Sivas Cumhuriyet University
Journal of Sport Sciences

| cuspor.cumhuriyet.edu.tr | Founded: 2020 Available online, ISSN: 2717-8919 Publisher: Sivas Cumhuriyet Üniversitesi

Severe Hypohydration and Inadequate Knowledge, Attitude, And Behaviour Among Collegiate Combat Sport Athletes

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Research Article

Acknowledgment
The authors declare no conflict of interest.

History
Received: 02/05/2025
Accepted: 01/08/2025

ABSTRACT

This study investigated hydration and fluid intake knowledge, attitude and behaviour, and hydration status via urine specific gravity (USG) and urine colour (UC) in collegiate combat sports athletes. Forty-four athletes (judo, taekwondo, and kickboxing) voluntarily participated in the study. Hydration survey was applied and hydration status was measured via USG and urine UC at the beginning of the preparation period. Sport had no significant main effect on hydration and fluid intake knowledge scores (F2-41=0.09, p=0.91). Moreover, it had no significant main effect on attitude scores (F2-41=0.83, p=0.44). Behavior sub-dimension scores did not differ among sports (F2-41=2.08, p=0.14). Moreover, athletes' USG values showed no difference (F2-41=1.96, p=0.15) and UC (F2-41=0.07, p=0.93). A positive moderate correlation between knowledge and behavior sub-dimensions (r=0.488, p=0.001), and nearly perfect correlation between USG and UC (r=0.950, p=0.000). According to USG classification, most athletes presented hypohydration (66%), while only 34% were classified as hydrated. This study suggested that hypohydration is common and level of knowledge, attitude and behavior is low in collegiate combat sport athletes. Therefore, comprehensive educational interventions are suggested for these athletes and their coaches with proper rehydration process, individual fluid intake and monitoring hydration status.

Keywords: Hydration, Judo, University Athletes, Health, Kickboxing

Üniversiteli Mücadele Sporcularında Yüksek Hipohidrasyon Ve Yetersiz Bilgi, Tutum Ve Davranış Düzeyi

Bilgi
Yazarlar herhangi bir çıkar çatışması bildirmemektedir.
**Sorumlu yazar*

Süreç
Geliş: 02/05/2025
Kabul: 01/08/2025

ÖZ

Bu çalışma, üniversite düzeyinde mücadele sporları yapan sporcuların hidrasyon ve sıvı alımı konusundaki bilgi, tutum ve davranışlarını ve idrar özgül ağırlığı (İÖA) ve idrar rengi İR yoluyla hidrasyon durumlarını araştırmayı amaçladı. Kırk dört sporcu (judo, tekvando ve kickboks) gönüllü olarak çalışmaya katılmıştır. Hidrasyon anketi uygulandı ve hazırlık döneminin başında İÖA ve İR ile hidrasyon durumu ölçüldü. Spor dalının hidrasyon ve sıvı alımı bilgisi puanları üzerinde önemli bir etkisi yoktu (F2-41=0,09, p=0,91). Ayrıca, tutum puanları üzerinde de önemli bir etkisi yoktu (F2-41=0,83, p=0,44). Davranış alt boyutu puanları sporlar arasında farklılık göstermedi (F2-41=2,08, p=0,14). Ayrıca, sporcuların İÖA değerleri (F2-41=1,96, p=0,15) ve İR (F2-41=0,07, p=0,93) arasında fark görülmedi. Bilgi ve davranış alt boyutları arasında pozitif orta düzeyde bir korelasyon (r=0,488, p=0,001) ve İÖA ile İR arasında neredeyse mükemmel bir korelasyon (r=0,950, p=0,000) vardı. İÖA sınıflandırmasına göre, sporcuların çoğu hipohidrasyon (66%) gösterirken, sadece %34'ü hidre olarak sınıflandırıldı. Bu çalışma, hipohidrasyonun yaygın olduğunu ve üniversite mücadele sporcularında bilgi, tutum ve davranış düzeyinin düşük olduğunu ortaya koydu. Bu nedenle, bu sporcular ve antrenörleri için uygun rehidrasyon süreci, bireysel sıvı alımı ve hidrasyon durumunun izlenmesi ile kapsamlı eğitim müdahaleleri önerilmektedir.

