



Research Article

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## The relationship between food addiction in obesity and anxiety, impulsivity, depression, and emotion regulation difficulty

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### Abstract

We aimed to develop interventions that can prevent obesity and food addiction in the early period by investigating the relationship between food addiction and impulsivity, anxiety, depression, difficulties in emotion regulation, sociodemographic characteristics, exercise and diet behaviors. We included 88 consecutive patients with BMI  $\geq 30$  and above, aged between 18-65 years, who applied to the Obesity outpatient clinic and psychiatry outpatient clinic of "---" in 2022 in our study sample. Sociodemographic and Clinical Information Form, Yale Food Addiction Scale(YFAS), Beck Anxiety Inventory(BAI), Difficulties in Emotion Regulation Scale-Brief Form (DERS-16), Barratt Impulsiveness Scale and Beck's Depression Inventory(BDI) were applied to the patients. It was determined that 45 of 88 patients included in our study had food addiction according to the YFAS score, and 43 did not have a food addiction. There was a significant difference between the two groups in terms of age and education level. Mean scale scores for BAI, DERS-16, and Barratt Impulsiveness Scale were found to be significantly higher in the food addiction group than in the other group. The subscales of the Barratt Impulsiveness Scale were evaluated separately, it was observed that the sub-scale scores of "motor impulsivity" and "attention impulsivity" were significantly higher in the food addiction group compared to the other group. Food addiction is seen at a higher rate in people with a lower average age and higher education level. Anxiety, impulsivity, and Difficulties in Emotion Regulation correlate with food addiction.

**Keywords:** food addiction, impulsivity, anxiety, emotional dysregulation

### 1. Introduction

Food addiction, a recently defined type of addiction, refers to the intense and excessive consumption of foods with high calories, sugar, and fat content (1,2). Some studies observed that these foods with high calories, high sugar, and fat content cause craving symptoms and reported that individuals have difficulty controlling their eating behaviors (3). Eating foods high in fat and sugar may alter the brain's reward system, resulting in food addiction and obesity (4).

An experiment with rats with high-sugar foods revealed that consuming these foods in large amounts developed withdrawal, craving, and compulsive-seeking behaviors similar to other addictive substances. The changes in the opioidergic and dopaminergic systems of the brain caused by high-sugar foods are similar to addiction (5).

Many studies have shown that there is a relationship between addiction and impulsivity. Impulsivity is related to excessive food intake, high motivation, energy expenditure to find food, and compulsive eating. Studies have shown that people with food addiction symptoms show higher impulsivity than people who do not experience symptoms and that the addictive characteristics of delicious foods are a risk factor for

increased impulsivity (6,7). It is widely accepted that eating behavior in humans varies according to various emotions, such as anxiety, joy, and anger. This eating behavior, which occurs in connection with the emotional state, has been defined as "emotional eating" and is associated with body weight in many studies (8). Food addiction is more associated with overeating, emotional eating, and problematic eating attitudes rather than high body mass index (4).

Other factors related to emotional, uncontrolled, and binge eating behavior were shown to be anxiety and depressive mood, and positive correlations were found between depression, anxiety and stress, and emotional eating (9). A study conducted with university students during the Sars-CoV-2 outbreak found that increased anxiety levels and depressive symptoms after the closure of their university were associated with food addiction (10).

The inability to regulate emotions following the current situation is defined as Difficulties in Emotion Regulation. Difficulty in emotion regulation can negatively affect the functionality and human relations of the individual, increase negative emotional experiences and decrease positive

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emotional experiences, resulting in maladaptive behavior patterns (11). The studies dealing with the relationship between eating disorders and emotional regulation difficulties argued that individuals with eating disorders had the insufficient ability to cope with negative emotions, and this inadequacy may cause deterioration in eating behaviors (12,13).

When all these data are evaluated, the relationship of food addiction with anxiety, impulsivity, difficulty in emotion regulation, and depression has been assessed separately and in limited amounts in the current literature. In our study, we aimed to evaluate all of these factors that are effective on food addiction together and to determine their relationship.

