Human Factors in Enhancing Safety and User Experience in Virtual Environments

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Abstract:

In virtual environments, user experience and safety are influenced by a multitude of factors that can significantly affect the efficacy of gaming or training programs. One such challenge is simulator sickness, an undesirable phenomenon with varying presence and intensity among individuals, even in similar simulator applications. The variability in these symptoms can be attributed to a broad range of factors. Our study aims to explore these variations, emphasizing factors that could either worsen or alleviate simulator sickness. In our experiment, thirty-nine participants underwent an 8-minute helicopter flight simulation, after which we collected their feedback using subjective measurements. We found a direct correlation between susceptibility to motion sickness and the occurrence of simulator sickness. Our results revealed that repetitive exposure to virtual environments is associated with a reduction in symptoms. However, prior driving experience did not exert a significant impact on simulator sickness. Furthermore, we observed that participants' dietary choices before the simulation may influence their virtual experience and overall safety. In summary, our findings suggest that previous exposure to virtual environments can reduce the occurrence of simulator sickness, while prior exposure to real-world environments does not appear to have a significant impact on this virtual experience. Moreover, our study suggests that dietary factors may play a role in the experience of simulator sickness in virtual environments. These findings highlight the need for further research to understand the extent and nature of these potential relationships, as they could offer valuable insights into mitigating simulator sickness, thereby improving safety and user experience in virtual reality settings.

Keywords—Simulator sickness, Human factors, Virtual reality

I. INTRODUCTION

Using virtual applications such as simulators are critical for collaborative training in various fields, including emergency response, military operations, police training, ambulance services, firefighter training, and scientific research [1]. Real-world training paradigms in these fields are often complex and costly and are challenging to replicate. However, simulators provide a practical and highly effective training solution for these demanding situations [2]. One of the disadvantages to simulators is the possibility of simulator sickness to occur. Simulator sickness involves a range of undesirable symptoms, which may include dizziness, blurred vision, headaches, fatigue, a feeling of fullness in the head, and in more severe cases, nausea and vomiting [3]. These symptoms arise from the incongruity between the visual cues in a simulator or virtual environment and the absence of corresponding physical motion or sensations, leading to the mentioned symptoms [4]. Approximately 60% to 70% of individuals who use simulators are estimated to experience simulator sickness [5]. The high prevalence of simulator sickness in users highlights the importance of addressing this problem in order to enhance user comfort and the overall simulation experience [5, 6]. Studies have revealed that the primary factors underlying virtual reality-related sickness, including simulator sickness [4], can be attributed to three substantial factors including hardware, such as display type, display mode, and time delay, content, such as graphics and task-related elements, and human factors (including individual variations) [7]. Human factors play a significant role in influencing both the severity and onset timing of simulator sickness [8]. These human factors include, but are not limited to, aspects such as age, gender, genetics, body position, posture, emotional states (such as stress and anxiety), adaptation, habituation, and more [9]. Despite similarities in hardware factors, content elements, scenarios, and situations, people's experiences can vary significantly due to the complex interplay of diverse human factors [7]. Therefore, the variations in self-reported sickness symptoms may arise from the influence of various human factors that could strongly impact symptoms [10]. One of the critical human-related factors that can potentially influence simulator sickness is food and dietary intake [4]. Food consumption has been identified as an important contributor to physiological changes [11]. For example, previous studies have demonstrated that food and nutrient consumption can significantly affect physiological markers, including heart rate , stomach signals [12], brain signals [13, 14]. In turn, these physiological changes can significantly impact mood, and cognitive, performance and attitudinal determinants [15, 16], all of which are relevant factors that can influence simulator sickness [17]. Researchers have indicated that factors like food intake can affect both the likelihood and intensity of motion sickness [4]. As food consumption can play a crucial role on physiological signals and motion sickness [18], there is a gap in existing research concerning the influence of food consumption as a human factor on simulator sickness. Additionally, there are other significant factors that should be considered as potential modulators in the context of simulator sickness. In particular, real-life driving experience has been shown to enhance essential cognitive skills, including spatial awareness [19], hand-eye coordination [20], and decision-making [21], which are crucial for safe driving. Moreover, previous research has demonstrated that individuals with driving experience generally exhibit lower susceptibility to motion sickness [22]. Nonetheless, there are still gaps in our understanding when it comes to whether real-life driving experience influences the incidence of simulator sickness. Furthermore, establishing a connection between an individual's susceptibility to motion sickness in real life and their experience of simulator sickness in virtual environments, while considering other factors like prior food consumption and simulator usage experience, can offer valuable insights into how these various elements cooperatively influence this phenomenon.

