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Does the Colors Effect on Cardiovascular Status

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A R T I C L E I N F O

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A B S T R A C T

Color is believed to affect human physiological responses. The aim of this study was to explore the effects of color on physiological responses; blood pressure and heart rate. A Quasi Experimental Design with Pre and Posttest Design employed. The sampling technique was simple random sampling in hypertensive patients in the area of the Community Health Center in Maos Subdistrict, Cilacap Regency. Inclusion criteria are a blood pressure of at least 140/90 mmHg, not color blind (Ishihara test). The sample group is divided by color. For 20 minutes, 150 hypertension patients wore glasses with red, blue, and green lenses, and the results were evaluated. The impact of color on heart rate and blood pressure was examined through analysis. The findings indicated that the heart rate and blood pressure differed significantly ($p < 0.05$). The findings revealed a substantial difference in heart rate and blood pressure ($p < 0.05$). Three groups' systolic values showed significant differences ($F (2, 147) = 7.703$, $p = .0001$). Blue (M = 76.60, SD = 8,079), Red (M = 81.54, SD = 7.838), and Green (M = 76.74, SD = 5,229) had the highest average scores in Tukey HSD. Tukey HSD for Blue (M = 88.22, SD = 14.72) and Red (M = 96.92, SD = 10.99) in diastolic F (2, 147) = 8.703 p =.0001. Green (SD = 8.23, M = 88.86). For Blue (M = 76.60, SD = 8.079), Red (M = 81.54, SD = 7.838), and Green (M = 76.74, SD = 5,229), the Tukey HSD at heart rate was F (2, 147) = 7.703, p =.0001. Group 1 (blue) is not different from Group 3 (green), but both are different from Group 2 (red), indicating that red has the opposite impact and blue and green have the same effect, according to post-hoc comparisons for all dependent variables using the Tukey test. According to the findings, red raises both blood pressure and heart rate, whereas green is better at lowering both than blue.

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INTRODUCTION

One chronic health issue that turns into a public health issue is hypertension. Normal blood pressure is less than 120/80 mmHg, according to the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure's Seventh Report. When blood pressure exceeds 140/90 mmHg, it is referred to as hypertension. Adults above the age of eighteen are subject to this limit (Chobanian et al., 2003).

According to data from the National Health and Nutrition Examination Survey (NHANES), at least 50 million Americans suffer from excessive blood pressure (BP). The prevalence of hypertension is estimated to be as high as 1 billion individuals worldwide, and it may be the cause of 9.4 million deaths annually. According to the World Health Association, high blood pressure causes 49% of ischemic heart disease and 51% of cerebrovascular illness (stroke). The leading cause of mortality or disability globally is high blood pressure (WHO, 2013).

According to data from the Health Research and Development Agency, the prevalence of hypertension in Indonesia was 26.5% among those aged 18 and over. South Kalimantan had the highest rate at 44.13 percent, followed by West Vava (39.60 percent), East Kalimantan (39.30 percent), and Central Java (37.57 percent). As lifestyle factors including smoking, obesity, physical activity, and psychological stress increase, so does the prevalence of hypertension. Hypertension has emerged as a public health issue that would worsen if left untreated (Health Research and Development Agency, 2018).

In Cilacap Regency, there were 21,354 cases of hypertension in people aged 18 and over, according to statistics from the Cilacap District Health Office (2022). This represents a significant rise from the 15,717 cases reported in 2014. In the Maos Public Health Center, there were 1352 hypertensive patients, 786 of them were men and 566 of whom were women. Patients with hypertension were ranked fourth out of ten disorders in Cilacap. Alongside lifestyle changes including smoking, obesity, physical inactivity, and psychological stress, the prevalence of hypertension rises (Cilacap District Health Profile, 2022).

According to Vasilopoulos et al. (2012), individuals with hypertension are required to take antihypertensive medications for the rest of their lives and must accept the possibility of adverse consequences, particularly those affecting the kidneys and liver. In order to help patients avoid becoming dependent on antihypertensive medications, alternative therapies, such as color therapy, are required to lower blood pressure and lower the risk of consequences from hypertension.