## 2. Materials and Methods

We included 88 of 108 consecutive patients between 18-65 years, with a BMI of 30 and above, who applied to the Obesity and psychiatry outpatient clinics in --- Hospital to this cross-sectional case study In 2022. A total of 8 patients left some parts of the forms blank, five patients had vision problems and therefore could not fill the forms, and seven took the forms to fill in but did not bring them back. We excluded these 20 patients from our study.

Firstly, we explained the purpose of the study to the patients and obtained their written informed consent for participation. Also, we clarified that they were free to refuse to participate or to terminate the interview at any point, and their records would be kept confidential.

Sociodemographic and Clinical Information Form for Patients, Sociodemographic and Clinical Information Form, Yale Food Addiction Scale (YFAS), Beck Anxiety Inventory(BAI), Difficulties in Emotion Regulation Scale-Brief Form (DERS-16), Barratt Impulsiveness Scale and Beck's Depression Inventory( BDI) was applied.

Patients between 18-65, literate, BMI of 30 and above, had the mental capacity to respond to the assessment tools, and agreed to participate were included in the study. People with a <30 BMI, did not have the mental capability to answer the assessment scales, had alcohol and substance addiction or any other diagnosed psychiatric disorders, and had a BMI below 30 were not included in the study.

### 2.1. Tools

**Sociodemographic and Clinical Data Form:** Following the purpose of the study, we developed this form to collect sociodemographic and clinical data, which includes age, gender, marital status, education level, economic income, habits, medications, history of concomitant mental and physical illness, family history of mental illness and obesity, childhood obesity, diet, and exercise habits.

**Yale Food Addiction Scale (YFAS):** It is a 27-item scale developed by Gearhardt et al. (13) that evaluates eating attitude with substance addiction symptoms (tolerance, withdrawal, loss of control, and others). There are two scoring methods. The first must meet at least one of the symptoms to qualify as

an eating disorder. Three or more symptoms must be positive in the last year, and additional clinical deterioration must accompany the diagnosis of an eating disorder. A validity and reliability study was conducted by Bayraktar et al. (14) in our country.

**Beck Anxiety Inventory (BAI):** Beck et al. (15) developed this scale to determine the frequency of anxiety symptoms experienced by individuals. It is a Likert-type scale including 21 items and scored between 0-3. The high scores obtained from the scale indicate the severity of the anxiety experienced by the individual. A validity and reliability study was conducted in our country by Ulusoy et al. (16)

**Difficulties in Emotion Regulation Scale-Brief Form (DERS-16):** Bjureberg et al. (17) developed DERS-16 as the short form of the Dysregulation of Emotions Scale designed by Gratz and Roemer, which aimed to measure the difficulty level of emotion regulation of individuals. The scale consists of 16 items in total, and the items are scored on a Likert-type scale from 1 (rarely) to 5 (almost always). A high score implies a high emotion dysregulation symptom level. Turkish validity and reliability study of Difficulties in Emotion Regulation Scale-Brief Form (DERS-16) was conducted by Yiğit and Guzey Yiğit (18).

**Barratt Impulsiveness Scale:** This is a Likert-type scale consisting of 30 items. It has three subscales: attention-related impulsivity, inability to plan-related impulsivity, and motor impulsivity. A higher total grade implies a higher impulsiveness level of the practitioner. A high score for attention indicates that the person behaves more carelessly, a high motor score indicates an increase in motor activity, and a high unplanning score indicates instability in life planning and an inability to plan (19). The Turkish validity and reliability study of the Barratt Impulsivity Scale was conducted by Güleç et al (20).

**Beck Depression Inventory (BDI):** The Beck Depression Inventory, developed by Beck et al. (21) in 1978, measures the motivational, cognitive, emotional, and vegetative symptoms seen during the depression. Beck Depression Inventory is a 21-item self-assessment scale. Each item has a score between 0 and 3. The highest score is 63, and the lowest is 0. A high score on the scale indicates that the severity or level of depression is high. Hisli N. (22) translated the Beck Depression Inventory.

### 2.2. Statistical analysis

Whether there was a difference between groups with continuous variables in terms of independent variables was investigated using the Independent Groups T-Test for normally distributed variables and the Mann-Whitney U-Test for variables that did not fit the normal distribution. We evaluated normality with the Kolmogorov-Smirnov test. We used the Spearman test for correlation analysis. All data were evaluated with SPSS (Statistical Package for the Social Sciences) 22 computer programs. A p-value of <0.05 was considered statistically significant in all these analyses.

