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The Effect of Dietary Water Consumption and Environmental Humidity on Adolescent Acne

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ABSTRACT

Acne, a common dermatological condition, is often seen as a natural part of puberty, with 70% of adolescents aged 14 to 18 in Southern New Jersey reporting acne in March 2024. As teenagers become more self-conscious, acne can contribute to insecurity, anxiety, and even depression, impacting their mental health and self-esteem. Numerous treatments, from skincare products like salicylic acid and benzoyl peroxide cleansers to more invasive options like chemical peels and laser therapy, attempt to address acne. However, these treatments do not always account for individual skin differences, highlighting the need for holistic approaches. This research examines the role of dietary water consumption and environmental humidity in influencing acne severity among adolescents. By adopting healthy lifestyles, teenagers can potentially improve their skin health. The study aimed to determine the impact of water consumption on acne severity, alongside factors like environmental temperature and humidity. Findings supported the hypothesis that higher water intake correlates with reduced acne severity, aligning with Palma et al. (2015), who noted water's positive influence on skin physiology. Despite limitations, such as reliance on self-reported data and potential bias, the research suggests that lifestyle modifications can significantly affect acne outcomes. Adolescents informed by this study may prioritize hydration and environmental management, leading to clearer skin and improved self-confidence. Ultimately, this research supports the notion that controlling lifestyle-associated acne factors can foster healthier, more empowered individuals.

Introduction

Acne, one of the most common diseases in dermatology, is so frequent in young people that it is regarded as a physiological manifestation of puberty. Namely, in March 2024, 70 percent of adolescents aged 14 to 18 located in Southern New Jersey, USA, reported that they have suffered from acne. Now, in contemporary times, adolescents start developing blemishes on their faces as early as nine years old, lasting throughout the teenage years to as late as their early 20s.

Markedly, one's teenage years are a defining period of a person's life, so to a certain degree, when a young individual sustains these raised red spots on their skin, they may feel insecure. Embarrassment and apprehension, coupled with feelings of insecurity and self-deprecation unintentionally raid a teenager's mind. At an age where adolescents suddenly become overly self-aware of themselves in comparison to the world around them, acne is precisely one more aspect of his/her physical appearance to agonize about. Simultaneously, the young population's levels of depression and anxiety could be heightened to a point where self-esteem is diminished – leading suicide rates to rise. In a world where physical beauty is fixated on and praised, it is no wonder that acne has become a prominent topic of discussion amongst teenagers in classrooms and on social media. Discovering the solution to acne remains a crucial theme to contemplate as fostering a healthy and confident mental state for the young generation will usher a place for successful future leaders, scientists, and innovators.

Throughout the years, numerous treatments have been released in an attempt to mitigate the appearance of extenuating blemishes ranging from pustules and comedones to blackheads on your forehead, cheeks, nose, and chin. Skincare products such as cleansers containing "sensational curing compounds" of salicylic acid

and benzoyl peroxide that clean the face of unwelcome bacteria, dirt, and pollutants; toners that work to shrink pores and restore skin to its natural pH balance; exfoliators that remove dead skin cells to help rejuvenate the skin; along with moisturizers, serums, sunscreen, and a plethora of other products on the market that collaborate to achieve healthier, smoother, and brighter skin. Moreover, should acne intensify to a certain threshold, individuals may opt to treat their acne through alternative methods such as oral medication (Isotretinoin also known as Accutane), chemical peels, laser therapy, cortisone injections, and surgical removal (Gardner, 2023). Since skincare products do not have the same reaction on all types of skin–oily, dry, normal, combination, and sensitive–there is a growing recognition of the need for holistic approaches that eradicate acne.

Regardless of how effective these treatments are, targeting the origin of acne may appease the vigor of new pimples appearing. While hormonal changes and genetics could trigger acne by making skin oilier, one should not advocate for removal of testosterone, estrogen, progesterone, or DNA in the human body. Instead, individuals should consider assuming control over modifiable factors that significantly impact the severity of acne. Through my research, I discovered that the first step to breaking acne patterns is adopting a healthy lifestyle. Adolescents possess the capacity to take control of their skin health by managing stress levels, making healthy dietary choices, and sleeping eight hours a night. Clear skin will be a byproduct of exceptional general health. Taking charge of these controllable factors could be the key to increasing confidence among teens.

For the purpose of this research paper, I analyzed the primary factor of dietary water consumption and the side factor of environmental humidity to develop a conclusion on the connection between said variables and the severity of adolescent acne to fill the gap in the existing body of knowledge. The project goal of this research paper is to study the considered controllable aspects to construct a framework and educate adolescents on how they can take control of their acne manifestations through monitoring water intake and indoor humidity.

Literature Review

Pathogenesis

In order to fully comprehend the extent of acne treatment, the key pathogenic processes that lead to the formation of acne lesions must be acknowledged. The cause is simply put in the following: change in follicular keratinization (how skin cells in hair follicles shed), leading to blockages (comedones), excess sebum (oil) production influenced by hormones, colonization of hair follicles by bacterium, and inflammatory responses involving the body's immune system (Tan et al., 2018). Typically, adolescents are especially susceptible to acne because Growth Hormones (GH and IGF-I) reach their highest serum levels and are positively associated with triggering the development of sebaceous glands, generating increased sebum secretion; there is a higher chance that the process of follicular keratinization will be interfered with, causing acne lesions (Makrantonaki et al., 2011). Extreme occurrence of this process in the teen body highlights the need for a solution. Having discussed the biological process of pathogenesis, it is also worthy to note several factors that may contribute to the development of acne: genetics, diet (glycemic index), dairy consumption, environmental factors, occlusive cosmetics, and occupational exposures. However, Masterson (2020) and Tan all agree that the exact cause of acne has not been well established. It is an interplay of multiple factors.