Chromatherapy, another name for color therapy, is predicated on the idea that each hue in the surroundings has healing properties. Color influences human psychophysiology (Tomassoni, Galetta, & Treglia, 2015) and has a variety of effects on people (Ab Jalil, Yunus, Sheik Said, & Iqbal, 2016). Color therapy is categorized as electromagnetic medicine, or treatment using electromagnetic waves, in the medical sector, according to Kusuma (2010). It affects a person's behavior, psychology, and physical health. In humans, color has a variety of effects on people's emotional states in addition to affecting the physiological response of smooth muscle relaxation (Dagget Willard R, 2008).

The application of color to the body has a range of energy characteristics (Lynnay, 2007). Color psychology is the study of the effects of color on human behavior, emotions, and physical state. Comfort, relaxation, calmness, stress reduction, and emotional equilibrium are all facilitated by green. Green for cancer, respiratory pain, and heart failure patientsOrange is a happy hue. capable of letting go of emotions, getting rid of self-pity, feeling unworthy, and refusing to forgive. Purple has a deep spiritual impact and has been utilized in psychiatry to help people with panic attacks and other mental illnesses relax. Orange is more effective for constipation and allergy issues. The color blue is soothing and cool. White hues that are genuinely sacred, protective hues that instill tranquility and a sense of security. Silence is related with black hues that are cozy, protective, and enigmatic. We cannot develop and change because of blackness (Dagget Willard R, 2008).

Color affects not only the physiological responses of living organisms but also a range of human psychological states. It is important to remember that color therapy has more physiological effects than psychological ones. An autonomic nervous system, for instance, may glow when red is present, whereas blue and green have a relaxing impact. Understanding how color affects human behavior, emotions, and physical health is called color psychology. (Collopy 2003).

The retina of the eye will pick up color from the surroundings. The primary job of the eye is to direct light from the surroundings toward the retinal photoreceptor cells, which are made up of cone and stem cells. According to Sherwood (2014), photoreceptors subsequently transform light energy into electrical signals that are sent to the central nervous system. One image shows three different kinds of cone cells, and the other four show various pigments in stem cells. According to Sherwood (2014), these four photopigments absorb light at various wavelengths. Red, green, and blue pigments are the three light-sensitive substances found in cone cells; rodopsin is the name for the light-sensitive substance found in stem cells (Guyton & Hall, 2014).

LITERATURE REVIEW

According to Cajochen et al. (2005), humans are extremely sensitive to light, and even 1.5 lux of light can alter circadian rhythms (Wright, Hughes, Kronauer, Dijk, & Czeisler, 2001). Acute physiological effects of light include a rapid decrease in melatonin (Brainard et al., 2001), an increase in alertness (Cajochen et al., 2005), an increase in heart rate (Scheer, Van Doornen, & Buijs, 2004), and an increase in the sympathetic nervous system (Sakakibara et al., 2000; Kohsaka et al., 2001). These effects are in addition to the regulation of circadian rhythms. In response to internal or external stimuli, heart rate has been used to evaluate how cardiac autonomic activity is modulated (Pumprla, Howorka, Groves, Chester, & Nolan, 2002). The short-term impact of light on human physiology may be assessed with the help of heart rate measurements (Schafer, 2006).

According to Tsunetsugu, Miyazaki, and Sato (2005) and Jin, Yu, Kim, Kim, and Chung (2009), psychological assessments were used in many earlier research instead of physiological ones. The results of these two investigations were similar in that there was relatively little use of the physiological method in color research. However, there are a number of color impacts that are difficult to identify or explain but have a big influence on people's health, therefore a better approach is required.

