diastolic blood pressure

On the other hand, mean values of the difference in gender of individuals on response to urban and mountain environment demonstrated a more comprehensible outcome. Figure 4 compares the difference in systolic BP and diastolic BP of individuals based on gender. It could be seen that both male and female individuals experienced marginal increase in their systolic BP (male = 1.36 mmHg, female = 3.50 mmHg) but a decrease in diastolic BP (male = 2.37 mmHg, female = 1.64 mmHg) at the mountain environment.

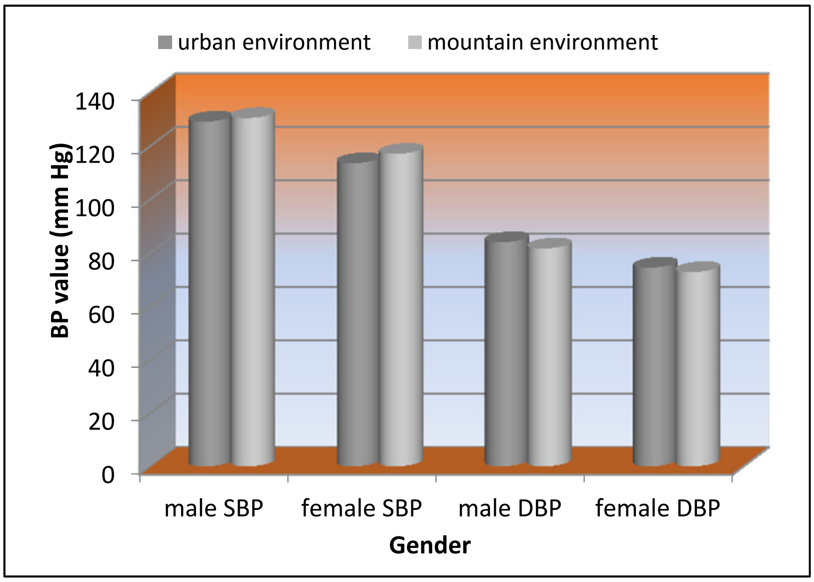

Figure 4. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) based on gender response

Also, Figure 5 reveals that both male and female pulse rates reduced at the mountain environment while Figure 6 shows that whereas only male respiratory rates reduced, female respiratory rates increased marginally. On the whole, the result confirms that both gender account for the general increase in systolic BP and decrease in diastolic BP in the mountain environment. Similar to the diastolic BP response in terms of gender, both male and female individuals accounted for the decrease in pulse rate in the mountain environment. However, the pattern of respiratory rate response shows that female individuals had a slight increase in respiratory rate in the mountain environment, compared to the male individuals which decreased.