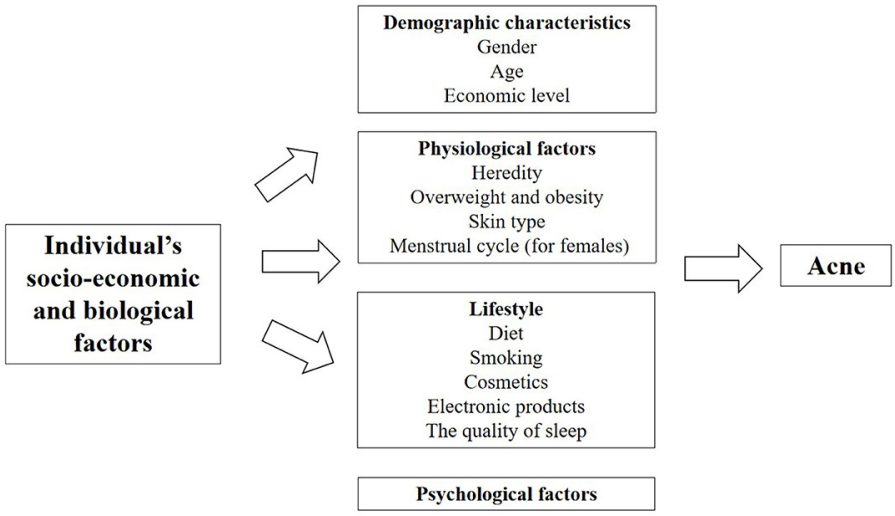


Figure 1. Factors of Natural Environment Affecting Acne. (Yang et al., 2020)

Physical Holistic (Lifestyle) Approaches to Acne Management

For the purposes of this research paper, I will consider and control specific lifestyle and environmental factors to narrow the scope of study: stress level, hours of sleep, and dietary habits since previous research has established that low quality of these aspects has the potential to exacerbate existing acne.

Both Dreno and J. Yang agree that the psychological factor of stress induces the release of neuropeptides and hormones that activate cells and pathways affecting inflammatory processes (Dreno et al., 2018; Yang et al., 2020). These two studies also indicated that individuals with acne suffered from significantly higher stress levels than acne-free individuals.

While sleep deprivation is a factor that seems to have leverage in many medical conditions, Schrom expresses that the relationship between skin disease and sleep remains unclear. Alternatively, Yang argues that sleep is much more of a defining characteristic contributing to acne than Schrom had perhaps thought. For instance, less than five hours of sleep led to significantly higher levels of transepidermal water loss than greater than five hours (Yang et al., 2020). I postulate that skin barrier damage like this leads to a weaker defense system from external stimuli, increasing acne.

Moreover, Yang argues that a "high sugar diet…dairy products…soft drinks… [and] chocolate consumption" are risk factors for acne (Yang et al., 2020). Specifically, Matsui performed similar analysis on the interaction of diet and acne and found that high glycemic load diet increases blood glucose levels, prompting the pancreas to release more insulin; these elevated insulin levels can raise androgen levels, leading to increased sebum production and hyperkeratosis in hair follicles, aggravating the occurrence of acne (Matsui, 2019). In studies reporting on a similar vein, milk and fried foods also had a positive association with acne due to the effect it has on increasing the level of insulin-like-growth factors-1 and fatty acids through triglycerides (Yang et al., 2020).

Temperature and Humidity

Temperature and humidity in different seasons and regions may also lead to varying prevalence rates of acne. Narang found particular interest in the effect of temperature and humidity on seasonal aggravation of acne in the summers of Delhi, India. According to Narang et al. (2018), 47.95% of patients reported seasonal variation in acne and 40.4% reported aggravation in summer, while only 6.42% reported aggravation in winter. Most patients noticed summer aggravation due to sweating and increased humidity. In the British Journal of Dermatology,

Williams et al. (1973) backs the above claim with evidence that sebum excretion increased by 10% for every 1°C increase in temperature. This finding brings the discussion back to sebum interference with follicular keratinization discussed in the Literature Review section. While Sardana concurred with Narang that winters do not affect the severity of acne in a majority of patients, they cite that Western dermatologists hold the belief that "acne improves in summer and worsens in winter" (Sardana et al., 2014). After searching extensively for a primary source of these traditional dermatologic opinions, I was unable to locate one. However, a study conducted in 1996 on the "Seasonal Variations in the Severity of Acne Vulgaris" neither approved nor disproved that acne worsens in the winter, noting that about one-third of the participants reported acne aggravation in the winter while one-third reported aggravation in the summer (the remaining did not notice change) (Gfesser et al., 1996). The fact that these studies were done in India's tropical climate and unspecified European countries' temperate climates could explain the uncertain discussion regarding the effect of season on acne. These conflicting results and the fact that little research has been done on this theme in literature indicates that temperature and acne need further study in more regions across the world to reach a consensus.