Anahtar Kelimeler: Hidrasyon, Judo, Üniversiteli sporcular, Sağlık, Kick boks

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How to Cite: Taşkın H.B., Ceylan B., Simenko J., Mekic A., and Baydil B. (2025). Severe Hypohydration And Inadequate Knowledge, Attitude, And Behaviour Among Collegiate Combat Sport Athletes. *Sivas Cumhuriyet University Journal of Sport Sciences, 6*(2):45-52

Introduction

Combat sports refer to contact sports where athletes participate in one-on-one fighting under particular rules that vary based on the sport. Such sports can use striking tactics like punches and kicks, grappling techniques like chokes and joint locks, or a combination (Barley, Chapman, Guppy, & Abbiss, 2019). Combat sports are often classified as grappling, striking, or mixed-style disciplines. The federations split competitors by their body weight to ensure they are of equal size and decrease the risk of injury (Pallarés et al., 2016). However, combat sports athletes usually resort to weight loss by decreasing substantial body weight in the days and weeks preceding weigh-ins to gain a competitive advantage and be paired with a smaller opponent (Artioli et al., 2010; Barley, Chapman, & Abbiss, 2019). This technique is prevalent in almost all combat sports. Sixty to 80% of the athletes in competitive combat sports, including but not limited to Brazilian jujitsu (BJJ), taekwondo, boxing, judo, kickboxing, and wrestling, typically participate in weight loss. Prior to competition in combat sports, a variety of weight loss methods have been used, including energy intake restriction (gradual dieting and fasting), total body fluid reduction (restricting fluid intake, increasing sweat response (heated wrestling, plastic suits, saunas and spitting), and pseudo extreme/abusive medical practice (laxatives, diet pills, diuretics, sporting bulimia/vomiting) (Artioli et al., 2010; Ceylan, Barley, & Balci, 2023; Kons, Athayde, Follmer, & Detanico, 2017).

One of the most common methods, fluid deficit, in other words “hypohydration”, is common in combat sports athletes before and during competitions due to rapid weight loss among athletes (Bialowas, Laskowski, Franchini, & Kujach, 2023; Ceylan, Aydos, & Šimenko, 2022; B. Ceylan, Oliver R. Barley, et al., 2023; Ceylan, Baydil, & Aydos, 2021; Janiszewska & Przybyłowicz, 2020; Jetton et al., 2013). In most of the abovementioned studies, most athletes presented hypohydration before, during and after the competitions. Hypohydration has a detrimental impact on health and athletic performance. It is often associated with reduced plasma volume and deleterious effects on cardiovascular function (González-Alonso, Mora-Rodríguez, Below, & Coyle, 1997). Furthermore, Cheuvront and Kenefick (2014) found that more than 2% hypohydration reduces endurance, strength, and power performance. Jones, Cleary, Lopez, Zuri, and Lopez (2008) also stated that the ability to generate upper and lower body anaerobic power with a dehydration level of 2.9% body mass decreased. Even modest dehydration (1-2% body weight) reduces athletic performance (S. A. Kavouras, 2002). Furthermore, altered bodily water balance can result in diminished cognitive functioning, such as slower decision-making time (Cian, Barraud, Melin, & Raphel, 2001), lower levels of attentiveness and poor psychomotor performance (Shirreffs, Merson, Fraser, & Archer, 2004) and lowered mood levels (Dube, Gouws, & Breukelman, 2022). Weight-classified athletes often lose 5-13% of their body weight (B. Ceylan, Oliver R. Barley, et al., 2023; Matthews, Stanhope, Godwin, Holmes, & Artioli, 2019; Steen & Brownell, 1990), suggesting that hypohydration may deleteriously impact performance after rapid weight loss.

