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The Association Between Social Appearance Anxiety and Eating Attitudes Among Vocational High School Students

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Abstract

High school students experience many growth and developmental changes. These changes make adolescents vulnerable to body image, appearance issues. Negative body image perception can lead to psychosocial problems such as social appearance anxiety and eating disorders in adolescents. Our aim of this study is to assess the relationship between social appearance anxiety and eating attitude as a descriptive study design. Study was held in two vocational high schools in Ankara between May and June 2018 (n=685). The research data were collected by sociodemographic and diet information form, social appearance anxiety scale (SAAS) and eating attitude test (EAT-26). Researchers used independent-samples t-test, one-way analysis of variance and correlation analysis for the data analyses. 60% of the students are male, and 35.8% of students have an abnormal body mass index. The frequency of normal eating attitudes was found as 71.8% while the frequency of abnormal eating attitudes was found as 28.2%. A weak positive correlation is between the SAAS and the EAT-26 scores ($r = .129$). Although, a weak negative correlation was between the school year and the EAT-26 score ($r = -.076$). The SAAS mean score of the students, who stated that they used medicines, was significantly higher than the others. Abnormal eating attitude is related to social appearance anxiety. Eating attitudes are related to social appearance anxiety among vocational school students. Social appearance anxiety impacts abnormal eating attitudes. Psychosocial support to reduce social appearance anxiety might improve the physical and mental health of vocational high school adolescents.

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1. Introduction

Physical appearance and social appearance may cause individuals to experience emotional, cognitive and behavioural concerns regarding their appearance and nutrition (Abdo et al., 2023). Social appearance anxiety refers to the fears that one will be negatively evaluated because of one's appearance. This appearance could include body shape, facial features, complexion, hair and skin colours (Hart et al., 2008; Ayala, 2020). Social appearance anxiety, focusing on their own physical appearance, expresses the people concerns that others may experience regarding their assessment. Because, other people's ideas play a role in determining the level of this anxiety, social appearance anxiety, eating attitudes are similar to social anxiety disorder (Verm & Kaushik, 2017; Casagrande et al., 2019; Dun et al., 2019).

Eating attitudes and eating heterogeneity is related to improving the quality of life (Baguley et al., 2019). A study stated that there is a relationship between emotion and excess food intake. Individuals' feelings about their bodies cause them to display negative eating attitudes (Casagrande et al., 2019). Also, the improvement strategies could be beneficial to perception and emotion underlying negative eating behaviour. Eating behaviours are signed to eating disorders and lots of serious mental health problem (Alcaraz-Ibáñez et al., 2020). Negative appearance perception could vary according to high or low body mass index. Eating disorders such as anorexia nervosa, bulimia and binge are thought to be associated with social appearance anxiety (Baguley et al., 2019).

A study's results supported the expected positive relationship between physical appearance comparisons and social physique anxiety and disordered eating (Alcaraz-Ibáñez et al., 2020). According to research, appearance anxiety and fear are extremely characteristic of eating disorders among students whose mean age is 20 (Levinson et al., 2019).

The importance of physical appearance in someone's self-esteem regardless of age group, geographic area or personal emotional circumstances (Sánchez-Cabrero et al., 2020). Adolescence is the life period, most often related to the onset of eating disorders due to adolescents' excessive fear of negative appearance (Christian et al., 2019). Since adolescents have high social anxiety, trying to make a good impression on other people may cause anxiety (Wang et al., 2018). In the studies conducted, it is stated that due to the characteristics of this period, adolescents mostly experience eating behaviour disorders. Eating disorders develop among adolescents generally high school period. Body perception, which has an important place in the formation of social appearance anxiety, occurs in adolescence, which corresponds to high school period. According to research, social appearance anxiety partially mediated the association between body esteem and eating-disorder risk among high-school students (Li, 2019).

Vocational or technical schools prepare the students' technical and occupational skills developing as well as academic. Vocational or technical skills are required to complete the tasks for a specific job.