Water Consumption

Water is a major component of the human body and plays a vital role in normal physiological balance. It is widely accepted and generally assumed that water intake has a substantial influence on skin physiology. However, a limited number of publications have backed up this claim. Various sources in the literature point out that hydration's effect on skin and more specifically acne emerges as conspicuously overlooked in existing research. Investigating water intake and acne further narrows the scope of this study. While synthesizing this literature review, I noticed that very few studies have been conducted on these components. Palma et al. (2015) examined the effect of dietary water on human skin hydration and biomechanics. They discovered that "higher water inputs in a regular diet might positively impact normal skin physiology, in particular in those individuals with lower daily water consumptions" as expressed by the skin' hydration and biomechanical behaviors. Results of the study also suggest that higher dietary water intake functions the same on the skin as a topical moisturizer. Despite the implications of increased water intake, only Group 1 (consuming less than 3,200 mL/day) revealed a "significantly modified superficial and deep skin hydration" (2015) while Group 2 (consuming more than 3,200 mL/day) did not receive much of a change. These outcomes potentially suggest that water consumption has little effect on people who already drink adequate amounts of water regarding the skin's ability to retain moisture or that the epidermis commonly self-regulates to a state of moisture equilibrium. Furthermore, there remains a need for a precise definition for the daily requirement of water intake. Although Palma proposed the significance of dietary water on human skin function, there remains a significant gap in the literature as far as decisive evidence of the role of dietary water intake on the severity of adolescent acne. I infer that this gap exists due to the reason that people may hold the view that the effect of acne is trifling especially since the topic mainly pertains to appearance and beauty. Evolving my research purpose, I recognized that given the correlation between hydration and environmental temperature/humidity, studying these variables in conjunction could lead to better-based treatments concerning dietary water consumption.

Hypothesis

This study sets the stage for addressing the gap in understanding how water consumption levels impact acne severity among adolescents aged fourteen to eighteen in Camden County, New Jersey. Based on my exploration of existing literature, I hypothesize:

1. As dietary water consumption increases up to a certain threshold, the amount and severity of facial acne decreases.
2. During the colder months, acne will reduce due to lessened sebum production in low humidities and temperatures.
3. During the warmer months, acne will worsen due to increased sebum production or elevated fluidity of sebum in higher humidities and temperatures.

Methodology

Online Survey

For the purposes of this research, it is necessary to conduct an online survey via Google Forms for the adolescent demographic composed of 14-18-year-olds. This method works effectively in gathering qualitative and quantitative information from the target population both conveniently and quickly for the researcher. Another benefit of Google Forms is that questions could be marked as required to be answered for the submission of the form, helping to mitigate missing data. In my case, the type of data my method will generate is quantitative, helping to correlationally answer the following research question: What are the perceptions of adolescents aged 14 to 18 in Camden County, NJ regarding the impact of their daily dietary water intake and environmental humidity on the severity of their acne? Additionally, how does the level of daily dietary water intake correlate with the severity of acne in this population? The advantages of surveys are some of the main driving factors behind their abundance in modern research. This is one of the methods used by Wolkenstein (2017), when he discovered from representative samples of individuals aged 15-24 years all across Europe that self-reported acne was high in adolescents/young adults and heredity was the main risk factor for acne development. This age range was chosen because acne prevalence is typically highest at age 15-17 years as shown below (Lynn et al., 2016).

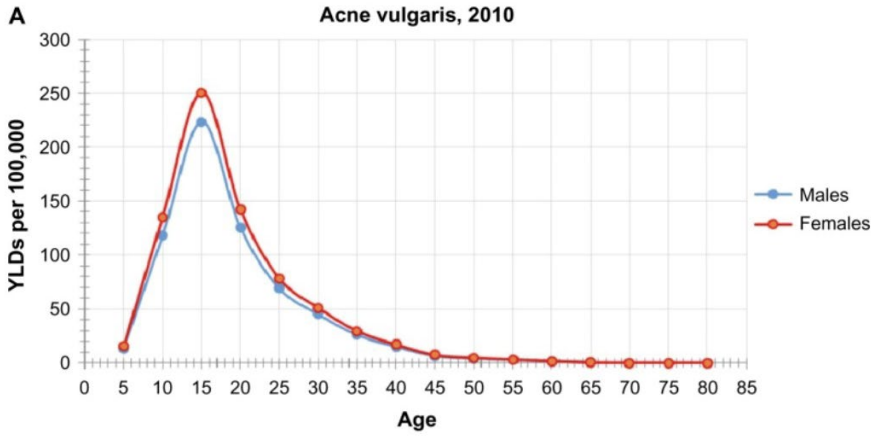


Figure 2. The years living with the disability (YLD) by age (Lynn et al., 2016)

Convenience of accessing participants and my personal association to the specified population were also part of the rationale. Although the limitations of survey research exist, such as sampling/response bias, surveys give researchers a detailed, systematic, and replicable way to view and analyze data. Using this method, the frequency and severity of adolescent acne and associated factors can be quantified.

Basic Procedure

This is a correlative epidemiology study employing a quantitative approach. The method of data collection consisted of four main steps:

1. Studying the existing literature under the umbrella of skin health
    a. to effectively design a survey that addresses all aspects of adolescent acne
2. Crafting a Google Forms survey with questions separated into five sections (as they appeared in my survey):
    a. Reasons for Implementing these Specific Subsections:
        i. *Demographic*: Existing literature suggests that age, gender, and the amount of melanin in skin affect fluctuations in acne. Although the direct correlation between the aspects above and acne are insufficiently studied, ensuring that these specific qualities are marked down could lead to further deeper investigation of the results.
        ii. *Basic Skin Questions*: Different skin types require different needs, particularly when it comes to topical treatments such as cleanser and moisturizer. Whether the participant had past personal and current experience with acne also provided a measure of the population that suffered from the condition, giving a meaningful statistic on the percentage of the population. Perception of the mental aspect of acne revealed further insight into the stance that adolescents hold, which could potentially address the purposes of the study detailed in the literature review.
        iii. *Dietary Water Consumption*: I found that in my personal experience when I drank more water, my skin would look brighter and clearer the following day. Palma et al. (2015) also led me to believe that skin physiology and biomechanical behaviors such as repair, regulation, and suppleness could be positively influenced by water intake.
        iv. *Temperature and Humidity*: Existing literature is conflicting regarding the effect of these variables on acne prevalence. For instance, Narang et al. (2018) argue that acne is aggravated in the summer, while Gfesser et al. (1996) neither approves nor disproves that statement.
        v. *Additional Variables*: Taking into account the main underlying extraneous variables increases the complexity and accuracy of this study through full comprehension of the global issue of acne. It also helps to gain greater control of these variables.
3. Obtaining informed consent for minors
4. Distributing the survey among high school students from ages 14 to 18 in Camden County, NJ