Studies mostly in psychology have documented unique impacts on human light color. Although the psychological impacts of light are extremely complicated and may involve processes other than melatonin suppression (Ruger, 2005), few studies have examined how colored light affects blood pressure and heart rate to date. Lifestyle choices like smoking (Cagirci et al., 2009), exercising (Henje Blom, Olsson, Serlachius, Ericson, & Ingvar, 2009), drinking alcohol (Thayer, Hall, Sollers, & Fischer, 2006), and sleeping (Fang, Huang, Yang, & Tsai, 2008) have also been shown to have an impact on heart rate.

The aim of this study was to assess the effects of blue, red, and green on heart rate and blood pressure in patients with hypertension who wore blue, red, and green lens glasses during the day after being exposed to these colors. When determining the risk of increased morbidity and mortality in patients with cardiac issues, the dependent variables of blood pressure and heart rate are selected since they are both reasonably often measured and significant prognostic indicators (Sánchez-Gil et al., 2017). The rationale behind selecting blue, red, and green as independent variables is that they are frequently found in nature and also correspond to the color of the pigment in the retina's cone cells.

METHODOLOGY

This study employs a quasi-experimental methodology with a pre- and post-test group design, making it a quantitative study. The sampling procedure used in simple random sampling yields 150 samples of respondents that meet the inclusion and exclusion criteria. Three groups of responders were formed based on colour: Group 1 was blue, Group 2 was red, and Group 3 was green.

150 hypertension patients were split into three groups for this study, which examined their use of glasses with transparent red, blue, and green lenses. 50 people with hypertension made up each group. Group 1 is using transparent blue lenses, Group 2 is wearing transparent red lenses, and Group 3 is wearing clear green lenses. Respondents were evaluated for colour blindness using the Ishihara Test prior to being given coloured spectacles; if colour blindness was not detected, blood pressure and heart rate were then measured. The respondent was then instructed to wear the group's recommended glasses for 20 minutes. Blood pressure and heart rate readings were taken right away after 20 minutes. At every step of the data gathering process, participants sit comfortably.

The respondents were randomly selected from among hypertension patients who lived in the Cilacap District's operating area of the Public Health Centre of the District of Maos. Patients who had high blood pressure of at least

140/90 mmHg, were willing to participate, and were not colour blind based on the findings of the Ishihara test met the inclusion criteria. Students in their fourth semester participate in one-on-one data collecting at the respondent's residence. There are 80 students at the Serulingmas Nursing Academy in Cilacap who have received training in taking heart rate and blood pressure readings. Measurements are made of heart rate and blood pressure using the supplied form.

In March and April of 2018, the data was retrieved and processed. One Way ANOVA and Multiple Comparison Post Hoc Tukey HSD were the statistical tests employed to determine the degree of difference between the two groups. Additionally, the effect size of colour exposure on heart rate on the Cohen scale and blood pressure (systole/diastole) is calculated using eta squared. According to Cohen's classification, a minor influence is defined as 0.01–0.05, a moderate effect as 0.06–0.13, and a big effect as greater than 0.14.

RESULTS AND DISCUSSION

Univariate Analysis

150 respondents, 110 of whom were women and 40 of whom were men, satisfied the inclusion criteria, according to the results of the univariate analysis. Respondents were 56.15 years old on average, 54 years old on average, and 12.353 years old on average. The age range is 28 years old for the youngest and 87 for the oldest.

Mean Blood Pressure and Heart Rate

Blood pressure levels before and after the intervention in the Blue Group differed significantly. Before and after the intervention, the mean systole and systole were 158.14 and 151.36 mmHg, respectively. Prior to intervention, the mean diastole was 92.30 mmHg, and following intervention, it was 88.22 mmHg.

In the Green Group, the systolic mean before intervention was 164.90 mmHg and after the intervention 150.48 mmHg. While the Diastolic Mean before intervention was 99.96 mmHg and after the intervention 88.86 mmHg. In the Red Group, the mean systolic blood pressure before intervention was 156.46 mmHg and after the intervention was 166.00 mmHg. The mean for diastolic before intervention was 89.02 mmHg and the mean after intervention was 96.92 mmHg.