Hydration can be assessed via various markers (Barley, Chapman, & Abbiss, 2020); however, the Urine Specific Gravity (USG) has been widely used and recognized as a fast, accurate, non-invasive assessment tool in addressing hydration status (Zubac, Marusic, & Karninčič, 2016). Many studies investigated the hydration status of combat sports athletes during training (Ceylan & Santos, 2020; B. Ceylan, M. Taşcan, J. Simenko, & Ş. Balcı, 2023; Pettersson & Berg, 2014; Rivera-Brown & De Félix-Dávila, 2012; Stefanovsky, Clarys, Cierna, & Matejova, 2019). The participants' competitive levels and ages differ, but the results are the same; athletes presented high hypohydration levels during training days with mostly fluid intake ad libitum. A current study by (Ceylan et al., 2023) monitored high-level senior judo athletes' hydration status and fluid intake during a weight-stable training camp and stated the results were perilous. All athletes presented a high level of hypohydration (USG >1.020) during the six measurement times with no change in body mass. Moreover, they did not intake enough fluid to eliminate hypohydration within 24 hours. However, even though the state of hypohydration is common among many combat sports athletes, there are no up-to-date studies investigating the knowledge, attitudes, and behaviours on hydration and fluid intake in these athletes (Esa, Saad, Phing, & Karppaya, 2015; Jenus, Pitil, & Wahed, 2018). Research has shown that knowledge of hydration in athletes ranges from poor to moderate (Judge et al., 2016; Kavouras et al., 2012; Magee, Gallagher, & McCormack, 2017). Therefore, several papers have identified the education of athletes in this specific field as crucial for improving hypohydration (Ceylan et al., 2023; Kavouras et al., 2012). It has been shown that educational intervention can be used to increase the knowledge and awareness of athletes in this manner (Abbasi, Lopez, Kuo, & Shapiro, 2021; Cleary et al., 2012; Kavouras et al., 2012). However, there is scarce information on the combat sports athletes in the literature.

Demonstrating combat sports athletes' hydration and fluid intake knowledge, attitudes, and behaviours and their relationship with hydration status would provide information related to whether this is truly a habit or a lack of education. Therefore, the current study aimed to present knowledge, attitudes, and behaviours on hydration and fluid intake of collegiate combat sports athletes and its relationship with hydration status, which was determined by USG and urine colour (UC). We hypothesised that athletes' level of knowledge, attitudes, and behaviour would not be at a sufficient level, and they would present high USG and UC levels.

Materials and Methods

Study Design

This descriptive cross-sectional study aimed to demonstrate collegiate combat sports athletes’ hydration

and fluid intake knowledge, attitudes and behaviours in relation to their hydration status. A survey developed by Nichols, Jonnalagadda, Rosenbloom, and Trinkaus (2005) and adapted in Turkish by Baykara (2018) was used to determine knowledge, attitudes, and behaviours regarding athletes' hydration and fluid intake. Athletes' hydration status was determined via urine specific gravity (USC) and urine colour (UC). Athletes were in the preparatory period, and data collection occurred in September 2024 before entering the competitive season, which would start in April 2025.

Participants

The number of participants was determined via a priori power analysis using GPower (Verison 3.1.9.7., Universität Kiel, Kiel, Germany) (Faul, Erdfelder, Buchner, & Lang, 2009). The assumptions used were a one tailed test, a significance level of $\alpha = 0.05$ and a power of 90 with a correlation coefficient of 0.5 (strong) for correlation: bivariate normal model and actual power of 0.90 with a total sample size of 31 were determined. However, 44 combat sports athletes (judo, taekwondo and kickboxing) were recruited for the study. The inclusion criteria were as follows: having at least 5 years of experience, regularly participating training held in the faculty, holding at least blue belt. Data were collected at the beginning of the preparation period for national collegiate championships, and athletes were not in the weight-cutting period, which may adversely influence their hydration status (Ceylan et al., 2022). A written informed consent form was obtained from each participant before applying the survey and taking urine samples. The study was conducted in accordance with the latest version of the Declaration of Helsinki. The approval of the local clinical research ethics committee (No. 2024-KAEK-68) was provided for the study.

Measurements

Personal information form: This form comprised four questions including age, sex, sport and experience in sport. Athletes completed these questions before answering the survey.