Therefore, the objective of this study is to investigate how different human factors, such as prior experience with simulators, real-life driving experience, and prior food consumption, influence simulator sickness. To the best of our knowledge, this is the first study in the field of simulator research to compare the impact of real and virtual experiences, alongside food intake, on simulator sickness. This research holds significance as it explores a novel aspect of simulator sickness, revealing the diverse factors that could contribute to this syndrome. These findings have the potential to enhance safety by guiding the development of customized simulator designs and encouraging the creation of innovative applications and simulations in the future.

II. Material and Method

A. Participants

This study was conducted on 39 healthy, non-smoking, habitual-coffee-consuming volunteers (9 women and 30 men) aged between 18 to 54 years among students and staff of Deakin university. We employed various methods to gather participants, including distributing flyers, sending emails, and personally inviting students and staff from Deakin University. Additionally, we used snowball sampling to expand our participant pool. Our research project received approval from the Deakin University Human Research Ethics Committee under a high-risk ethics application (number 2021-181).

B. Devices

The HeliMod (Mark III, Ryan Aerospace, N.S.W., Australia) is a fixed helicopter simulation control platform that allows users to operate a virtual helicopter using cyclic, collective, and anti-torque pedal controls. To ensure consistency among all participants, an operator navigated and recorded an 8-minute flight scenario through a green lake area from a first-person view, which was then shown to all participants (Figure 1.)

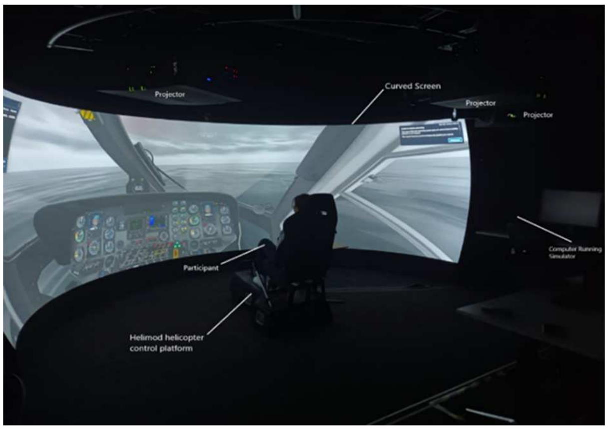

Fig 1. Flight Simulator. Note. Republished With Authorization From [23]

C. Subjective Measurments

In order to evaluate the subjective experiences of simulator sickness, we employed the Simulator Sickness Questionnaire (SSQ) which assesses symptoms, their intensity, and the overall feeling of sickness associated with the use of the simulators [24]. The SSQ comprises 16 items categorizing common symptoms experienced during virtual environment interactions into four groups: Total Simulator Sickness (TSS) score, nausea, oculomotor, and disorientation symptoms. Participants answered this questionnaire based on what they experienced during the virtual flight. the total score and simulator sickness subclasses were calculated based on the method denoted in Kennedy et al [25]. Moreover, we developed a comprehensive general assessment questionnaire to gather general information from participants including gender, prior virtual/simulator experience, driving experience, medical background, current medications; also, the information regarding participants' food intake was collected and categorized in accordance with the Australian Dietary Guidelines (ADG) [26]. The ADG divides foods into five categories (See Figure 2. For more details). Participants were categorized into two distinct groups according to their experiences with simulator sickness: the 'Sick' group, comprising individuals who experienced symptoms, and the 'Not-Sick' group, consisting of those who did feel well at the end of experiment. The study then analyzed the food consumption patterns of each group.

