

Perceived Risks and Effects of Heat Stress to Students and their Coping Strategies

Bondee L. Peñaflor, PhD

College of Forestry and Environmental Management

Isabela State Univeristy

Cabagan, Philippines

bondee.l.penaflor@isu.edu.ph

Beverly Gay N. Cambri, PhD

College of Science

Isabela State Univeristy

Cabagan, Philippines

beverlygay.n.cambri@isu.edu.ph

Abstract— The study assessed the perceived risks and effects of heat stress to students and their coping strategies which could serve as input for policy and institutional innovation in the school. A cross-sectional survey research design was employed in this study covering 583 respondents. Data were analyzed using both descriptive and inferential statistics. Results show that the perceived risk with the highest weighted mean include: Hot weather during these days can cause sickness; People exposed to heat have a greater risk of developing serious diseases; and Heat is a potentially lethal risk. Meanwhile, the perceived effects of heat stress are: Tiredness/Exhaustion, difficulty in getting sleep, and not able to study well at home and in school. To address these effects, foremost of the students' coping strategies is by drinking cold water, juice or carbonated drinks, followed by keeping a personal tumbler to keep drinking water. In addition, students wear comfortable clothes to enhance thermal comfort and bathe more frequently to cope with heat stress. They also utilized trees and parks as the preferred places to stay or resting space for thermal comfort during hot days. To address these, the school management employs initiatives such as conserving/maintaining greeneries and blue spaces, water dispenser made available at no cost to the students, adjustment in class schedules, installation of air conditioning units and/or provision of additional fans, and adopting flexible learning modalities. The students were satisfied with these initiatives of the school. Finally, there is significant relationship between the perceived risks with that of the perceived effects, the coping strategies, and the school's interventions relative to heat stress. As students exhibit coping strategies, they are, in a way, reducing their risks. On the same manner, as the school management provides necessary interventions that address heat stress, the school also aid in lowering the risks and in enhancing the coping strategies of the students.

Keywords: *Coping Strategies, Effects of Heat Stress, Heat Risk, Heat Stress*

Introduction

Heat stress, a condition caused by the body's inability to cool down properly, is increasingly becoming a concern, especially in educational settings. This phenomenon arises from prolonged exposure to high temperatures and can lead to a range of physical and cognitive impairments. For students, the effects of heat stress are particularly significant, impacting their health, academic performance, and overall well-being. Understanding the perceived risks associated with heat stress is crucial, as students may be unaware of the potential dangers or underestimate their vulnerability. These risks can include dehydration, heat exhaustion, heat stroke, and even exacerbation of pre-existing health conditions. Moreover, heat stress can impair concentration, memory, and learning abilities, thus affecting academic outcomes.

Students employ various coping strategies to mitigate the effects of heat stress. These strategies may include seeking cooler environments, staying hydrated, wearing appropriate clothing, and adjusting their study schedules to avoid the hottest parts of the day. Additionally, schools and educational institutions can play a vital role in providing a supportive environment by implementing measures such as adequate ventilation, air conditioning, and access to water. Understanding these coping mechanisms is essential for developing effective interventions that can help students manage heat stress more effectively.

The growing concern over climate change and increasing global temperatures highlights the need for greater awareness and proactive measures to address heat stress in educational settings. By exploring the perceived risks and coping strategies, this study aims to shed light on the importance of creating safe and conducive learning environments, ensuring that students of Isabela State University-Cabagan Campus can perform at their best despite challenging weather conditions. This topic is not only relevant to students but also to educators, policymakers, and parents, who play crucial roles in supporting and protecting students from the adverse effects of heat stress.

Objectives

Generally, the study aimed to assess the perceived risks and effects of heat stress to students and their coping strategies, which could serve as input for policy and institutional innovation at Isabela State University Cabagan Campus.

Specifically, the research aimed to:

1. assess the perception of students on the risk associated with heat stress;
2. determine the perception of students on the effects of heat stress;
3. identify the coping strategies of students on the effects of heat stress;
4. assess the students' level of satisfaction on schools' interventions to address heat stress;
5. determine if there is significant relationship between the variables; and
6. provide recommendations for policy and institutional innovations for an improved initiatives in dealing with heat stress.