The mean heart rate in the Blue Group before intervention was 77.36 and after the intervention was 76.60. In the Red Group, the mean heart rate before intervention was 77.20 and after the intervention 81.54. In the Green Group, the mean heart rate before intervention was 83.44 and after the intervention was 76.74.

Difference in Mean (mean after intervention minus the mean before intervention) in systole at - 6.78 for blue while for green at -14.42. While the difference in the Diastole Mean for Blue is -4.08 and Green is -11.1. The difference in the Systole Mean in red is +9.54 while the difference in Mean for diastole is +7.9. Difference The mean heart rate in blue is -0.76, green colour is -

6.7 and red colour is +4.34. The sign (-) shows a decrease while the sign (+) shows an increase.

Bivariate Analysis

The effects of the colour intervention on each group's systole, diastole, and heart rate were investigated using a One-Way Anova analysis.

The systole findings of the One-Way Anova statistical test revealed that the three groups had statistically significant differences at the $p < .05$ level, with $F(2, 147) = 15.908$, $p = .0001$. There are 0.18 big categories in the Cohen range for eta-soared effect sizes that are calculated. A significant colour effect on systolic blood pressure is implied by such an effect. Tukey HSD test post-hoc comparisons revealed that Group 1's average score (M = 151.36, SD = 17.43) differed substantially from Group 2's (M = 166.00, SD = 13.76). Additionally, Group 2 and Group 3 were very different (M = 150.48, SD = 14.94). Group 1 and Group 3 were not much different. Accordingly, systolic blood pressure is lowered by both blue and green interventions, but red interventions have the opposite effect. It can be inferred that green is more effective than blue at lowering systolic blood pressure based on the difference between mean values before and after the blue intervention (-6.78) and green (-14.42).

The diastolic results from the One-Way Anova analysis showed statistically significant differences between the three groups at the $p < .05$ level: $F(2, 147) = 8.703$, $p = .0001$. with eta squared of 0.11 (medium) indicating a size effect and a modest average score across the groups. Group 1's mean score (M = 88.22, SD = 14.72) differs substantially from Group 2's (M = 96.92, SD = 10.99) according to post-hoc comparisons using Tukey HSD. Additionally, Group 2 (M = 96.92, SD = 10.99) and Group 3 (M = 88.86, SD = 8.23) were very different from one another. Group 1 and Group 3 did not differ all that much. This indicates that red treatments have the opposite effect from blue interventions, which have a comparatively equal effect of lowering diastolic blood pressure.

With a size effect of 0.01 (small) on eta squared, the One-Way Anova analysis of heart rate revealed a statistically significant difference in heart rate for three groups at the level of $p < .05$: $F(2, 147) = 7.703$, $p = .0001$. Group 1's average score (M = 76.60, SD = 8.079) differed substantially from Group 2's (M = 81.54, SD = 7.838), according to post-hoc comparisons using Tukey HSD. There were also notable differences between Group 2 (M = 81.54, SD = 7.838) and Group 3 (M = 76.74, SD = 5.229). Group 1 and Group 3 are not much different. These findings show that red treatments have the opposite effect from blue interventions, which lower heart rate, whereas green interventions have a comparatively similar effect.

According to theory, visible light, which is defined as colour wavelengths between 400 and 700 nanometres, is the range that the human eye can perceive. 450–480 nm is the blue wavelength, 630–700 nm is the red wavelength, and 480–560 nm is the green wavelength. In contrast to red, which contains hues with long wavelengths, blue and green have short wavelengths (Valdez & Mehrabian, 1994; Lynnay, 2007; Bakker, Van Der Voordt, De Boon, & Vink, 2013). While red and yellow are warm colours (high saturation, low brightness), blue and green are considered cool colours (low saturation, high brightness) (Valdez & Mehrabian, 1994; Lynnay, 2007).