According to research, gender is not found to moderate either the mediated or moderated relationships among adolescents underlying both physical appearance comparisons and social physique anxiety (Alcaraz-Ibáñez et al., 2020). Students of vocational school might be a family member of disadvantaged groups in the population as economic or educational status (Sánchez-Cabrero, 2020; Houtepen et al., 2020). In a study conducted by Wang (2018), to examine the frequency of obesity and dietary habits, it is stated that vocational high school students are in the risk group regarding dietary habits. In the literature, there is no study investigating the relationship between social appearance anxiety and eating behaviours that may occur in vocational schools, and this age group. In addition, there are very few studies in the literature, especially for vocational high school students. They are more vulnerable than their peers and preferred by children from socio-economically disadvantaged families. Therefore, they should receive more developmental interventions than their peers. This study can serve as a guide for these interventions.

The purpose of this study is to examine the relationship between social appearance anxiety and eating attitudes among vocational high school students.

Research questions:

- How is the social appearance anxiety of vocational high school students?
- How is the eating attitude of vocational high school students?

- What is the association between social appearance anxiety and eating behaviours among Vocational High School Students?

2. Material and Methods

2.1. Study design

This research was planned as a descriptive study type.

2.2. Study setting

This research was held in two vocational high schools in Ankara between May and June 2018. This study was conducted in the classroom environment, at the hours deemed appropriate by the school administrators, in a way that does not hinder education. There are suitable physical environments such as libraries to make the attempts of students to take anthropometric measurements comfortably.

2.3. Study population

According to the school's records, there are 698 students in the First Vocational Technical Anatolian High School and 1463 in the Second Vocational Technical Anatolian High School. Total 2161 student constituted the universe of the research. There are also students who start high school late or repeat a grade, so the upper age limit is as high as 23. The sample of the research comprised 685 students who were approved to participate in the study by their parents, and who agreed to participate in the study involved. These also cover the inclusion criteria, in summary.

- being a vocational high school student
- to have the permission of his family
- volunteering

Power analysis was performed with the G*Power 3.1.9.7 program to determine the minimum number of students who could participate in the study. t tests: Sample calculation was made according to the correlation test.

Effect size $p = 0.3$, α err prob=0.05, power=0.95, the minimum number of students to be sampled was determined as 111.

2.4. Study measures

The research data were collected with the sociodemographic and diet information form, social appearance anxiety scale (SAAS) and eating attitude test (EAT-26). Sociodemographic and diet information form consists of eight questions and anthropometric measurement (height, weight). The researchers developed the sociodemographic characteristics questions (Gerrard et al., 2020; Tayfur & Evrensel, 2020; Ebrahim et al., 2019).

Social Appearance Anxiety Scale is developed by Hart et al (2008), to measure the emotional, cognitive and behavioural anxiety of the individual regarding his/her appearance. The scale contains 16 items. The scale items are graded as “not suitable at all”, “not suitable”, “somewhat appropriate”, “suitable” and “completely suitable”. The first item of the scale is reversly scored. The total score of the scale is between 16 and 80. The high score obtained from the scale indicates that the social appearance anxiety is high. For the Turkish population, the validity and reliability of the scale were done by Doğan et al. (2010). The internal consistency coefficient of the scale was found .84. In this study, the internal consistency coefficient of the scale (Cronbach’s Alpha) was determined .92.

Eating Attitude Test (EAT-26) was developed by Garner and Garfinkel (1979) to measure the symptoms of anorexia nervosa. EAT-26 scores do not indicate eating disorder; it shows the risk is developing an eating disorder when EAT-26 scores. In this research, the 26-item version was used.

The analysis of the test is determined by evaluating the sum of the scores of the 26 items. The scale items are graded as "never", "rarely", "sometimes", "often", "usually" and "always", with the answer option, 20 points are used as the cut-off point for the test. The 25th item of the test is reversed. Individuals scoring 20 and above are called individuals with “high risk of eating disorders”, while those scoring below 20 are considered as individuals with “normal eating behaviour”. The validity and reliability of the test are not conducted in Turkey; this study has made an application-specific among university students as a pilot study (Savasir & Erol, 1989). There is a lot of evidence that the scale can be used in high school and adolescents (Vardar & Erzengin, 2011; Uzdil et al., 2017; Buyuk & Duman, 2014; Hasan, 2017; Büyük & Özdemir, 2018). The internal consistency coefficient (Cronbach’s alpha) was found as .70. In this study, the internal consistency coefficient (Cronbach’s alpha) of the test was determined as a .84.