### 3. Results

We determined that 45 of 88 patients included in our study had food addiction according to the YFAS score, and 43 did not. The sociodemographic characteristics of the groups are shown in Table-1. According to the results, while there was a significant difference between the two groups by age and

education level ( $p=0.038$ ,  $p=0.017$ , respectively), there was no significant difference between the groups for other sociodemographic characteristics. We observed that the mean age resulted in lower and the level of education higher in the group with food addiction (Table-1).

**Table 1.** Comparison of sociodemographic characteristics between patients with and without food addiction

	Food addiction	No food addiction	
<b>Number, (n)</b>	45	43	
<b>Gender, n (%)</b>			P= 0.375
• Female	38 (%84.4)	39 (%90.7)	
• Male	7 (%15.6)	4 (%9.3)	
<b>Age, (year) (mean <math>\pm</math> s.d.)</b>	34.58 $\pm$ 12.77	40.02 $\pm$ 11.39	<b>P= 0.038</b>
<b>Height (cm) (median; i.r.)</b>	162; 11.5	162; 10	P= 0.841
<b>Weight (kg) (mean <math>\pm</math> s.d.)</b>	111.62 $\pm$ 17.85	111.73 $\pm$ 20.44	P= 0.979
<b>BMI (kg/m<sup>2</sup>) (mean <math>\pm</math> s.d.)</b>	41.80 $\pm$ 5.96	42.06 $\pm$ 7.27	P= 0.858
<b>Marital status;</b>			
• Married	28 (%62.2)	32 (%74.4)	
• Living apart	0 (%0)	1 (%2.3)	
• Divorced	0 (%0)	3 (%7)	
• Widow	0 (%0)	2 (%4.7)	
• Single	17 (%37.8)	5 (%11.6)	
<b>Education;</b>			<b>P= 0.017</b>
• Literate	2 (%4.4)	4 (%9.3)	
• Primary School	6 (%13.3)	14 (%32.6)	
• Middle School	7 (%15.6)	4 (%9.3)	
• High School	19 (%42.2)	17 (%39.5)	
• University	11 (%24.4)	4 (9.3)	
<b>Work Status;</b>			
• Unemployed	9 (%20)	23 (%53.5)	
• Student	5 (%11.1)	1 (%2.3)	
• Employee	19 (%42.2)	11 (%25.6)	
• Resigned	11 (%24.4)	4 (%9.3)	
• Retired	1 (%2.2)	4 (%9.3)	
<b>Monthly income (Turkish Lira);</b>			P= 0.055
• 4000 TL >	14 (%31.1)	6 (%14)	
• 4000 TL <	31 (%68.9)	37 (%86)	
<b>Cigarette smoking</b>			P= 0.538
• Yes	10 (%22.2)	12 (27.9)	
• No	35 (%77.8)	31 (%72.1)	
<b>Alcohol consumption</b>			p=1.0
• Yes	4 (%8.9)	4 (%9.3)	
• No	41 (%91.1)	39 (%90.7)	
<b>Diet</b>			P= 0.090
• Yes	16 (%35.6)	23 (%53.5)	
• No	29 (%64.4)	20 (%46.5)	
<b>Exercise</b>			P= 0.295
• Yes	17 (%37.8)	21 (%48.8)	
• No	28 (%62.2)	22 (%51.2)	

s.d.: standard deviation; i.r.: interquartile range

Independent samples t-test was applied for variables that follow a parametric distribution. Mean values and standard deviations are provided. Mann-Whitney U test was used for variables that do not follow a parametric distribution and ordinal variables. Median values and interquartile ranges are provided. Chi-square test or Fisher's exact test has been used for nominal variables.  $p < 0.05$  is considered statistically

significant.

Table-2 shows whether there is a difference between the groups in terms of scale scores. The mean scale scores were higher in the food addiction group than in the other group in BAI, DERS-16, and Barratt Impulsiveness Scale ( $p=0.007$ ,  $p=0.006$ ,  $p=0.011$ , respectively). In terms of BDI, there was no

significant difference between the two groups. When we evaluated the subscales of the Barratt Impulsiveness Scale separately, we found that the motor impulsivity and attention impulsivity subscales scores were significantly higher in the food addiction group than in the other group ( $p=0.003$  and  $p=0.030$ , respectively). But there was no statistically significant difference between the groups in the inability to plan.