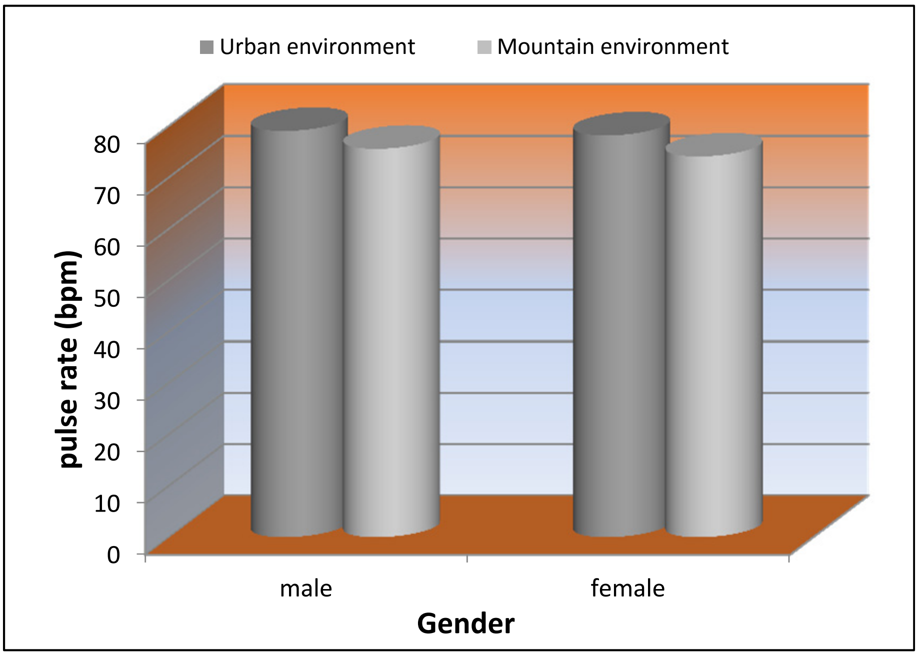

Figure 5. Pulse rate based on gender response

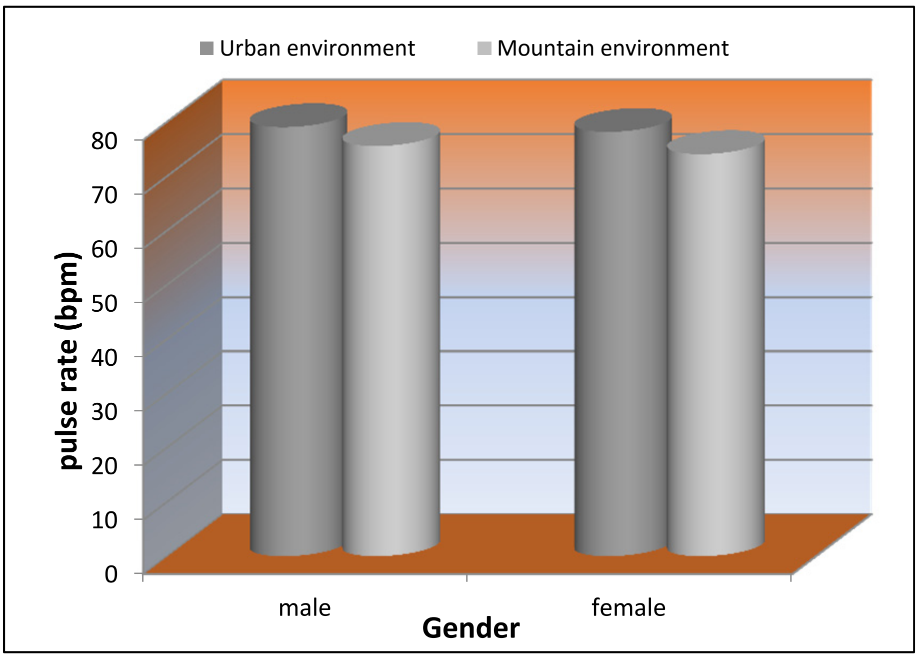

Figure 6. respiratory rate based on gender response

Overall, the systolic BP increase of both male and female individuals and diastolic BP decrease at the mountain landscape environment suggests that sudden changes in environmental configuration are likely to have exerted a demand on the sympathetic nervous system (SNS). The demand on the SNS initiated the release of catecholamine from the nerves and adrenal medulla which led to increase in blood pressure (Brady & Matthews, 2006). Similarly, in an attempt by the body functions to attain a homeostatic standard (physiological balance), a rise in systolic BP is witnessed. In other words, Individuals' inability to adapt to sudden variations in environmental configuration of the mountain landscape environment influenced the increase in their systolic blood pressure. Also, diastolic BP and pulse rate decreased in the mountain landscape environment in both gender due to an attempt by the human body system to maintain homeostasis. Homeostasis was maintained through the activation of the response system by way of adjustment and adaptation to the mountain landscape features which fostered calmness and excitement. The features enhanced individual's ability to attain a state of calm, relaxation and excitement in the absence of stress stimulating features found in urban environments. Calmness and excitement are affective and positive feelings that determine mental wellbeing (Holbrook, 2009; Scopelliti & Giuliani, 2004; Ulrich, 1986).

The assumption guiding this study pertains to how interaction with an environment possessing restorative features can stimulate stress recovery better than environments without restorative features. A consistent finding across the physiological response of individuals in terms of gender is that females experienced increase in systolic BP and respiratory rates in the mountain environment. It appears the effect of experiential interaction with the mountain landscape environment features acted upon the physiognomy of females differently. The apparent increase in systolic BP and respiratory rate of females at the mountain environment suggests that they are more vulnerable to changes in environmental configuration more than males. This is at variance with studies suggesting that males are more vulnerable in terms of blood pressure reaction to changes in stimuli (McAdoo, Weinberger, Miller, Fineberg, & Grim, 1990; Wagner & Horvath, 1985). However, the finding is in agreement with that of Hinojosa-Laborde, Chapa, Lange, and Haywood (1999) which suggest that the mechanism controlling the SNS in females is 'less sensitive' to excitatory stimuli and more 'more sensitive' to inhibitory stimuli compared to males. This means that females are less sensitive to the exciting and stress reliving aspects of the mountain environment than males.

One limitation identified in this study pertains to the characteristics of the sample. The study sample was made up of healthy male and female volunteers. Hence, it is necessary to ascertain through further studies if the outcomes could be generalized when applied to other groups such as patients with historical stress challenges, the elderly and children.

4. Conclusion

In sum, experiential contact with the mountain landscape environment, gender notwithstanding, influenced individual's ability to attain a relaxed state through the reduction of their diastolic blood pressure and pulse rate. Also, clear physiological effects leading to recovery from stress are obtainable through short time interaction, minimum of three days, with the mountain landscape environment. Hence, a platform is set for policy makers and governments for the creative harnessing of mountain landscape environments.

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