2.5. Anthropometric measurements

Students’ anthropometric measurements were obtained at the library. Students were provided with as few clothes as possible to minimize errors that may occur while taking measures. Evaluation of body mass index is arranged following, according to the World Health Organization Europe (2019). Very weak/Underweight II (≤ 16.9), Weak/Underweight I

(17-18.4), Normal weight (18.5-24.9), Pre-obesity/Overweight (25-29.9), Obesity I and II/Obesity (30-39.9), Obesity III/Heavy Obesity (>= 40).

2.6. Statistical Analysis

The data were obtained with the Statistical Package for the Social Sciences program. Number, percentage, average, standard deviation were used as descriptive statistics. The t-test (Independent Sample t-Test), one-way ANOVA, and Pearson correlation analysis (Point Biserial Correlation) were used according to the normality test (skewness, kurtosis +1, -1) results to compare the average scores.

3. Results

Majority of the students were male (60.4%). The mean age of students was 16.3±1.36 (min=15-max=23). Approximately half of the student (42.9%) is in the first year of school. 16.8% of students had very weak BMI, and 19% of the students are overweight and obese. More than half of students (64.2%) had a normal BMI. 11% of the students reported that they have a chronic disease, 9.3% of the student used any medication, and 8.2% had a diet. These diets were determined to be 33.3% with calorie restriction and increase (Table 1).

Table 1. Sociodemographic and diet characteristics of students (N=685)

Characteristics	n	%
Grade (School years)		
1 st year	294	42,9
2 nd year	148	21,6
3 rd year	139	20,3
4 th year	104	15,2
Gender		
Girl	271	39,6
Boy	414	60,4
BMI		
Very weak	115	16,8
Normal	440	64,2
Overweight, obese, heavy obese	130	19,0
Chronic disease characteristics		
I have a chronic disease	80	11,7
I have not any chronic disease	605	88,3
Medicine usage		
I have medicine, regular I used	64	9,3
I have not any medicine, I used	621	90,7
Diet		
I have a diet	56	8,2
I have not any diet	629	91,8
Diet type*	N:72	
Calorie restriction or increase	24	33,3
Salt restriction	20	27,8
Fat restriction	20	27,8
Diabetic diet	8	11,1

*Students could choose more than ones

The SAAS mean score of the students revealed 36.67±15.05. The EAT-26 mean score of the students was 13.80 ± 11.09. The frequency of normal eating attitudes was found as 71.8% while the frequency of abnormal eating attitudes was found as 28.2%. (Table 2).

The difference between students' medicine used status and SAAS scale mean scores were found statistically significant (t: 0.004; p: 0.006). The difference between the students with diet and EAT-26 scores were found statistically significant (t: 6.247; p: 0.001). (Table 3).

Table 2. The students' EAT-26 and SAAS characteristics (N=685)

	N	%	Min	Max	$\bar{x} \pm sd$
SAAS (total)	685		16	79	36,67±15,05
EAT-26 (total)	685		0	54	13,80±11,09
EAT-26 (20≤mean)	193	28,2	Anormal eating attitude		
EAT-26 (20>mean)	492	71,8	Normal eating attitude		

Table 3. The difference between students' SAAS and EAT-26 mean scores according to some sociodemographic characteristics (N=685)

	N	%	SAAS $\bar{x} \pm sd$	p	EAT-26 $\bar{x} \pm sd$	p
Grade (School years)						
1 st year	294	42,9	37,50±14,83	F:2,120	14,68±10,24	F:1,694
2 nd year	148	21,6	37,56±15,60	p:0,096	13,28±11,40	p:0,167
3 rd year	139	20,3	33,89±12,43		13,63±11,67	
4 th year	104	15,2	36,73±17,62		12,31±12,10	
Gender						
Girl	271	39,6	37,34±14,56	t:0,902	14,81±10,47	t:5,607
Boy	414	60,4	36,22±15,36	p:0,351	13,14±11,45	p:0,203
BMI						
Very weak	115	16,8	36,79±15,39	F:1,082 p:0,339	14,99±11,90	F:0,670
Normal	440	64,2	36,13±14,51		13,65±10,94	p:0,512
Overweight, obese	130	19,0	38,36±16,47		13,26±10,87	
Chronic disease characteristics						
I have a chronic disease	80	11,7	39,25±16,24	t:2,135 p:0,130	14,46±10,82	F:0,290
I have not any chronic disease	605	88,3	36,32±14,87		13,72±11,13	p:0,754
Medicine usage						
I have a medicine, regular I used	64	9,3	41,59±15,07	t:0,004 p:0,006	15,09±11,00	t:0,055 p:0,478
I have not any medicine, I used	621	90,7	36,16±14,97		13,67±11,10	
Diet						
I have a diet	56	8,2	36,45±16,13	t:1,367 p:0,873	17,23±12,59	t:6,247 p:0,001
I have not any diet	629	91,8	36,69±14,97		13,50±10,91	