When the subscales of the Difficulty in Emotion Regulation Scale were examined, it was found that the subscales of clarity, goals, impulse and strategies were significantly higher in the group with food addiction than in the group without food addiction. The difference between the groups in terms of the non-acceptance subscale is at the statistically significant level (Table 2).

**Table 2.** Comparison of scale scores between patients with and without food addiction

	Food addiction	No food addiction	
<b>BAI</b> (median; i.r.)	44 ; 30	33 ; 15	<b><math>P=0.007</math></b>
<b>BDI</b> (median; i.r.)	19 ; 8	16 ; 12	$P=0.067$
<b>DERS-16</b> (median; i.r.)			
• Total score	33 ; 26	25 ; 14	<b><math>P=0.006</math></b>
• Clarity	4 ; 4	3 ; 2	<b><math>P=0.005</math></b>
• Goals	7 ; 6	6 ; 4	<b><math>P=0.022</math></b>
• Impulse	5 ; 4.75	4 ; 2	<b><math>P=0.020</math></b>
• Strategies	10 ; 11	7 ; 5	<b><math>P=0.016</math></b>
• non-acceptance	5 ; 5.75	4 ; 3	$P=0.051$
<b>BIS</b> (median; i.r.)			
• Total score	29 ; 7	25 ; 7	<b><math>P=0.011</math></b>
• Not making plans	11 ; 4	9 ; 6	$P=0.322$
• Motor impulsivity	9 ; 3.5	7 ; 3	<b><math>P=0.003</math></b>
• Attentional impulsivity	10 ; 3	9 ; 2	<b><math>P=0.030</math></b>

i.r.: interquartile range; BAI: Beck Anxiety Inventory; BDI: Beck Depression Inventory; DERS-16: Difficulties in Emotion Regulation Scale-Brief Form; BIS: Barratt Impulsiveness Scale

As all scale scores followed a non-parametric distribution, the Mann-Whitney U test was used for all of them. Median values and interquartile ranges are provided  $p < 0.05$  is considered statistically significant.

**Table 3.** Examination of the correlation between Yale Food Addiction Scale scores and other scale scores

	YFAS	BAI	BDI	BIS	DERS-16
YFAS		$r=0,503$ $p<0,001$	$r=0,332$ $p=0,002$	$r=0,308$ $p=0,004$	$r=0,441$ $p<0,001$
BAI	$r=0,503$ $p<0,001$		$r=0,613$ $p<0,001$	$r=0,285$ $p=0,007$	$r=0,566$ $p<0,001$
BDI	$r=0,332$ $p=0,002$	$r=0,613$ $p<0,001$		$r=0,347$ $p=0,001$	$r=0,656$ $p<0,001$
BIS					
• Plannig	$r=0,184$ $p=0,087$	$r=0,158$ $p=0,142$	$r=0,297$ $p=0,005$	$r=0,740$ $p<0,001$	$r=0,317$ $p=0,003$
• Motor	$r=0,402$ $p<0,001$	$r=0,406$ $p<0,001$	$r=0,327$ $p=0,002$	$r=0,598$ $p<0,001$	$r=0,420$ $p<0,001$
• Impulsivity	$r=0,203$ $p=0,058$	$r=0,141$ $p=0,189$	$r=0,149$ $p=0,167$	$r=0,780$ $p<0,001$	$r=0,225$ $p=0,036^*$
DERS-16					
• Clarity	$r=0,367$ $p<0,001$	$r=0,562$ $p<0,001$	$r=0,684$ $p<0,001$	$r=0,467$ $p<0,001$	$r=0,722$ $p<0,001$
• Goals	$r=0,401$ $p<0,001$	$r=0,505$ $p<0,001$	$r=0,559$ $p<0,001$	$r=0,342$ $p=0,001$	$r=0,893$ $p<0,001$
• Impulse	$r=0,397$ $p<0,001$	$r=0,436$ $p<0,001$	$r=0,552$ $p<0,001$	$r=0,363$ $p=0,001$	$r=0,788$ $p<0,001$
• Strategies	$r=0,402$ $p<0,001$	$r=0,526$ $p<0,001$	$r=0,545$ $p<0,001$	$r=0,442$ $p<0,001$	$r=0,924$ $p<0,001$
• Non-acceptance	$r=0,300$ $p=0,005$	$r=0,386$ $p<0,001$	$r=0,541$ $p<0,001$	$r=0,276^*$ $p=0,010$	$r=0,805$ $p<0,001$