D. Motion Sickness Susceptibility Questionnaire

The Motion Sickness Susceptibility (MSS) Questionnaire explores susceptibility of participants to motion sickness (real environment) while using 9 different types of transportation, including boats, cars, buses, planes, or amusement park rides. To this end, participants rated how often they experienced motion sickness for each category, using a scale from 0 (never) to 3 (often). The MSS Questionnaire has two parts: one about experiences during childhood (before age 12) called motion sickness susceptibility child (MSSC), and one about experiences in the last 10 years during adulthood called MSS adult (MSSA). They could also mention if they have never used or been on a particular mode of transportation. The sum of MSSC and MSSA is considered as the Motion Sickness Susceptibility Total (MSST) [27]. $MSST = MSSA + MSSC$

E. Procedure

The experimental procedure employed a repeated-measures design to investigate the impact of simulator exposure on participants' simulator sickness experience, relying on subjective measurements. Participants were briefed on the experiment's objectives, provided informed consent, and completed a pre-experiment questionnaire along with the SSQ to establish baseline states and well-being. Subsequently, participants experienced an 8-minute simulated helicopter flight using the HeliMod simulator. Post-exposure, the SSQ was readministered to gauge perceived simulator sickness. The sequential steps were visually summarized in Figure 3.

F. Statistical Analysis

Our study employed various statistical methods, including Kruskal-Wallis and Post hoc analyses for non-parametric data, along with descriptive analysis. We utilized Spearman's rank correlations and regression analyses to investigate correlations between motion sickness susceptibility, simulator sickness, and other human factors. An alpha level of 0.05 was maintained for significance testing. All analyses were conducted using IBM SPSS Statistics Software (version 24)

III. RESULTS

Our findings from participants demographics information are reported as indicated in Table 1. Most participants were between the age of 25 and 34, had over 6 years of driving experience, and had experienced one or more simulator sessions. None of the participants were smokers or had any allergies or medical conditions.

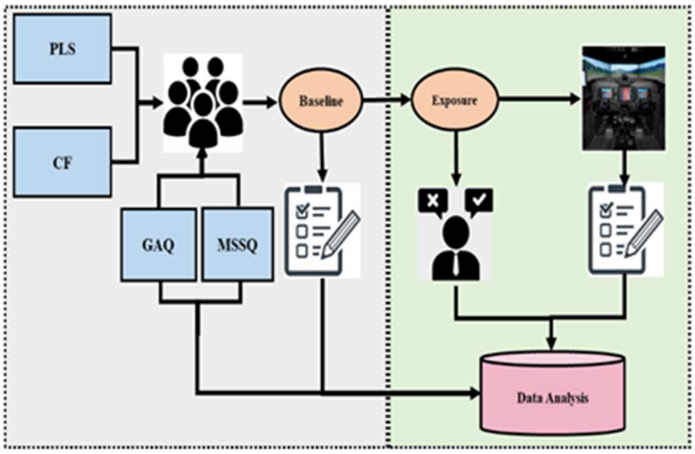

Figure 3: Overview of Experimental Procedure in This Research.

TABLE I. SUMMARY OVERVIEW OF THE PARTICIPANT DEMOGRAPHICS

Demographic	*Range*	*Number of Participants*
Ages (years)	18-24	7
	25-34	24
	35-54	8
	55+	0
Driving experience	0	4
	<1	2
	1-2	5
	3-5	3
	6-10	11
	>10	14
Simulator experience	0	12
	1	7
	2-5	6
	6-10	5
	11-50	3
	51-100	6
	>100	0
Allergy/medical problem	-	39
Smoker	-	39

[a] Note. An overview of participant demographics: age, driving experience, simulator experience. No medical problem or allergy was found among participants. age was categorized in gender including 3 subclasses of male, female, and trans/other gender diverse; prior virtual/simulator experience including 0 for never exposed to simulators to >100 more than 100 times exposed to simulators driving experience including 0 for never driven to more than 10 years of driving experience, medical background, current medications, and any known allergies.