Participants and Setting

The state where this study is conducted in, New Jersey, is a part of the Mid-Atlantic region in the US with a total population of approximately 9.3 million with 1.38 million high schoolers enrolled as of 2024 (NJDOE, 2024). Choosing Camden as the area of study was most fitting for this project because it allows for easy access to participants and existing knowledge on the seasonal patterns. The majority of participants attend the same grade 9-12 public high school with approximately 500 students per class. Located in an economically stable area, this high school is ranked in the top 20% of all public schools in NJ, so the curriculum rigor and workload

is placed on the higher boundary. These students may feel more academic stress compared to their outside school peers. This may be worth noting before analysis of results.

Categories of Attention

Within this study, I presented participants with an assortment of 21 required questions including multiple choice, checkboxes, 'Yes' or 'No,' and five & six-point likert scales to target five specific areas of interest:

Demographic, Basic Skin Questions, Dietary Water Consumption, Temperature and Humidity, and Additional Variables. These question types were chosen to ensure that they encompassed the best way to accurately inquire and obtain valid results for the greater purpose of answering my research question. Inquiring about these particular sectors allowed me to gain a greater perception of the background of participants, variables of study, and extraneous variables that may have influenced results. Making a survey allowed me to acquire universal responses from adolescents.

Results

Overview of Findings

Initially, I hypothesized that water consumption is tied to acne severity such that when water consumption decreases, acne severity increases. This type of connection would work in the opposite direction where when water consumption increases, acne severity decreases. I based my hypothesis on the basis that existing literature suggests that water is necessary for the well-being of the human body.

In addition to water consumption, I concentrated on the impact of temperature and humidity on the severity of acne. I hypothesized that during the winter season, an individual's acne would get worse due to the lack of moisture in the air. Since acne is the result of clogged pores and excessive sebum production, I hypothesized that adolescent skin would generally overproduce oils during durations of low humidity.

Several other controllable factors including sleep, diet, stress, and skincare products and cosmetics were also accounted for during the data collection process. I aimed to determine which controllable factor has the greatest impact on adolescent acne in order to better understand and inform teenagers about the various ways in which they can make the most rational decisions to treat their acne.

Demographic

I sent out an online Google Form survey to high school students aged 14 to 18 years old in Camden County.

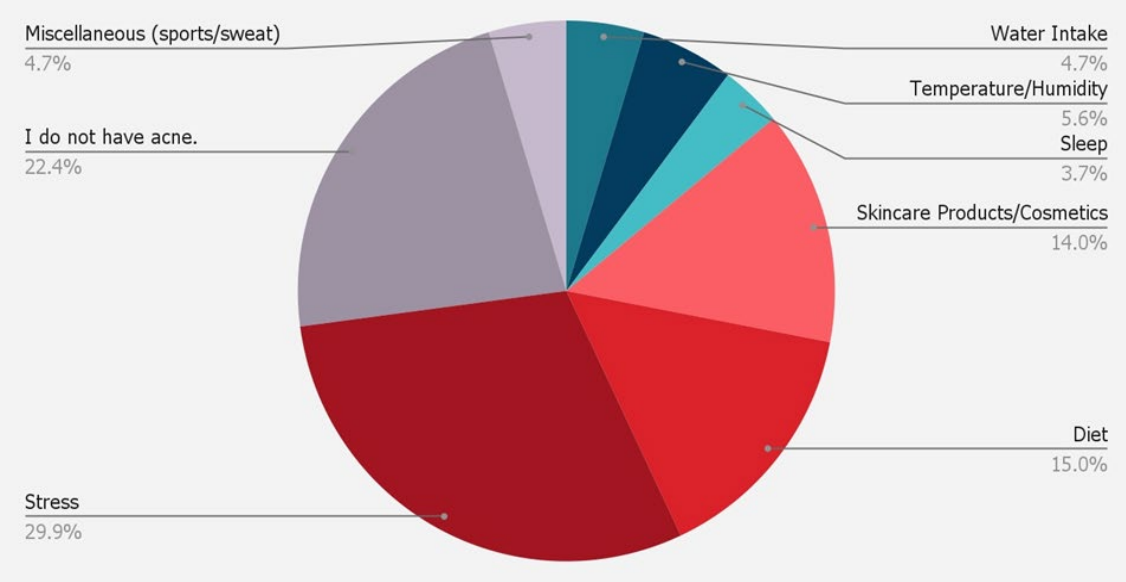
107 students responded. The average age of a respondent was 16.1 years old with the greatest number of respondents being 17 years old (30/107, 28%). Close to 70% of the population identified as female while 30% identified as male. The majority of the sample population (52.3%) were of the ethnic background of Asian, encompassing East, South, Central, West, Southeast, and South Asians while the other 40.2% were White or of European descent. The remaining 7.5% consisted of Black, Hispanic/Latino, Middle Eastern/North African, and Pacific Islander. Although age, gender, and race may not have a particular effect on acne, control of the sample population ensures that analysis is accurate.}

Table 1. Demographic information of adolescents

Characteristics	N=107	%
Age		
14	11	10.3
15	28	26.2
16	24	22.4
17	30	28
18	14	13.1
Gender		
Male	34	31.8
Female	73	68.2
Race		
White	43	40.2
Asian	56	52.3
Black	2	1.9
Hispanic/Latino	1	0.9
Middle Eastern/North African	3	2.8
Pacific Islander	2	1.9

70.1% of the sample population indicated "Yes" when asked, "Have you ever suffered from acne?" while 29.9% of the population indicated "No." 60.7% of respondents stated that they still suffer from acne while 39.3% stated that they do not suffer from acne anymore.