Methodology

A. *Locale of the Study*

The study was conducted within the seven (7) academic units of Isabela State University-Cabagan Campus, namely: College of Criminal Justice Education (CCJE), College of Education (CEd), College of College of Development Communication, and Arts and Sciences (CDCAS), College of Forestry and Environmental Management (CFEM), Institute of Business Management (IBM), College of Agricultural Sciences and Technology (CAST), and College of Computing Studies, Information and Communications Technology (CCSICT).

B. *Research Design*

A cross-sectional survey research design was employed in this study. A cross-sectional survey research design is a study in which participants are selected and assessed on a current or present variable of interest at a time [1]. The participants/respondents in this study are students of Isabela State University-Cabagan Campus. The design is, therefore, best suited for this study.

C. Respondents and Sampling Procedure

The respondents in the study are students of ISU Cabagan Campus. The sampling procedure involved a non-probability sampling technique (convenient sampling technique) for the selection of respondents. A total of 583 respondents participated in the online survey. Meanwhile, the school management such as the Cluster Executive Officer, the Director for Academic Affairs, and the Director for Planning and Development, served as key informants relative to the various interventions of the school in addressing the concerns on heat stress.

D. Data Gathering

A survey questionnaire was prepared by the researchers as a guide for the assessment of the perceived risks and effects of heat stress to students, their coping strategies, and their level of satisfaction on the schools' interventions to address heat stress. The sets of questions were inputted into Google Form. Prior to data collection, the researchers sought the approval of the Cluster Executive Officer for the conduct of this research. After the approval, the link containing the survey questionnaire was shared into various Group Chats whereby Deans, Program Chairs and Class Advisers were requested to inform the students about the survey. The students' responses were solicited from May to June 2024. It is important to highlight that several recording agencies from among various stations across the globe confirmed that 2024 was the hottest year on record.

E. Data Analysis

Students' responses into the Google Form were downloaded using .csv web format which was transformed into Microsoft Excel format and subsequent processing and analyses were done for the descriptive statistics (e.g. frequency counts, percentages, and mean). Also, a 5-point Likert Scale was used to determine the levels on the respondents' perception on the risk associated with heat stress, perception on the effects of heat stress, and coping strategies of students on the effects of heat stress (Table I) and on the levels of students' satisfaction on schools' interventions to address heat stress (Table II). To determine whether the perceived risks are related with that of the perceived effects, the coping strategies, and the school's interventions relative to heat stress, a test of correlation was performed using Spearman's rho, a nonparametric correlation.

Table I. Arbitrary Levels on the Respondents' Perception on the Risk Associated With Heat Stress, Perception on the Effects Of Heat Stress and Coping Strategies of Students on the Effects of Heat Stress

SCALE	MEAN RANGE	QUALITATIVE DESCRIPTION
5	4.51-5.00	Strongly Agree
4	3.51-4.50	Agree
3	2.51-3.50	Neutral
2	1.51-2.50	Disagree
1	1.00-1.50	Strongly Disagree

Table I. Arbitrary Levels on The Students' Satisfaction on Schools' Interventions to Address Heat Stress

SCALE	MEAN RANGE	QUALITATIVE DESCRIPTION
5	4.51-5.00	Strongly Satisfied
4	3.51-4.50	Satisfied
3	2.51-3.50	Neutral
2	1.51-2.50	Dissatisfied
1	1.00-1.50	Strongly Dissatisfied

Results and Findings

F. Respondents' Perception on the Risk associated with Heat Stress

The global temperature has increased compared with the pre-industrial levels. This has resulted in the change in climatic conditions which posed significant risk to human health and wellbeing [2]. A consequence of this is increasing incidents of heat stress [3]. However, anthropogenic sources of increased heat stress are not limited to climate change, but also include the built environment and loss of green and blue spaces [4].

The perception of risk associated with heat stress differs from sectoral groups. For example, a study highlighted that for outdoor workers, there is a decrease in working hours in summer. In addition, some workers, such as daily wage laborers, are unable to modify work schedules based on heat stress. For children, it is revealed that they cry more because of the heat, and are generally uncomfortable and occasionally miss school because of heat, especially on excessively hot days [3]. Meanwhile, as presented in Table III, the study revealed that the Top 5 perceived risk associated with heat stress according to the students are: (1) I am afraid that hot weather during these days can cause me an injury or sickness; (2) People exposed to heat have a greater risk of developing serious diseases; (3) Heat is a potentially lethal risk; (4) Heat causes a fatal effect for those exposed; and (5) Prevention measures can reduce the severity of heat stress. The respondents also agreed to the different statements of risks presented to them but found neutral on the statement "heat poses a very low threat to future generations". While the respondents clearly perceived the health risks associated with heat stress, studies have already proven that vulnerable populations, including the elderly, children, and individuals with chronic health conditions, are particularly at risk [5] and the prevalence of vector-borne diseases such as dengue fever can rise with increased temperatures, further straining the healthcare system [6].