A. *Effect of Different Human Factors on Simulator Sickness*

Table 2 presents the outcomes of Kruskal-Wallis tests examining the impact of several variables, namely driving experience, simulator experience, and age, on different aspects of self-reported simulator sickness, including TSS, disorientation, oculomotor issues, and nausea. We found that the effect of simulator sickness on TSS, disorientation, oculomotor symptoms, and nausea was statistically significant (all $p < 0.05$). However, no significant differences in the effects of driving experience and age on TSS, nausea, oculomotor symptoms, and disorientation were found (all $p > 0.05$).

Moreover, post hoc analysis following the Kruskal-Wallis test showed significant effects of prior simulator experience on TSS, nausea, disorientation, and oculomotor symptoms (refer to Figure 4-7). Notably, for TSS, significant differences were found between groups 5 and 2 (d(5,2)=18.583, P_{raw}=.005 and P_{adj}= 0.070), groups 5 and 1d(5,1)= 20.143, P_{raw}=.010 and P_{adj}= .022), and groups 5 and 0 (d(5,0)= 22.875, Praw= .000 and Padj= .001) (Figure 4.)

TABLE 2. EFFECTS OF DRIVING EXPERIENCE, SIMULATOR EXPERIENCE, AND AGE ON SIMULATOR SICKNESS

	TSS	*Disorientation*	*Oculomotor*	*Nausea*
Driving experience				
H	7.274	6.510	6.927	4.824
Df	5	5	5	5
p	.201	.260	.226	.438
Simulator experience				
H	20.036	18.614	17.872	15.144
df	5	5	5	5
p	**.001**	**.002**	**.003**	**.010**
Age				
H	3.251	2.125	1.747	4.506
df	2	2	2	2
p	.197	.346	.417	.105

Note: TSS = This table shows the results of a Kruskal-Wallis H test analyzing Total Simulator Sickness (TSS) and its aspects (Disorientation, Oculomotor, Nausea) across three categories: Driving Experience, Simulator Experience, and Age. 'H' indicates the test statistic, 'df' the degrees of freedom, and 'p' the significance level

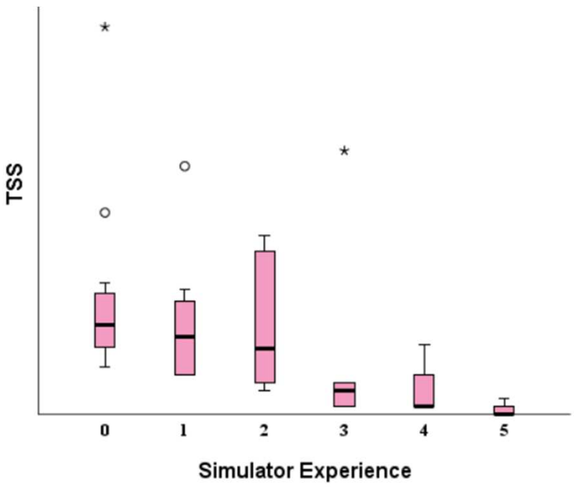

Fig 4. Tss Variations By Simulator Experience Level.

Furthermore, for nausea, significant differences were found between groups 5 and 2 (d(5,2)= 13.08, P_{raw}= .043 and P_{adj}= .648), groups 5 and 3 (d(5,3)= 16.00, P_{raw}= .018 and P_{adj}= .276), groups 5 and 1 (d(5,1)= 18.00, P_{raw}= .004 and P_{adj}= .058), and groups 5 and 0 (d(5,0)= 20.83, P_{raw}= .000 and P_{adj}= .003) (Figure 5).