Teen Perception of Acne-Related Factors

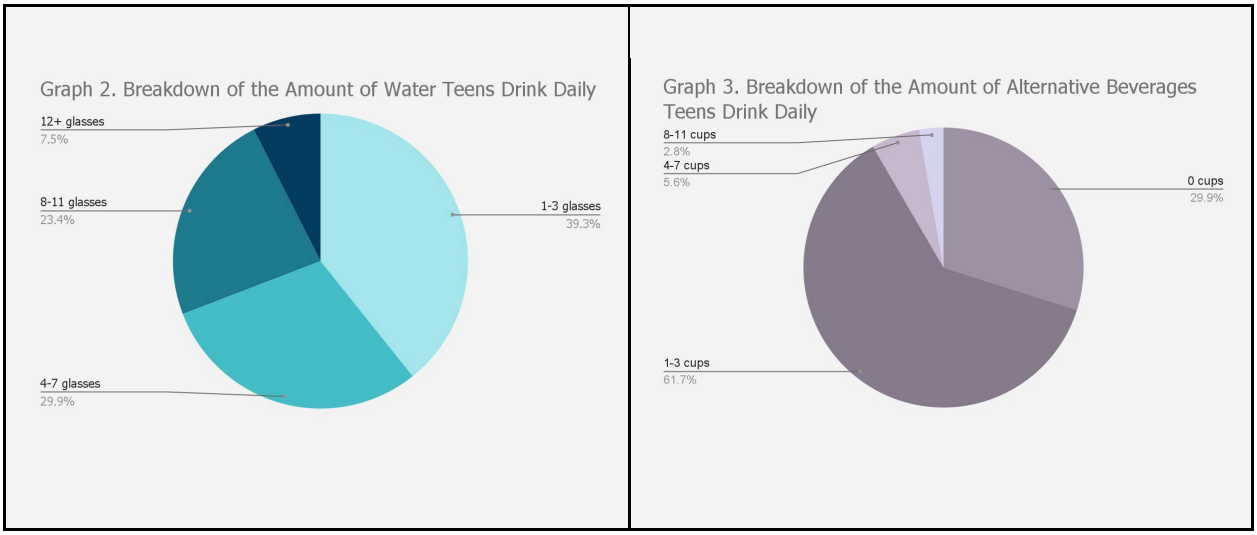


Graph 1. Teen perception of the biggest lifestyle factor that affects their own acne.

Most adolescentes agree:

1. *Stress* – 29.9%
2. *Diet* – 15%
3. *Skincare Products and Cosmetics* – 14% have the largest effect on their individual acne. It is apparent that *Water Intake* (4.7%) and *Temperature/Humidity* (5.6%) have a perceived minor effect on acne according to teens.

The Role of Water Consumption and Hydration on Acne



According to the sample population, most adolescents aged 14-18 drink 1 to 3 glasses of water a day, which is one fourth of the recommended amount of water intake by the National Academy of Medicine, which recommends that individuals aged 14-18 years drink 8-11 cups or 64-88 ounces of water a day. Survey results show that most teens are aware that they fail to drink enough water.

Factoring in alternative beverage (AB) consumption such as juice, fizzy drinks, milk, coffee, tea, or soup could also play into the role of liquid intake on the severity of adolescent acne. Averaging the amount of water and AB consumed per day, I added 5.55 glasses to 0.16 cups to get 5.71 cups of daily liquid consumption as the mean of the data set.

Steps Taken to Employ a Correlation Study

In my study, water consumption is the independent variable that I will be measuring and exploring the effects of; the severity of acne is the dependent variable that I predict depends on altering levels of water consumption. Refer back to "Hypothesis" in the Literature Review.

To start evaluating results, I compiled all of my data collected from my survey into a Google Sheets spreadsheet. As shown below, I then converted the range of glasses of water to a water consumption scale, allowing me to identify a single number associated with the range of water consumption.

Table 2. Numeric rating scale and glasses of water conversation.

Scale *numeric rating*	Water (glasses) *1 glass = 8 ounces = 240 mL*
1	1 to 3
2	4 to 7
3	8 to 11
4	Greater than or equal to 12