Hydration knowledge, attitudes, and behaviours: A survey developed by Nichols and Jonnalagadda [27] and adopted to Turkish by Baykara [28] was used to determine knowledge, attitudes, and behaviours regarding the hydration and fluid intake of the athletes. This survey comprises three parts: knowledge, attitudes, and behaviours. The knowledge part includes 20 questions with "correct" and "wrong" answers. One and zero points were given to each correct and wrong answer, respectively. The higher the score in this part, the higher the knowledge of the athletes was. The second part was attitudes. In this part, athletes answered 20 questions with 5-point Likert scale (from “strongly disagree” to “strongly agree”). Survey items are scored as "strongly agree" (5 points), "agree" (4 points), "undecided" (3 points), "disagree" (2 points), and "strongly disagree" (1 point). The higher the score in this part, the higher the hydration attitudes of the athletes were. The last part was behaviour and included 18 questions with “yes” and “no” answers. In the behaviour section, 1 point is given for each correct answer and 0 points for each incorrect answer. The maximum scores for the knowledge, attitude, and behaviour subdimensions were 20, 100, and 18, respectively. According to Cronbach's Alpha, the reliability of the survey was provided (0.85).

Hydration status: All athletes were previously informed about the procedures for collecting urine samples. Plastic cups were given to each athlete the day before the urine sample collection, and they were instructed to provide a midstream urine sample (Casa et al., 2000; Zubac, Reale, Karnincic, Sivric, & Jelaska, 2018) upon waking up in the morning and bring it to the laboratory for further investigation. The samples were refrigerated to 20°C and analyzed within 8 hours (Floris Wardenaar et al., 2021). USG was determined using a digital refractometer (ATAGO PAL-10S, Japan) and UC was determined under the brightest LED light (F. Wardenaar et al., 2022). USG was classified as hydrated (USG<1.020) and hypohydrated (USG ≥1.020) according to suggestions by the ACSM position stand (Sawka et al., 2007), and UC was classified according to an 8-color UC chart.

Statistics

The analysis was performed using JASP (0.15.0.0 Version, The Netherlands) and IBM SPSS 20 (IBM Corporation Inc. Armonk, NY, USA). The variables' means, standard deviations, and 95% confidence intervals (CI) were provided. The Shapiro-Wilk test was used to determine data normality and descriptive approaches such as skewness and kurtosis coefficients (Mishra et al., 2019). After checking the homogeneity of each variable, a one-way ANOVA was used to compare hydration and fluid intake knowledge, attitude, and behavior sub-dimensions’ scores, as well as USG and UC among athletes from different combat sports. The relationship among variables was investigated with the Pearson correlation coefficient. Effect sizes for pairwise comparisons, analysis of variance, and correlation analysis were classified according to Cohen's d and eta-squared ($\eta 2$) and correlation coefficient (r) values (Cohen, 1988), respectively. Significance was set at $p<0.05$.

Results

The information related to age and sport experience can be found in Table 1. Seventeen athletes were from judo (38.6%), 10 athletes were from taekwondo (22.7%) and 17 athletes were from kickboxing (38.6%).

Table 1. Age and sport experience of the athletes in regard to sports

Sport	Age (year)	Sport experience (year)
Judo (n=17)	21.1±1.8 (20.1-22.1)	9.7±2.3 (8.5-10.9)
Taekwondo (n=10)	20.7±2.7 (18.7-22.7)	10.1±2.1 (8.6-11.6)
Kickboxing (n=17)	22.4±2.1 (21.3-23.5)	11.1±3.5 (9.3-12.8)

Table 2. Hydration and fluid intake knowledge, attitude and behavior scores, USG and UC values of the athletes

Variables	All (n=44)	Judo (n=17)	Taekwondo (n=10)	Kickboxing (n=17)
Knowledge	14.0±2.3 (13.3-14.7)	13.8±2.3 (12.6-14.9)	14.1±2.1 (12.6-15.6)	14.1±2.6 (12.7-15.4)
Attitudes	67.1±6.3 (65.2-69.1)	65.6±7.2 (61.9-69.3)	68.0±4.2 (65.0-71.0)	68.2±6.4 (64.9-71.5)
Behavior	10.7±3.6 (9.6-11-8)	10.2±3.3 (8.5-11.9)	9.2±4.5 (6.0-12.4)	11.9±3.2 (10.3-13.6)
USG	1.025±0.005 (1.023-1.027)	1.025±0.005 (1.022-1.028)	1.028±0.005 (1.024-1.033)	1.023±0.006 (1.020-1.026)
UC	4.6±1.7 (4.1-5.1)	4.7±1.5 (3.8-5.5)	5.1±2.2 (3.5-6.7)	4.2±1.6 (3.4-5.0)

Table 3. Collegiate combat sport athletes' responses to knowledge questions regarding hydration and fluid replacement (n=44)