Table III. Respondents' Perception on the Risk Associated With Heat Stress

Perceived Risk	Weighted Mean	Qualitative Description
I feel that my health is threatened by the heat stress	3.96	Agree
I am involuntarily exposed to heat	3.67	Agree
Heat causes a fatal effect for those exposed	4.05	Agree
Heat is a potentially lethal risk	4.08	Agree
Heat is a risk that I have learned to live with	3.78	Agree
Heat poses a very low threat to future generations	2.94	Neutral
Prevention measures can reduce the severity of heat stress	3.99	Agree
I am afraid that hot weather during these days can cause me an injury or sickness	4.10	Agree
People exposed to heat have a greater risk of developing serious diseases	4.09	Agree
Heat stress can be a risk factor for depression and anxiety	3.86	Agree

G. Respondents' Perception on the Effects of Heat Stress

This research examined the perceived effects of heat stress to students, most of which are related to their health. A study showed that illnesses such as heat exhaustion and heatstroke emerge due to high

temperatures, and can trigger sudden events like heart attack, or worsen existing medical conditions like kidney or lung disease. In addition, heat stress can lead to increased mortality rates [7]. It can be deduced in Table IV that the respondents have experienced the effects of heat stress. Notably, the perceived effects of heat stress with the highest weighted mean is Tiredness/Exhaustion (Mean=4.27). During scorching condition, it is easy to perspire and the perspiration results to loss of water which eventually decreases energy of the body. Another perceived effects of heat stress is the difficulty in getting sleep resulting to decrease in hours of sleep, with a weighted mean of 4.21. During night time, the concrete materials gradually release the heat it absorbed throughout the day thereby leading to an increase in temperature which bring discomfort at times of sleep. The students also perceived that due to excessive heat, they were not able to study well at home and in school (Mean=4.06), and felt a burning sensation (Mean=4.02). Other perceived effects of heat stress are: dizziness and nausea; skin rashes; irritation/frustration; loss of appetite; decreased vision during excessive heat which impair studies; and decreased attendance at school or social events due to uncomfortable conditions. Meanwhile, students did not perceive the increased anger toward family members and with classmates as an effect of heat stress, with a weighted mean of 3.39 and 3.43, respectively, qualitatively described as Neutral. Although it was revealed in a study that prolonged exposure to high temperatures can lead to increased stress, anxiety, and even aggression [8]. In fact, these physiological changes can contribute to a sense of restlessness and apprehension, intensifying anxiety symptoms [9]. It can even lead to heightened mood swings, feelings of sadness, or an overall sense of emotional instability [10].

Table IV. Respondents' Perception on the Effects of Heat Stress

Effects	Weighted Mean	Qualitative Description
Dizziness and Nausea	3.90	Agree
Burning sensation	4.02	Agree
Skin rashes	3.94	Agree
Difficulty in getting sleep resulting to decrease in hours of sleep	4.21	Agree
Increased anger toward family members	3.39	Neutral
Increased anger with classmates	3.43	Neutral
Irritation/frustration	3.98	Agree
Tiredness/Exhaustion	4.27	Agree
Loss of appetite	3.71	Agree
Decreased vision during excessive heat which impair studies	3.83	Agree
Not able to study well at home and in school due to excessive heat	4.06	Agree
Decreased attendance at school or social events due to uncomfortable conditions	3.73	Agree

H. Coping Strategies of Students on the Effects of Heat Stress

Considering the unprecedented increase in the ambient temperature during the summer months, this elevates the likelihood of experiencing heat stress. To cope with the effects of heat stress, the affected population requires coping capacities to be activated. Coping capacity refers to the ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters [11]. In this case, the adverse condition brought by excessive heat. The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as

during crises or adverse conditions. Coping capacities contribute to the reduction of disaster risks. However, the study focused on assessing the coping strategies employed by the students in response to the effects brought by heat stress. It does not necessarily assess their capacities.