p-value (<0,05) are in bold

A positive correlation was found between the SAAS score and the EAT-26 scores ($r = .129$). Although the EAT-26 scores were higher in the 9th and 10th-grade students than the other upper grades, the difference between the scores was not statistically significant, and a negative correlation was found between the

grade and the EAT-26 score ($r = -.076$). There was a negative and statistically significant relationship between students' SAAS mean scores and medicine usage ($r = .105$). Also, there was a negative statistically significant relationship between students' EAT-26 mean scores and diet ($r = .128$) (Table 4)

Table 4. Correlation between students' SAAS and EAT-26 mean scores and a lot of sociodemographic characteristics (N:685)

	EAT-26	SAAS	Grade	Gender	BMI	Chronic disease	Medicine usage	Diet
EAT-26	1,000							
SAAS	,129**	1,000						
Grade	-,076*	-,055	1,000					
Gender	-,049	-,036	-,043	1,000				
BMI	-,044	-,033	,094*	,115**	1,000			
Chronic Disease	-,011	-,062	,042	,078*	,013	1,000		
Medicine Usage	-,027	-,105**	,036	,099**	-,013	,602**	1,000	
Diet	-,128**	,007	-,003	,053	-,132**	,107**	,106**	1,000

* $p < ,05$; ** $p < ,01$

4. Discussion

Adolescences experience multi-dimensions changes. These changes make adolescents vulnerable to body image, appearance issues. Negative body image perception can lead to psychosocial problems such as social appearance anxiety and eating disorders in adolescents (Abdo et al., 2023; Houtepen et al., 2020). Previous studies indicate that the mean score of the SAAS supports the present study among high school students and female students in Turkey (Yildirim & Tastan, 2020; Radix et al., 2020). Also, unexpectedly, the current study was not found any significant relationship between SAAS and gender. However, it was observed that the social appearance anxiety levels of male students were higher than female students (Ebem, 2019).

Ebrahim (2019), indicate that obese participants have higher disordered eating attitudes among Kuwaiti college boys. This may be due to the majority of male students in the school.

It is important to emphasis, EAT-26 scores do not indicate eating disordered. High risk is developing an eating disorder when EAT-26 scores are ≥ 20 (Ebrahim et al., 2019). A study determined the mean score of EAT-26 was 30.89 ± 12.60 among women who have 21.6 mean ages for a clinical group. The same research represents the mean score of EAT-26 was similar to the current research. It is meaning that student who has more than 19 scores, there are eating disorder could present.

Also, the same study report that possible eating disorder is sensitive to pathologically healthful eating (Dunn et al., 2019). The current study shows, approximately a quarter of students have a high risk of eating disorders in this study. Also, they are reputed to could have possible eating disorders. Study support this percentage, (22.3%) and they focus on abnormal eating attitude was highly prevalent among the students (Mohiti et al., 2019). Tayfur and Evrensel (2020)' research, shows that 55 (18.3%) students have abnormal eating attitudes among Turkish university students aged 18 to 25 (Tayfur & Evrensel, 2020). However, the percentage of disordered eating attitudes is found quite low in another study (4.5%) (Michael et al., 2019). This prevalence difference might be rooted in study samples which is the Vocational School in the present study.

This study is focused on the relationship between eating attitudes and diet (-0.128), grade (-.076) is found statistically significant negative correlations ($p < 0.05$; Table 4). Michael (2019)'s study supports our findings partially; they are described in there are not any eating attitudes differences between grades. Their study indicates that BMI and eating attitudes have little to no relationship with each other, support the present study. Also, they argue that the diet and eating attitudes has not previously been studied among climber adolescent (Michael et al., 2019). The differences for the grades may be rooted in student school year distribution. Because the majority of students who were in the first year of the school, attend this study.