BAI: Beck Anxiety Inventory; BDI: Beck Depression Inventory; DERS-16: Difficulties in Emotion Regulation Scale-Brief Form; BIS: Barratt Impulsiveness Scale; YFAS: Yale Food Addiction Scale

All scale scores followed a non-parametric distribution, so all correlations were performed using the Spearman Test.

\*statistically significant with  $p<0.05$

All other results were considered statistically significant with  $p < 0.01$

Finally, we investigated whether the scale scores correlated with each other. As seen in Table-3, there is a statistically significant correlation between all scale scores. Especially, YFAS had moderate positive correlations with BAI and DERS-16 ( $r=0.503$ ,  $p<0.001$  and  $r=0.441$ ,  $p<0.001$ , respectively) and low-moderate positive correlations with Barratt Impulsiveness Scale and BDI ( $r=0.308$ ,  $p=0.004$  and  $r=0.332$ ,  $p=0.002$ , respectively). The subscales of Barrat Impulsivity Scale and Difficulty in Emotion Regulation Scales were also evaluated. Accordingly, it was found that there was a moderate positive correlation between the Yale Food Addiction Scale and the motor impulsivity subscale of the Barrat Impulsivity Scale ( $r=0.402$ ;  $p<0.001$ ), while no statistically significant correlation was observed with the inability to plan and attention impulsivity subscales ( $r=0.184$ ;  $p=0.087$  for inability to plan /  $r=0.203$ ;  $p=0.058$  for attention impulsivity). When the subscales of Difficulties in Emotion Regulation were examined, it was found that the Yale Food Addiction Scale had a low-moderate positive correlation with the clarity, impulse and non-acceptance subscales of Difficulties in Emotion Regulation ( $r=0.367$  for clarity;  $p<0.001$  /  $r=0.367$  for impulse ;  $p<0.001$  /  $r=0.397$  ;  $p<0.001$  /  $r=0.300$  ;  $p=0.005$  for impulse /  $r=0.300$  ;  $p=0.005$  for non-acceptance), and a moderate positive correlation with the goals and strategies subscales ( $r=0.401$  ;  $p<0.001$  for goals /  $r=0.402$  ;  $p<0.001$  for strategies) (Table 3).

#### 4. Discussion

In this study, we aimed to develop interventions that can prevent obesity and food addiction in the early period by determining the relationship between food addiction and impulsivity, anxiety, depression, emotional regulation difficulties, sociodemographic characteristics, exercise, and diet behaviors.

We found that food addiction was at a higher rate in the group with a lower average age and higher education level in our study. In a study with middle-aged and older women found that the prevalence of food addiction measured by YFAS ranged from 1 to 9%, and food addiction was inversely proportional to age (23). A cross-sectional study investigating the relationship between the prevalence of food addiction and stress and sleep quality among university students found that food addiction was negatively associated with age (24). Food addiction was inversely proportional to age in the literature, consistent with our study results, which we think may be due to the easier access of the young population to high-energy, flavor-enhanced, and processed foods.

The education level was higher in the food addiction group in our study. Although there are not many studies about the relationship between education level and food addiction in the literature, many studies show that the risk of obesity decreases as the education level increases (25-27). The study of Devaux et al. (25) links the positive effect of education level on obesity to the quick accessibility to health-related issues, awareness of

risk perception in lifestyle, and the development of control. Another study examining the prevalence of food addiction among low-income women of reproductive age suggests that education level did not affect food addiction (26). There are different results between these studies and ours. We think that this may be related to the fact that these studies included people with a BMI<30 and only low-income women. However, another study reported that food addiction incidence was higher in individuals with high academic performance, in line with our results (27). As the level of education increases, the expectations of society, the environment, and even the expectations of the individuals increase. The higher the requirements, the higher the stress level, and the problematic eating behaviors as a way of coping with stress, may have caused this result.