There are different practices on how Filipinos cope with heat stress. It is shown in Table V that students have agreed that they have adopted all the coping strategies presented with them during the survey. Foremost of the coping strategies of the students is by drinking cold water, juice or carbonated drinks with a weighted mean of 4.47, and also keeping a personal tumbler to keep drinking water, with a weighted mean of 4.37. Notably, staying hydrated is one effective way of coping with the excessive heat condition as a natural response of a human body. This helps in preventing possible health risks of dehydration. Meanwhile, students wear comfortable clothes to enhance thermal comfort (e.g. made of cotton and white in color) and bathe more frequently (twice or more in a day) to cope with heat stress, with a weighted mean of 4.39 and 4.34, respectively. In addition, students also utilized trees and parks as the preferred places to stay or resting space for thermal comfort during hot days (mean=4.34). In a study, trees were seen as the primary coping strategy for heat stress [3]. Also, cool drinking water from public taps and electric fans (particularly table fans) were other preferred coping mechanisms. The study provides other coping strategies of students such as: during scheduled power interruption, staying outdoors under a tree shade to cope with the heat; using an umbrella when outdoors; fans or handy chargeable “hand fans” were preferred for heat relief; going to malls and other establishments equipped with air conditioning units were the preferred places to stay during hot days; increased consumption of fruits and vegetables; at night, windows and doors were usually left open to cool down the house; canceling of non-essential activities due to very hot weather; attending earlier in school to catch up with the cooler condition and to get rid of busy hours that contribute to un-comfortability; regularly apply sunscreen/ sunblock; and staying indoors and less attendance to outdoor activities (be it school-related or family-related undertakings).

Table V. Coping strategies of students on the effects of heat stress

Coping Strategies	Weighted Mean	Qualitative Description
Using an umbrella when outdoors	4.23	Agree
Fans or handy chargeable “hand fan” were preferred fans for heat relief	4.17	Agree
Bathe more frequently (twice or more in a day)	4.34	Agree
Regularly apply sunscreen/ sunblock	3.93	Agree
Drinking cold water, juice or carbonated drinks	4.47	Agree
Keeping a personal tumbler to keep drinking water	4.37	Agree
Attending earlier in school to catch up with the cooler condition and to get rid of busy hours that contribute to un-comfortability	4.11	Agree
Wear comfortable clothes to enhance thermal comfort (e.g. made of cotton and white in color)	4.39	Agree
Increased consumption of fruits & vegetables	4.14	Agree
Trees and parks were the preferred places to stay or resting space for thermal comfort during hot days	4.34	Agree

Coping Strategies	Weighted Mean	Qualitative Description
Malls and other establishments equipped with air conditioning units were the preferred places to stay during hot days	4.15	Agree
During scheduled power interruption, staying outdoors under a tree shade or establishments equipped with air conditioning units to cope with the heat	4.26	Agree
At night, windows and doors were usually left open to cool down the house	4.13	Agree
Staying indoors and less attendance to outdoor activities (be it school-related or family-related undertakings)	3.88	Agree
Canceling of non-essential activities due to very hot weather	4.12	Agree

1. Students' Level of Satisfaction on School's Interventions to address Heat Stress

In the Philippines, government and non-government organizations have launched initiatives to educate the public about the dangers of heat stress and how to prevent heat-related illnesses. At Isabela State University-Cabagan Campus, efforts were pushed to address the challenge posed by the excessive heat conditions. During the interview with key informants and the review of existing office files in the school, the following were the school interventions in addressing the effects of heat stress: Conserving or maintaining greeneries and blue spaces in the school that aid in cooling; Drinking water facilities (e.g. water dispenser) made available at no cost to the students; Class schedules were shifted to an earlier start and shortened contact hours to minimize heat exposure; Installation of air conditioning units and/or provision of additional fans to improve thermal comfort of the students; and Adopting flexible learning modalities (e.g. synchronous and asynchronous mode of learning). As presented in Table VI, the students were satisfied with the schools' interventions to address heat stress with a weighted mean ranging from 4.11 to 4.26.