Furthermore, for disorientation, significant differences were found between groups 5 and 2 (d(5,2)= 15.67, P_{raw}= .016 and P_{adj}= .237), groups 5 and 1 (d(5,1)= 17.52, P_{raw} = .005 and P_{adj} = .076), groups 5 and 0 (d(5,0)= 20.00, P_{raw} = .000 and P_{adj} = .006), groups 4 and 0 (d(4,0)= 17.00, P_{raw} = .019 and P_{adj} = .287), and groups 3 and 0 (d(3,0)= 14.33, P_{raw} = .017 and P_{adj} = .249) (Figure 6)

Finally, for oculomotor, significant differences were found between groups 5 and 1 (d(5,1)= 15.93, P_{raw}= .011 and P_{adj}= .161), groups 5 and 2 (d(5,2)= 16.33, P_{raw}= .012 and P_{adj}= .175), and groups 5 and 0 (d(5,0)= 22.17, P_{raw}= .000 and P_{adj}= .001) (Figure 7).

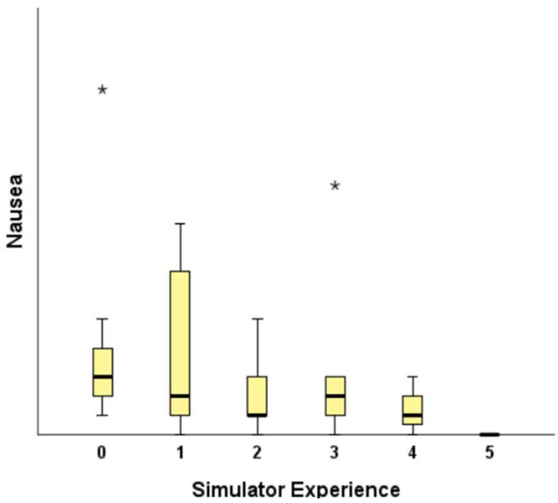

Fig 5. Nausea Variations By Simulator Experience Level

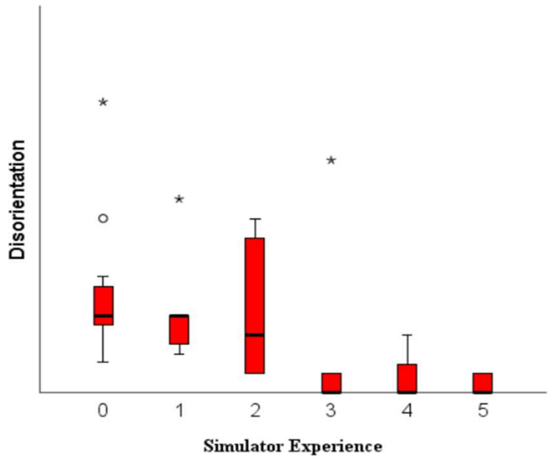

Fig 6. Disorientation Variations By Simulator Experience

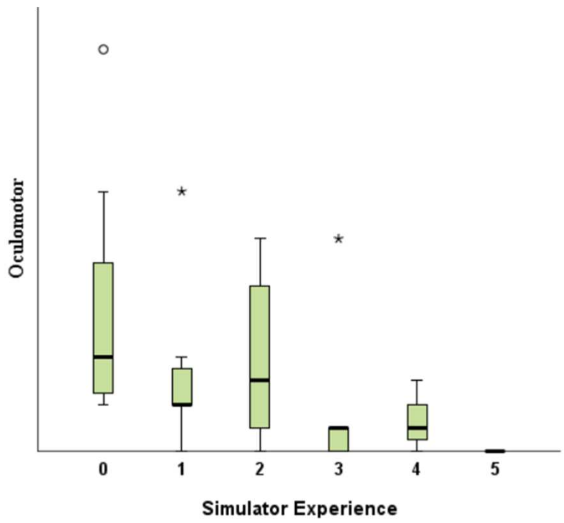

Fig 7. Oculomotor Variations By Simulator Experience

Furthermore, as shown in Table *3*, the Spearman's rank correlations reveal that susceptibility to motion sickness has a statistically significant moderate positive correlation with TSS, nausea, and oculomotor symptoms ($p < 0.05$). However, there is no significant correlation between disorientation and motion sickness susceptibility ($p > 0.05$).