We determined that the Barratt Impulsiveness Scale total scores and motor impulsivity and attention impulsivity subscales scores were significantly higher in those addicted to eating. In a study examining the relationship between food addiction and impulsivity in young adults, motor impulsivity and impulsivity total scores were higher in individuals with food addiction than those without food addiction (28). Meule et al. (29) reported that attention-related impulsivity and motor impulsivity predicted food addiction together in obese individuals. After evaluating the current findings, we think there is a clinical association between impulsivity and food addiction.

In our study, we evaluated the presence of depression with the BDI, and there was no difference between the groups with and without food addiction. In a meta-analysis, unlike our study, they reported a positive correlation between food addiction and depression (30). A study investigating the relationship between depression, food addiction, and body mass index in 793 university students reported that the level of depression was higher in the food-addicted group (31). The causes of the different results in our study may be that we included only obese individuals in our study group, and the sample sizes and depression scales used were different between studies.

Studies reported that anxiety was associated with emotional, uncontrolled, and excessive eating behaviors and health outcomes related to eating (9, 32). We evaluated the anxiety level of the subjects with BAI. The anxiety level was higher in the food addiction group, which was compatible with other studies in the literature. A study examining the longitudinal relationship between food addiction and anxiety in men and women found that food addiction affected anxiety longitudinally. The interventions that address food addiction reduce anxiety in men and women, while interventions that reduce anxiety help prevent food addiction in women (33).

The number of studies about how eating is affected by changes in people's emotions increased in recent years. Based on the idea that eating makes people happy, Smith et al.(34)

determined that eating reduces their negative affect and increases their positive affect in their 3-year study with adolescents. A study investigating the predictors of food addiction with 878 undergraduate students found that impulsivity and difficulty in emotion regulation were positively related to food addiction (35). A study examining the relationship between food addiction and difficulty in emotion regulation in 214 university students determined that the total score of difficulty in emotion regulation and sub-factors (refusal to accept, strategies, and impulse) were higher in food-addicted participants than non-food addicted participants (36). We found that difficulty in emotion regulation predicted food addiction positively in our study, which is consistent with the literature.

In our study, it was found that the scores of clarity, goals, impulse and strategies subscales of the Difficulty in Emotion Regulation Scale were significantly higher in the group with food addiction compared to the group without food addiction. In another study, it was found that the scores belonging to the subscales of Non-Acceptance, Impulse and Strategies were more related to food addiction. This shows that people with food addiction have greater difficulties in accepting their emotional reactions and controlling their impulses when they experience negative emotions. This is perhaps due to their limited access to effective emotion regulation strategies (37).

The limitations of the study: This study does not show a definite cause-effect relationship between the variables due to its cross-sectional nature and small sample size. Due to the lack of sufficient objective measurement tools for the diagnosis of food addiction, it was assessed only with the Yale Food Addiction scale and limited to the subjective interpretations of the participants.

While the food addiction rate is higher in the group with lower mean age and higher education level, other sociodemographic characteristics did not differ between groups with and without food addiction. While anxiety, impulsivity, and difficulty in emotion regulation were higher in the food-addicted group, there was no significant difference in terms of depression.

Our results suggest that psychiatric evaluation is crucial in people seeking obesity treatment. Providing psychiatric treatment and support to these individuals will contribute to the prevention and treatment of obesity and food addiction.

Psychological evaluation should not be neglected in patients who apply to non-psychiatry outpatient clinics for obesity treatment. Our study emphasises the importance of multidisciplinary evaluation in these patients.

#### Conflict of interest

The authors declared no conflict of interest.

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None to declare.

#### Authors' contributions

Concept: F.U., E.K., K.T.A., M.K.T., Design: F.U., E.K., K.T.A., M.K.T., Data Collection or Processing: F.U., E.K., M.A., Analysis or Interpretation: Ö.Ö., K.T.A., M.A., M.K.T., Literature Search: F.U., E.K., Ö.Ö., N.T., M.K.T., Writing: F.U., E.K., Ö.Ö., N.T., M.K.T.

#### Ethical Statement

We obtained the approval for this study from the "Istanbul Kartal Lütfi Kırdar City Hospital Ethics Committee" on 28.09.2022 with the number 2022/514/234/5. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

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