Table 3. Global acne assessment chart

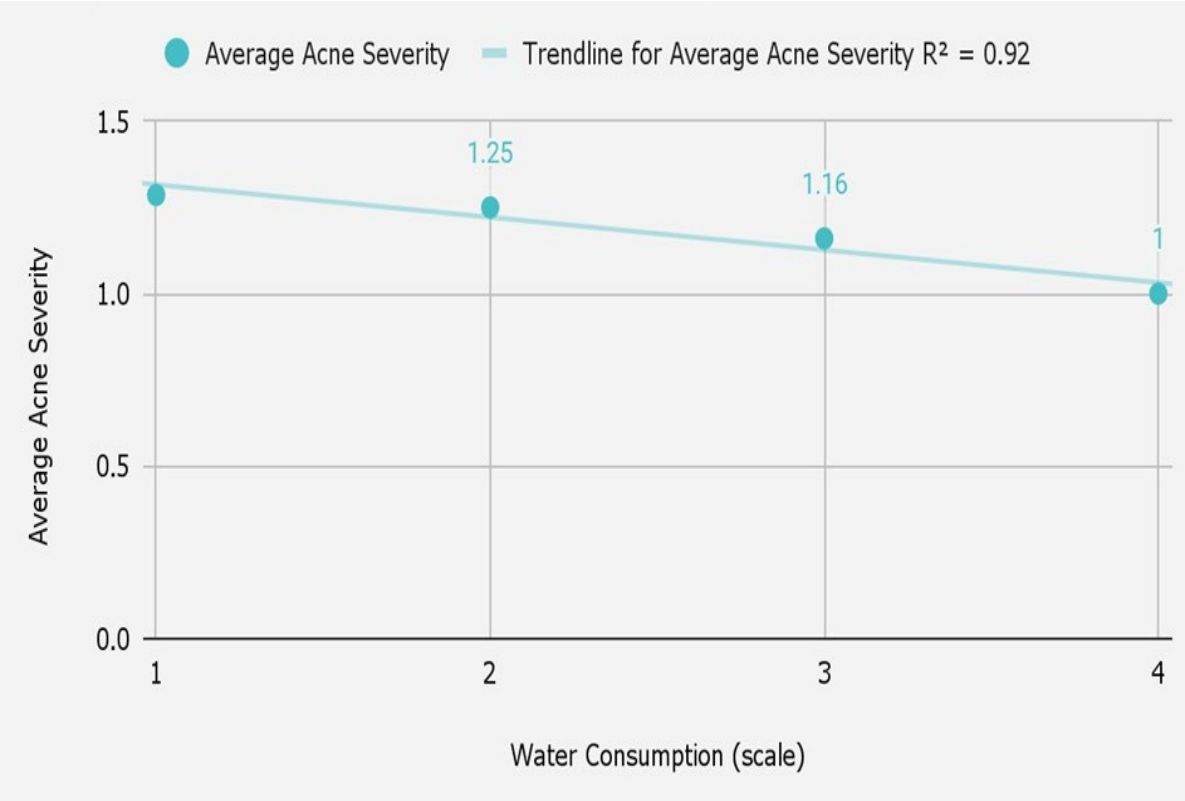
0	Clear	Residual hyperpigmentation and erythema may be present.
1	Almost clear	A few scattered comedones and a few (less than five) small papules are present.
2	Mild	Easily recognizable; less than half of the face is involved. Many comedones and many papules and pustules are present.
3	Moderate	More than half of the face is involved. Numerous comedones, papules and pustules.
4	Severe	Entire face is involved and covered with comedones, numerous papules and pustules, and few nodules and cysts.
5	Very severe	Highly inflammatory acne covering the face; nodules and cysts are present.

Provided chart on the survey for teens to rate the severity of acne on a scale (Jiang et al., 2018).

Participants were asked two questions:

1. How many glasses of water do you drink on a daily basis?
2. How would you rate the severity of your acne at this point in time?

The answers that they selected from were based on Table 1 and 2. After compiling these results, I found the average acne severity according to each level of water intake.

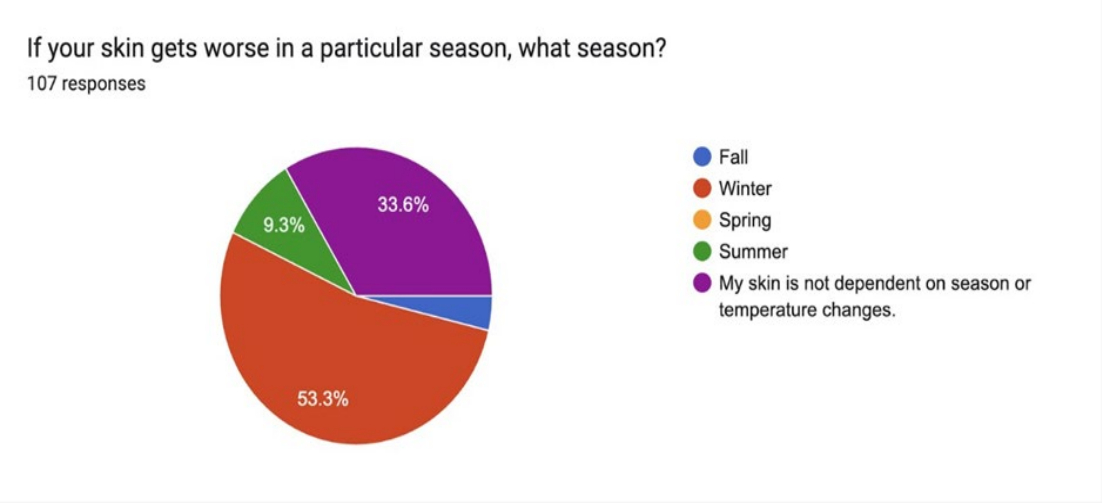


Graph 4. The effect of water consumption on acne severity

After graphing the values on a chart, a negative correlation exists between water consumption and acne severity. The R-squared value is 0.92, meaning water consumption may have a high predictability of acne severity due to its low variance from 1. To reinforce the R-squared value, I calculated Pearson's correlation coefficient with all 107 rows of data. R evaluated to be -0.0582, indicating a weak negative correlation. I believe the fact that I averaged the acne severity for R-squared is the reason that there is some disparity in the calculations because the scale was altered. In this case, the R-value would be more accurate in displaying the significance of results. Ultimately, water consumption and acne severity are perceived as having a weak correlation. As water consumption increases, acne severity tends to decrease, and vice versa. These results verified my initial hypothesis that greater water consumption would lead to less accumulation of acne.

Although water consumption and acne severity appear to be inversely related, several factors could have contributed to the results being skewed. For instance, human error may have been at the forefront of the inaccuracies of this experimentation. Respondents were asked to answer the questions based on their best knowledge, so it is likely that they could have indicated an inaccurate answer choice while selecting their daily water consumption and acne severity. Another limitation to consider is social desirability bias. This especially aligns with teens because they tend to want to present themselves in a positive light. As a result, they may have reported a lessened degree of acne to be viewed more favorably by others. I attempted to eliminate this bias by stating that the results would be kept entirely anonymous. Additionally, the fact that people drink other beverages may have skewed the data. It is harder to approximate the variation in data for this aspect.