Table VI. Students' Satisfaction in School's Interventions to Address Heat Stress

Interventions	Weighted Mean	Qualitative Description
Adopting flexible learning modalities (e.g. synchronous and asynchronous mode of learning)	4.11	Satisfied
Class schedules were shifted to an earlier start and shortened contact hours to minimize heat exposure	4.20	Satisfied
Drinking water facilities (e.g water dispenser) made available at no cost to the students	4.20	Satisfied
Installation of air conditioning units and/or provision of additional fans to improve thermal comfort of the students	4.18	Satisfied

Interventions	Weighted Mean	Qualitative Description
Conserving or maintaining greeneries and blue spaces in the school that aid in cooling	4.26	Satisfied

J. Relationship between Perceived Risk on Heat Stress with other variables

The students have provided affirmative answers relative to the risks associated with heat stress. To determine whether these perceived risks are associated with that of the perceived effects, the coping strategies, and the school's interventions relative to heat stress, a test of correlation was performed using Spearman's rho. The 2-tailed test of significance revealed positive correlations among the variables. Notably, the test showed that the perceived effects had strong correlation with the perceived risk with a correlation coefficient of 0.753. As the identified risks are rated higher ordinally, there was also an observed higher rating for the perceived effects. These were also shown with the coping strategies and the school's interventions, with correlation coefficients of 0.578 and 0.545, respectively, denoting moderate correlation.

It is important to highlight that as there is a risk over a certain natural hazard or stimulus, the effects can be experienced by the exposed elements, the students in particular. Having experienced those effects, coping strategies have surfaced. These are natural responses embedded to human instincts needed to adapt and survive. The school management also recognized the risks and the effects associated with heat stress, thereby leading to the provision of the needed interventions of which, during the assessment, were rated satisfactorily by the students.

Table VII. Relationship Between Perceived Risk on Heat Stress With Other Variables

Variable	Correlation Coefficient	Description
Perceived Risk	1.000**	Very strong correlation
Perceived Effects	.753**	Strong correlation
Coping Strategies	.578**	Moderate correlation
School's Interventions	.545**	Moderate correlation

** Correlation is significant at the 0.01 level (2-tailed).

Conclusion

Based from the results of the study, the following conclusions were drawn:

The students were abreast of the risk associated with heat stress. They were afraid that hot weather during these days could cause injury or sickness. They perceived that people exposed to heat have a greater risk of developing serious diseases and that heat is a potentially lethal risk and could cause a fatal effect for those exposed. However, they neither agreed nor disagreed that heat poses a very low threat to future generations.

The students felt the effects of heat stress. Notably, they perceived Tiredness/Exhaustion as the most identified effects to them, followed by difficulty in getting sleep resulting in decrease in hours of sleep. They also perceived that due to excessive heat, they were not able to study well at home and in school, and felt a burning sensation. Other perceived effects were: dizziness and nausea; skin rashes; irritation/frustration; loss of appetite; decreased vision during excessive heat which impair studies; and decreased attendance at school or social events due to uncomfortable conditions.

Given the risks and the effects of heat stress to them, the students have adopted coping strategies such as drinking cold water, juice or carbonated drinks, keeping a personal tumbler to keep drinking water, wearing comfortable clothes to enhance thermal comfort, and bathe more frequently to cope with heat stress. They also utilized trees and parks as the preferred places to stay or resting space for thermal comfort during hot days.

The school management employed various initiatives to address the effects of heat stress such as: conserving or maintaining greeneries and blue spaces, water dispenser made available at no cost to the students, adjustment in class schedules, installation of air conditioning units and/or provision of additional fans, and adopting flexible learning modalities. The students were satisfied with these initiatives of the school.

There is significant relationship between the perceived risks with that of the perceived effects, the coping strategies, and the school's interventions relative to heat stress. As students exhibit coping strategies, they are, in a way, reducing their risks. On the same manner, as the school management provides necessary interventions that address heat stress, the school also aid in lowering the risks and in enhancing the coping strategies of the students.

It is recommended that:

The school administrators, faculty and staff should strengthen awareness and education campaigns on heat stress and its effects by organizing workshops or seminars to increase awareness of heat stress, its long-term effects, and prevention strategies. Students need to understand not only the immediate effects but also the possible future implications of heat stress;

An enhanced cooling infrastructure and facilities should be available on campus, including shaded areas, well-ventilated classrooms and availability of water stations to provide additional thermal comfort;

School policy that encourages students to carry personal refillable water bottles and stay hydrated throughout the day and use appropriate clothing especially during hotter months;

Adopt technology-based solutions for flexible learning during extreme heat events, allowing students to study from cooler environments if necessary;

Foster collaborative efforts with Local Government Units to implement broader heat mitigation strategies, such as tree planting, which can benefit students and the wider community; and

Conduct further studies to explore the long-term effects of heat stress on students' academic performance, mental health, and physical well-being.

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