B. Regression Analysis of Different Factors

According to Table 4, the model's overall fit for the TSS is statistically significant (F(4, 34) = 4.10, p = 0.008), with an adjusted R-squared (Radj2) of 0.246. Similarly, the model is statistically significant for nausea (F(4, 34) = 2.97, p = 0.033),

TABLE 3. CORRELATION BETWEEN SIMULATOR SICKNESS QUESTIONNAIRE FACTORS AND MOTION SICKNESS SUSCEPTIBILITY

	TSS	***Disorientation***	***Oculomotor***	***Nausea***
MSS				
rho	.326	.260	.359	.332
p	**.043**	.110	**.025**	**.041**
N	39	39	39	39

Note: This table presents correlations between motion sickness suceptibility (MSS) and Total Simulator Sickness (TSS), Disorientation, Oculomotor, Nausea, across participants (N=39). 'rho' indicates Spearman's rank correlation coefficient, and 'p' denotes significance levels. Values near 0.05 or lower suggest notable correlations.

Oculomotor (F(4, 34) = 4.84, p = 0.003), and disorientation (F(4, 34) = 3.68, p = 0.014), with Radj2 values of 0.172, 0.288, and 0.220, respectively.

Furthermore, key findings from Table 4 show that prior simulator experience is negatively associated to disorientation, TSS, nausea, and oculomotor ($p < 0.05$). Similarly, susceptibility to motion sickness is negatively associated with nausea, meaning that people with higher motion sickness susceptibility experienced less nausea. However, motion sickness susceptibility was positively associated to total sickness score and oculomotor symptoms, meaning that people with higher motion sickness susceptibility experienced overall more simulator sickness symptoms and oculomotor symptoms. Age and driving experience did not appear to be strongly associated to simulator sickness symptoms ($p > 0.05$).

C. Effect of Food Consumption on Simulator Slickness

According to Table 5, participants who were categorized in the sick group, had mostly consumed from the food group of 'lean meats and poultry, fish, eggs, tofu, nuts, seeds, and legumes/beans (33.33%). On the other hand, most of non-sick group had consumed from grains (35.90%) and dairy products (30.77%).

TABLE 4. REGRESSION ANALYSIS OF DIFFERENT HUMAN FACTORS ON NAUSEA, DISORIENTATION, OCULOMOTOR ASPECTS OF SIMULATOR SICKNESS

		Unstandardized Coefficients		***Standardized Coefficients***		
		B	Std. Error	Beta	*t*	*p*
TSS	Intercept	25.38	25.39		01.00	.324
	MSS	01.73	.820	.330	02.12	**.042**
	Simulator experience	-10.69	03.19	-.478	-03.35	**.002**
	Age	01.14	09.45	.018	.120	.905
	Driving experience	05.21	03.77	.215	01.38	.176
Disorientation	Intercept	40.57	31.82		01.28	.211
	MSS	01.75	01.02	.272	01.72	.095
	Simulator experience	-13.30	04.00	-.483	-3.33	**.002**
	Age	-.19	11.84	-.002	-0.02	.987
	Driving experience	05.84	04.72	.196	01.24	.225
Nausea	Intercept	12.68	25.15		.500	.617
	MSS	-07.58	03.16	-.359	-02.40	**.022**
	Simulator experience	-02.13	09.36	-.035	-.23	.822
	Age	06.29	03.73	.276	01.69	.101
	Driving experience	01.79	.810	.362	02.22	**.034**
Oculomotor	Intercept	15.15	18.23		.830	.412
	MSS	01.34	.590	.346	02.29	**.029**
	Simulator experience	-08.45	02.29	-.512	-3.69	**.001**
	Age	04.94	06.78	.103	.730	.472
	Driving experience	02.05	02.71	.115	.760	.454