Statements	Mean ± SD (95% CI)	Percentage of the answers (%)	
		True	False
Athletes should not drink water or fluids during practice.a	0.18±0.40 (0.06-0.30)	81.8%	18.2%
Coaches should not let players drink fluids during practice.a	0.23±0.42 (0.10-0.36)	70.5%	29.5%
Sports drinks are better than water because they restore glycogen in muscles.b	0.43±0.50 (0.28-0.58)	43.2%	56.8%
When exercising more than one hour, an athlete should drink sports drinks rather than water.b	0.45±0.50 (0.30-0.61)	45.5%	54.5%

aFalse, bTrue

Table 4. Correlation coefficient among variables derived from questionnaire and hydration indices

Variables	Knowledge	Attitudes	Behavior	USG	UC
Knowledge	-	0.79	0.49**	-0.07	-0.01
Attitudes	0.08	-	0.13	-0.08	-0.10
Behavior	0.49**	0.13	-	-0.10	-0.02
USG	-0.07	-0.08	-0.10	-	0.95**
UC	-0.01	-0.10	-0.02	0.95**	-

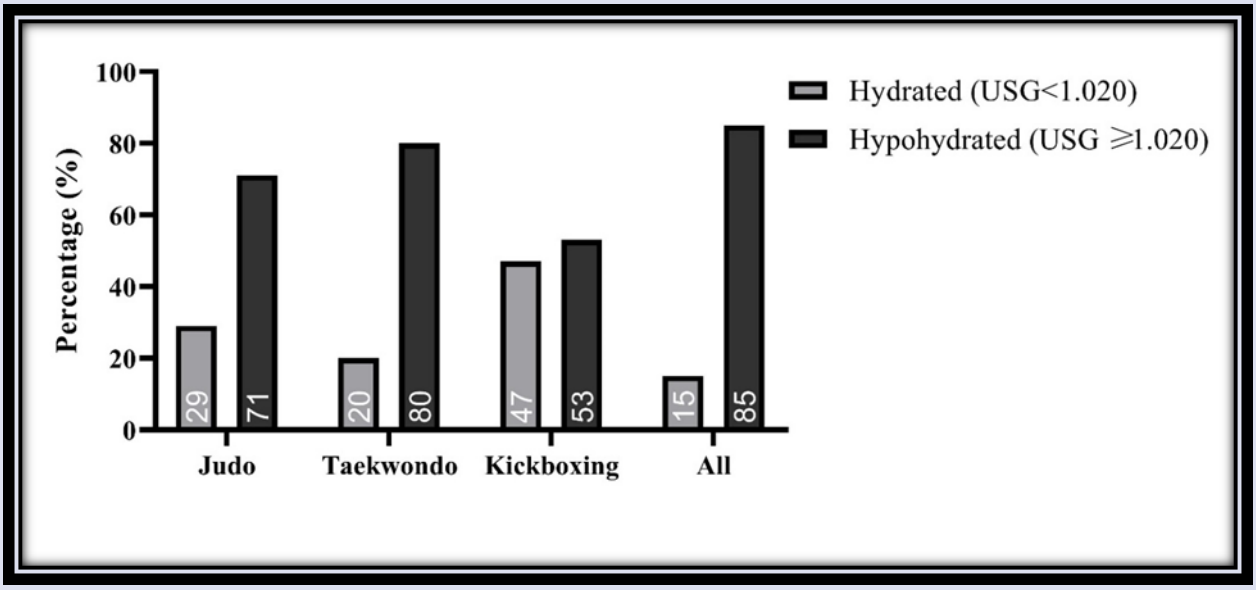

Figure 1. Hydration classification of the athletes from three different sports

Discussion

The current study aimed to determine hydration knowledge, attitudes, and behaviour levels of collegiate combat sports athletes and to explore the relationship between these factors and their hydration status as measured by USG and UC. The main findings of the study were as follows: a) The overall hydration knowledge, attitudes, and behaviour scores of the athletes were moderate; b) A significant positive correlation was found between hydration knowledge and behaviour; c) A strong positive correlation was also observed between USG and UC; d) The majority of the athletes (66%) were classified as hypohydrated based on USG, while only 34% were classified as hydrated.