Red, green, and blue (RBG) are the three components of all light that enters the eye. These three hues are subsequently transmitted to the brain via three channels: the black-white channel, the blue-yellow channel, and the red-green channel. According to Holzberg and Albrecht (2003), colour transmission leads to the limbic system via a Retin thalamic track that links the nervous system, Autonomic Nervus System (ANS), and endocrine system. This track then triggers the release of serotonin and endorphins, which alter mood, promote relaxation, and reduce tense muscles.

The statistics showed that there is a significant difference between blood pressure and heart rate ($p = 0.001$ or $p < 0.05$). A comparison of the mean heart rate and systole-diastole before and after the intervention revealed a drop in blood pressure in both the Blue Group and the Green Group. In contrast, the red has elevated heart rate and blood pressure.

The statistics showed that there is a significant difference between blood pressure and heart rate ($p = 0.001$ or $p < 0.05$). When the mean systole-diastole and mean heart rate were compared before and after the intervention, blood pressure decreased in both the Blue Group and the Green Group. In contrast, the red has elevated heart rate and blood pressure.

Before and after the blue and green colour intervention, there was a substantial difference in the heart rate and blood pressure of the Blue and Green Groups. With Effect Size, both were able to lower blood pressure by 0.18 in the systole and 0.11 in the diastole. The mean of the two hues shows that green is more effective at reducing heart rate and blood pressure. Although both can drop blood pressure, it can be inferred that green is also more effective in lowering blood pressure than blue because the mean difference between the two is larger. However, the exposure size of the red, green, and blue colours is only as small as 0.01 eta squared. The autonomic and cerebral effects of red light are highly significant for all physiological measurements except heart rate, according to Jacobs & Hustmyer (1974). However, the study did not explain why changes in heart rate did not have a significant impact.

According to Carol Venolia (1988) in Edge (2003), red improves blood pressure, breathing, circulation, muscle activity, heart rate, hormones, sexual activity, and nervous stress. It also stimulates and revitalizes the physical body. The liver, adrenal glands, neurological system, and senses in general are all stimulated by the colour red. Both the central nervous system and the nervous system as a whole benefit greatly from the green impact. The colour blue has an impact on the entire neurological system, but particularly on the central nervous system. Vajcovec (2008) observed that while red and yellow elevate blood pressure, green and blue can lower it. This is consistent with his studies. This study's findings are corroborated by a study by Shealy et al. (1996) in Honig (2007) that quantifies how different neurochemicals and neurohormones react to coloured light. Green increased the average levels of oxytocin by 45.5%, beta endorphins by 33%, and serotonin by up to 104%, according to the study. Green also results in a 29% drop in norepinephrine levels. Red exposure, according to the study, did not alter norepinephrine levels, but it did cause serotonin levels to be much lower than green. Because of this condition, red tends to raise blood pressure by causing sympathetic nerve activity to increase. Through the suppression of sympathetic nerve activity, which lowers cortisol and adrenaline hormones, changes in the levels of neurochemicals and neurohormones can lower blood pressure and tension (Liza, 2006). According to Watts, Morrison, Davis, and Barman (2012), hypertension is also brought on by a lower serotonin level.

CONCLUSIONS AND RECOMMENDATIONS

Blue, red, and green have an impact on human physiology, specifically heart rate and blood pressure, according to our research. Heart rate and blood pressure drop in response to green and blue. However, green reduces heart rate and blood pressure more effectively than blue. Red, on the other hand, has the opposite effect, increasing heart rate and blood pressure. Additional research should take into account variables including weight, body mass index, and degree of weariness that can impact blood pressure and heart rate.

Nursing professionals should take note of this research since it relates to how to treat hypertension patients by altering the physical surroundings' hue to match the colour of the glasses being used. Therefore, more research is required to determine how colour change affects the physical environment of the residence or inpatient room that is conducive to the well-being of individuals with hypertension in order to see further benefits.

FURTHER STUDY

This research still has limitations so further research on this topic is still needed “Does the Colors Effect on Cardiovascular Status”.

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