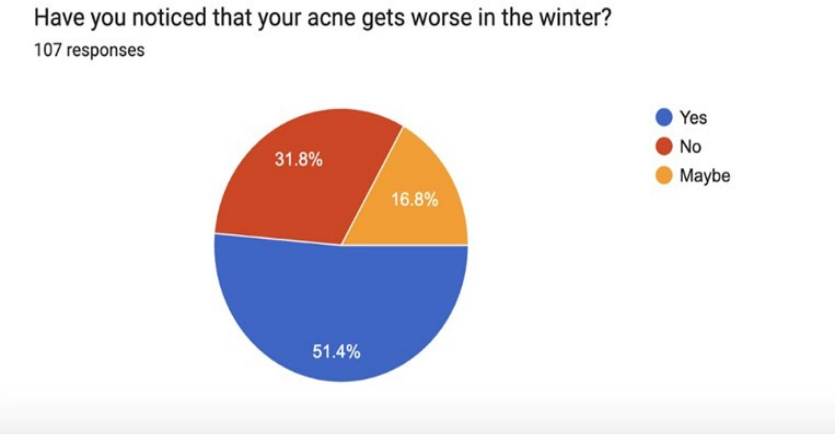
The Role of Temperature and Humidity on Acne



Graph 5. Seasonal Variation in Acne

53.3% of respondents indicated that they notice that their skin gets worse during the winter season. There was also a marked population (33.6%) that stated that their "skin is not dependent on season or temperature changes."

A drawback to the question in Graph 5 is that the term "skin gets worse" is vague and could be up to interpretation to mean an array of things such as worsened acne, drier skin, oilier skin, and etc.



Graph 6. Verification of seasonal variation in the winter.

Graph 6 displays a question that asks if the teenagers have observed that their acne gets worse in the winter.

A little more than half of the sample population agreed that it does, while 16.8% were unsure and 31.8% disagreed. One participant noted that more could be done to define the term "acne" since people may not have the same perception of what it means. I believe that this modification would have allowed for surveyor greater accuracy.

Upon reflection, I also realized that the presentation of these two questions in the survey were flawed since the question immediately after "If your skin gets worse in a particular season, what season?" is "Have you noticed that your acne gets worse in the winter?" indicating to the participant that winter likely affects acne.

Before curating the survey, a step that I should have taken would be to get rid of the second question as a whole to eliminate any
bias.

A reason that I was led to create the second question was because of conflicting existing literature about the role temperature plays in acne. For instance, 6 in 10 Americans suffer from drier skin in the winter due to the lack of moisture in the air (New York Post, 2019). Cold temperatures signify cold air that holds less moisture than warm air. Due to the fact that "water molecules in the air are held together by pressure" and "the maximum possible vapour pressure is lower in cold air than it is in warm air" (NASA, 2009), cold air contains less moisture. These sources led me to believe that when skin becomes dry, the body may kickstart or increase sebum production to accommodate the decrease in moisture. Panoxyl (2021) also stated in an article that "throughout winter, heated, indoor air is dry, causing your sebum-making glands to go into overdrive, making your face oily" and it is an established fact that oily skin is more prone to acne breakouts and clogged pores. In the article by Panoxyl, although credible as a skincare brand, there was no study conducted that confirmed the conclusions stated above. Before distributing the survey, I should have investigated more scientific studies that could have led me to create more targeted questions. After examination of the existing body of knowledge, still, the exact relationship of seasonal variation on acne is not fully understood and may vary from person to person.

Questions regarding additional variables such as sleep, diet, stress, and skincare products were also asked on the survey (See Appendix). I noticed that individuals who had less sleep, unhealthy diet, and greater stress tended to have more severe acne. The use of skincare products and cosmetics did not have any correlation with the severity of acne.

Conclusion and Future Directions

The main aim of this paper was to determine whether or not water consumption affects acne severity or the prevalence of acne. Temperature and humidity and the presence of water in the environment was also a factor tracked in this study. Other prevalent controllable factors such as sleep, diet, stress, and skincare products and cosmetics were also accounted for. The main takeaway from my research relates back to my initial hypothesis that higher water consumption correlates with decreased acne. The opposite also applies where lower water consumption correlates with increased acne or more severe acne. This finding supports the discussion of Palma et al. (2015) that water intake has a positive influence on skin physiology, indicating that water consumption has some sort of connection to skin hydration balance. Moreover, the results compiled from my survey and the presence of inconsistent literature suggest that season has less of an effect on acne severity. My findings make the role of water consumption and season on acne severity more clear, working to fill holes in the literature.

One big picture limitation of this new understanding is that it is based on survey responses and not a quantitative scientific experiment. Before completing the survey, some of the respondents may have had some sort of bias ahead of time if they knew what factors the research study was attempting to examine. This type of bias could have skewed the results in the direction that the research favored. As a researcher, bias was attempted to be mitigated through titling the survey as "Adolescent Acne Survey" so as to eliminate potential bias on the topic. Another limitation to this study is that there could have been more coverage on people with severe acne as many of the people had mild acne or close to clear skin.

My results allow for the future direction of controlling lifestyle-associated acne factors. Adolescents now have greater knowledge on how their actions could affect their acne. Specifically, adolescents may make greater efforts towards drinking adequate amounts of water and managing the environment such as air conditioning and the presence of an indoor humidifier. Their increased consumption of water and course of action may lead to better health and fewer blemishes. Maintain great general health with deliberate choices. Along with physical benefits, decreased acne severity also ties into the mental wellbeing of an individual. With the onset of healthier and clearer skin, teenagers may also experience an influx of self-confidence and expand the

action of advocating for themselves and their needs. My research helps to support and guide the growth of a future of empowered thinkers, leaders, and innovators.