Several observations can be made when comparing these results with the current literature. Previous studies have highlighted the prevalence of hypohydration among combat sports athletes, particularly during training and competition periods (Ceylan, Akgül, Gürses, Baydil, & Aydos, 2020; Ceylan & Balci, 2023; Ceylan et al., 2021; Ceylan & Santos, 2020; Ceylan, Taşcan, Simenko, & Balcı, 2023; Janiszewska & Przybyłowicz, 2020; Jetton et al., 2013). For instance, research by Ceylan, Mesut Burak Taşcan, et al. (2023) found that high-level judo athletes presented high hypohydration levels during weight-stable training camps. Similarly, studies by Pettersson and Berg (2014) and Rivera-Brown and De Félix-Dávila (2012) reported high levels of hypohydration among combat sports athletes during training days. In line with our results, studies on collegiate athletes have also shown significant variations in hydration status. A study by Salandy (2016) on university athletes reported that while some athletes maintained a favourable hydration status, a significant portion was hypohydrated post-training, underscoring the variability in hydration practices among athletes. Additionally, Pettersson and Berg (2014) observed that elite wrestlers, judokas, boxers, and taekwondo athletes often exhibited hypohydration, adversely affecting their performance and health. These findings align with the current study, suggesting that hypohydration is a common issue among combat sports athletes. However, some measures should be taken as hypohydration adversely affects cognitive and skill-based performance (Hillyer, Menon, Singh, Hillyer, & Menon, 2015), and it is related to physiological responses such as hyperthermia, decreased cutaneous blood flow, and cardiovascular strain, which provide a physiological reason for impaired sports performance (Noakes, 2007).

The current study contributes to the literature by demonstrating the relationship between hydration knowledge, attitudes, behaviour, and actual hydration status. This indicates that improving athletes' hydration knowledge could lead to better hydration practices and status. However, athletes presented a moderate level of knowledge about hydration and fluid intake and a high level of hypohydration, as determined by USG and UC. Despite the observed positive correlation between knowledge and behaviour, the overall moderate scores suggest that there is room for improvement in educating athletes about proper hydration. In line with our findings, the literature suggests that athletes have a moderate level of knowledge, attitude, and behaviour related to hydration (Esa et al., 2015; Judge et al., 2016; Veilleux et al., 2020). Esa et al. (2015) investigated hydration and fluid intake knowledge, attitude and behaviour of weight category sports athletes in Malaysia and concluded that the athletes had a lack of knowledge and poor level of attitude and behaviour. Moreover, athletes' hydration status was alarming as most of the athletes presented significant to serious hypohydration. Thus, comprehensive educational interventions are suggested for optimal hydration habits for combat sports athletes and coaches.

The study needs to acknowledge some limitations. First, the sample size was relatively small (n=44), which may limit the generalizability of the findings. However, the study's findings provide insight into the extent of hypohydration of collegiate combat sport athletes, and the findings align with the current literature. Additionally, the study only included athletes from three combat sports (judo, taekwondo, and kickboxing), which may not represent the hydration practices of athletes from other combat sports but may indicate a trend that should be further investigated. However, the athletes from the abovementioned sports are reported to be exposed the most to hypohydration via rapid weight loss (Barley, Chapman, & Abbiss, 2018, 2019).

Conclusions

Based on this study's findings, several suggestions can be made. It is recommended that comprehensive and long-term educational programs focused on hydration and appropriate fluid intake be implemented for collegiate combat sports athletes to improve their knowledge and behaviours. These programs could include practical strategies for monitoring hydration status, such as regular use of USG and UC measurements or body mass changes. Additionally, further research with more diverse samples is needed to confirm these findings and explore the effectiveness of different educational interventions in improving hydration practices among athletes.

In conclusion, this study highlights the importance of hydration knowledge and behaviour in maintaining proper hydration status among collegiate combat sports athletes. Addressing the gaps in education and promoting better hydration practices may reduce the prevalence of hypohydration and its associated negative impacts on athletic performance and health.

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Ethical Commintment

In this study, scientific, ethical, and citation rules were followed; no alterations were made to the collected data, the “Sivas Cumhuriyet University Journal of Sports Sciences and its Editor” bear no responsibility for any ethical violations that may arise, all responsibility lies with the Corresponding Author, and this study has not been submitted for review to any other academic publication medium.