Note: This table displays regression analysis results, showing the relationship between Total Simulator Sickness (TSS), Disorientation, Nausea, Oculomotor symptoms, and factors like motion sickness susceptibility (MSS), simulator experience, age, and driving experience. 'B' represents unstandardized coefficients indicating the change in the dependent variable for a one-unit change in the predictor. 'Std. Error' refers to the standard error of the coefficients. 'Beta' shows standardized coefficients, indicating the relative importance of each predictor. 't' is the t-statistic for hypothesis testing, and 'p' values indicate statistical significance.

TABLE 5. EFFECT OF FOOD CONSUMPTION ON SIMULATOR SICKNESS

	Sick		***Not sick***	
Food groups	***Number***	***Percentages***	***number***	***Percentages***
Grains (mostly wholegrain and/or high cereal fibre varieties)	7	17.95%	14	35.90%
Vegetables and legumes/beans	1	2.56%	3	7.69%
Fruits	2	5.13%	5	12.82%
Lean meats and poultry, fish, eggs, tofu, nuts, seeds, and legumes/beans	13	33.33%	7	17.95%
Milk, yogurt, cheese, and/or alternatives	4	10.26%	12	30.77%

Note: The table presents the number and percentages of individuals who reported feeling sick and those who did not experience sickness based on their food consumption in a simulator study. Percentages represent the proportion of individuals within each food category who reported sickness or no sickness.

IV. DISCUSSION

This research paper examines the effects of various human factors on simulator sickness. These factors encompass prior exposure to virtual environments (simulator experience), real-world experiences (such as driving), age, and the consumption of different food groups. To our knowledge, this is the first study to evaluate the collective impact of these variables on simulator sickness. Based on our findings, real-world driving experience did not show a strong correlation with the occurrence of simulator sickness in virtual environments. On the other hand, previous exposure to simulators seemed to be linked to a decrease in the severity of simulator sickness symptoms experienced in virtual settings. Moreover, we found that susceptibility to motion sickness in real environment can predict the overall severity of simulator sickness. Moreover, our research revealed that the consumption of different food groups, might influence the experience of simulator sickness. This finding suggests the need for in-depth study into how diet impacts simulator sickness. Similar to the findings of our study, other researchers [28] examined the effects of a driving video game (virtual experience) on car driver and non-car driver participants (real-world driving experience). Their findings revealed no significant differences in symptom severity and motion sickness incidence between the two groups [28]. Other studies, consistent with our research findings, indicated that frequent virtual video game playing was associated to lower levels of simulator sickness compared to non-video-game players [29]. This effect can be attributed to the adaptation process or habituation to visually induced motion sickness where repeated exposure to virtual environments can lead to a reduced susceptibility to this syndrome [30]. In fact, researchers found that the habituation process contributed to a reduction in visually-induced motion sickness when people were more exposed to the same virtual reality game [31]. On the other hand, there have been researchers who suggested that prior experiences with virtual reality environments, simulators, and 3D games may not have a direct impact on motion sickness levels [32]. Our results showed that age may not be a determining factor in the experience of simulator sickness. However, some researchers found a negative correlation between simulator sickness and the age of participants [33]. In contrast, Kim et al. found variations in the occurrence of simulator sickness across different age groups, with higher incidence observed in the 40–59 age group compared to the 19–39 age group [34]. The observed variations in reported results may arise from the influence of additional factors, one of which could be related to the effect of factors, such as food and nutrient consumption. Our findings indicate that the intake of lean meats, poultry, fish, eggs, tofu, nuts, seeds, and legumes/beans was approximately 50% lower. in participants who did not report simulator sickness compared to those who did. In contrast, the consumption of grains, vegetables, and fruits was nearly twice as high in the non-sick group as opposed to the group experiencing simulator sickness. Our study aligns with previous findings, where it was observed that pilots who reported sickness prior to flight consumed more meat products and high-sodium foods, approximately 2 to 3 times more often, compared to those who did not report sickness [35]. The relationship between food consumption and motion sickness has been explored in previous research. For instance, Levine et al. conducted a study in which participants were given either a protein-predominant meal (53% protein, 12% carbohydrate, and 35% fat) or a high-carbohydrate meal (100% carbohydrate) just before exposure to a rotating optokinetic drum. Their findings revealed that high-carbohydrate meals exacerbated motion sickness symptoms more than meals rich in protein [36]. It should be noted that the protein-predominant meal in their study contained a variety of macronutrients, potentially making it more palatable than a meal primarily composed of pure carbohydrates. On the other hand, other researchers found that, protein consumption may be one of the contributing factor in increasing air sickness [35]. This complexity in findings highlights the need for a multifaceted approach when studying motion and simulator sickness, considering the variety of factors that can influence an individual's susceptibility to these conditions.