Acknowledgments

I would like to thank my advisor for the valuable insight provided to me on this topic.

References

Dreno, B., Bettoli, V., Araviiskaia, E., Viera, M., & Bouloc, A. (2018). *The influence of exposome on acne* (pp. 812–819). University Hospital Nantes, Nantes, France. Retrieved from https://onlinelibrary.wiley.com/doi/full/10.1111/jdv.14820

Gardner, S. (2023, September 17). Acne Treatments That Work. Retrieved January 5, 2024, from https://www.webmd.com/skin-problems-and-treatments/acne/acne-treatments-that-work

Gervis, Z. (2019, January 8). Americans are plagued by 'winter skin syndrome.' Retrieved January 5, 2024, from https://nypost.com/2019/01/08/americans-are-plagued-by-winter-skin-syndrome/

Gfesser, M., & Worret, W. (1996). *SEASONAL VARIATIONS IN THE SEVERITY OF ACNE VULGARIS*. Technical University Munich, Germany. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-4362.1996.tb03274.x

Gunilla of Sweden. (2017, August 25). The Importance of Knowing your Skin Type. Retrieved January 5, 2024, from https://gunillaofsweden.com/the-importance-of-knowing-your-skin-type/

Jiang, L., Hino, P., Parker, L., Stephens, T., McCook, J., & Gotz, V. (n.d.). *Efficacy and Tolerability of an Acne Treatment Regimen with Antiaging Benefits in Adult Women: A Pilot Study*. Thomas J. Stephens and Associates, Inc. Retrieved from https://jcadonline.com/acne-antiaging-june-2018/

Lynn, D., Umari, T., Dunnick, C., & Dellavalle, R. (2016). *The epidemiology of acne vulgaris in late adolescence* (No. 26955297). University of Colorado School of Medicine. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4769025/

Makrantonaki, E., Ganceviciene, R., & Zouboulis, C. (2011). *An update on the role of the sebaceous gland in the pathogenesis of acne* (No. 21519409). Dessau Medical Center.

Masterson, K. (2020). *Acne Basics Pathophysiology, Assessment, and Standard Treatment Options*. Randall Dermatology, West Lafayette, IN. Retrieved from https://journals.lww.com/jdnaonline/fulltext/2018/01001/acne_basics__pathophysiology,_assessment,_and.2.aspx

Matsui, M. (2019). *Update on Diet and Acne*. Columbia University. Retrieved from https://www.farmakeftikamanitaria.gr/uploads/2/0/5/8/20582858/ct104001011.pdf

Narang, I., Sardana, K., Bajpai, R., & Garg, V. (2018). *Seasonal aggravation of acne in summers and the effect of temperature and humidity in a study in a tropical setting*. Maulana Azad Medical College. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/jocd.12777

NASA. (n.d.-a). Understanding Climate. Retrieved January 5, 2024, from https://sealevel.jpl.nasa.gov/ocean-observation/understanding-climate/air-and-water

NJDOE. (n.d.-b). Fall Enrollment Reports. Retrieved January 5, 2024, from https://www.nj.gov/education/doedata/enr/

Palma, L., Marques, L., Bujan, J., & Rodrigues, L. (2015). *Dietary water affects human skin hydration and biomechanics*. Research Center for Health Science and Technologies, Universidade Lusófona, Campo Grande, Lisboa, Portugal. Retrieved from https://www.tandfonline.com/doi/pdf/10.2147/CCID.S86822

Panoxyl. (2021, December 9). Why is my skin oilier in the winter? Retrieved January 5, 2024, from https://panoxyl.com/why-is-my-skin-oilier-in-the-winter/

Sardana, K., Sharma, R., & Sarkar, R. (2014). *Seasonal Variation in Acne Vulgaris—Myth or Reality*. Lady Hardinge Medical College & Smt. Sucheta. Kriplani Hospital. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1346-8138.2002.tb00313.x

Schrom, K., Ahsanuuddin, S., Baechtold, M., Tripathi, R., Ramser, A., & Baron, E. (2019). *Acne Severity and Sleep Quality in Adults*. University Hospitals Cleveland Medical Center. Retrieved from https://www.mdpi.com/2624-5175/1/4/39

Tan, A. U., Schlosser, B. J., & Paller, A. S. (2017). *A review of diagnosis and treatment of acne in adult female patients* (No. 29872679). Northwestern University. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5986265/

Williams, M., Cunliffe, W., Williamson, B., Forster, R., Cotterill, J., & Edwards, J. (1973). *The effect of local temperature changes on sebum excretion rate and forehead surface lipid composition Get access Arrow* (pp. 257–262). The General Infirmary, Leeds, St James's (University) Hospital, Leeds, and Harrogate General Hospital. Retrieved from https://academic.oup.com/bjd/article-abstract/88/3/257/6662854

Wolkenstein, P., Machovcová, A., Szepietowski, J. C., Tennstedt, D., Veraldi, S., & Delarue, A. (2017). *Acne prevalence and associations with lifestyle: a cross-sectional online survey of adolescents/young adults in 7 European countries*. Hôpital Henri Mondor, APHP, UPEC, Créteil, France. Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/jdv.14475

Yang, J., Yang, H., Xu, A., & Li, H. (2020). *A Review of Advancement on Influencing Factors of Acne: An Emphasis on Environment Characteristics*. The Center for Modern Chinese City Studies, East China Normal University. Retrieved from https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2020.00450/full#B21