Several factors may contribute to the observed discrepancies in findings across studies. Firstly, simulator sickness is inherently user-dependent [37], emphasizing the need for a holistic approach that considers not just single factors but their combination before conducting experiments [7]. Additionally, other factors, such as the health status of participants[38], sleep quality, pain sensitivity, and spatial ability [39], type of simulator, or different environment have demonstrated significant roles in the outcomes of simulator sickness research. For instance, better sleep quality has been associated with increased tolerance to simulator sickness symptoms; moreover, participants with a lower pain threshold tend to exhibit reduced tolerance to simulator sickness and report more associated symptoms [39]. Therefore, it is crucial to consider multiple factors during simulator and motion sickness research. Drawing robust conclusions from diverse studies requires accounting for as many factors as possible to minimize biases. Factors such as food and nutrition, motion sickness susceptibility, and past simulator experience should not be underestimated in their role, as they can significantly influence results and outcomes. Understanding these variables is crucial for developing effective strategies to mitigate simulator sickness and enhance the overall experience in virtual environments. This can lead to more accurate, applicable, and reliable research outcomes, benefiting a wide range of fields where simulation technology is used.

V. GAPS AND FUTURE DIRECTIONS

While one strength of our study lies in employing participants' actual data, which reflects their true behaviours and choices, there are certain gaps and limitations that should be considered and addressed in future studies. Initially, challenges in recruiting additional participants, particularly due to the complexities and concerns for their well-being associated with simulator sickness, constrained our ability to assemble a larger sample size. Furthermore, the absence of control over participants' food intake prior to simulator exposure in our study is a significant limitation that should be addressed in future research. Therefore, future directions for research in this field include conducting longitudinal studies to track dietary habits and simulator sickness symptoms over time, designing controlled dietary interventions to assess the direct impact of food groups, exploring the interplay of psychological factors, adapting research to evolving virtual reality technology, and predicting [40] the likelihood of motion sickness. These actions can provide a comprehensive understanding of the relationship between different factors and simulator sickness and develop better strategies for its prevention and management.

CONCLUSION

In summary, our study explored the impact of prior simulator experience, driving experience, age, and dietary factors on simulator sickness during an 8-minute helicopter flight simulation. Our findings indicate that prior simulator experience significantly reduced simulator sickness symptoms. However, prior driving experience did not show any significant effect on simulator sickness occurrence. Furthermore, there appears to be a connection between susceptibility to motion sickness and a heightened likelihood of experiencing simulator sickness. These findings underscore the importance of simulator familiarity in mitigating simulator sickness. Additionally, we found that different dietary choices may possibly impact the level of simulator sickness occurrence. Addressing these human factors can enhance safety and user experience in immersive virtual environments and enable users to make choices that reduce the risk of sickness during their simulator experiences.

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