The current research is focused on the relationship between social appearance anxiety, and medicine

usage is found statistically significant ($p < 0.05$; Table 4). Students who use any medicine generally have any disorders or any chronic disease. So, this could be the reason for the relation between social appearance and eating attitudes. Ebrahim et al (2019), indicate that obese participants have higher disordered eating attitudes among Kuwaiti college boys. High levels of eating disorder symptoms also linked to obesity. According to another research among 14–25 years old girls, an online survey. The SAAS score of the students with eating disorders ($n=83$) is higher than healthy students ($n=323$)' SAAS score (Yildirim & Tastan, 2020). Students who use any medicine have any diseases or any chronic disease. So, this could be the reason for a significant relationship.

Anxiety and fear are essential for eating disorders among adolescents (Levinson et al., 2019). The current study shows that there is a significant relationship between eating attitudes and social appearance anxiety. Many studies support this finding.

According to research among 14-25 years old girls an online survey. It was found that the SAAS score of the students with eating disorders and eating attitude ($n=83$) is higher than healthy students ($n=323$)' SAAS score (Radix et al., 2019). A study indicates that social appearance anxiety significantly predicted body dissatisfaction in college-aged male, providing additional support to a growing body (Gerrard et al., 2020). Another study report that high levels of eating disorder symptoms and eating attitudes are linked to obesity and obese students generally have social appearance anxiety. Also, body dissatisfaction-related indices pertaining to muscularity (Ebrahim et

al., 2019). So, social appearance anxiety is mediated. According to another study, social appearance anxiety are highly comorbid for eating disorders among high school students (Christian et al., 2019). Social appearance anxiety impacts the relationship between eating pathology and body image disturbances (Radix et al., 2019). Body image and self-esteem predicted eating disorder risk among the high school student-athletes; in the US. The findings of this study can be a productive start to understanding the issue, but more research and prevention programs are needed (Ayala, 2020). Based on the results, it can be concluded that the training programs which is conducted to reducing social appearance anxiety, might be useful for the prevent the risk of eating disorders among this vocational high school students. The most important limitation of this study was that it was conducted with only one type of high school students.

However, as we mentioned in the introduction, since vocational high school students are among the risk groups, we think that this supports the strength of this study for the beginning.

5. Conclusions

All in all, findings from the present study show that eating attitudes are related to social appearance anxiety among vocational school students. In other words, social appearance anxiety impacts abnormal eating attitudes. It may be recommended to consider these two parameters together in future studies. It emphasizes the need to focus on improving the physical and mental health of the adolescent by providing psychosocial support to reduce anxiety. These data should be taken into account especially in

the eating attitudes pathology (Radix et al., 2019). the interventions to be made for vocational high school students.

The parameters resulting from this study should be added when planning education and programs.

The limitations of this study are that it is specific to the high school where the study was conducted and cannot be generalized. In addition, another limitation of the study is that the sample is limited due to the small number of students who volunteered and whose permission was obtained.

Data availability

Data that support the findings of this study have been deposited by the Corresponding author. This datasets analysed during the current study are available from the via the e-mail on reasonable request.

Conflict of interest

The researchers declare they have no conflict of interest.

Ethical Statements

It was consulted to (...) University Ethics Commission to evaluate the ethical suitability of the study. It was approved by the commission. Commission approved 04th meeting on 08.05.2018 (approval date). The research code is 2018-157 (approval number). The permission of the institution, scale and participants was obtained before the study was started. Also, it presented as an oral abstract presentation 6th International Nursing Congress, 19-21 December 2019 Ankara in Turkiye.

References

- Abdo, Z. A., Seid, S. A., & Woldekiros, A. N. (2023). Self-perception of physical appearance of adolescents and associated factors in Addis Ababa, Ethiopia, *Plos one*, 18(1), <https://doi.org/10.1371/journal.pone.0281202>
- Alcaraz-Ibáñez, M. Sicilia, Á. Díez-Fernández, D. M., & Paterna, A. (2020) Physical appearance comparisons and symptoms of disordered eating: The mediating role of social physique anxiety in Spanish adolescents. *Body Image*, 32, 145-149. <https://doi.org/10.1016/j.bodyim.2019.12.005>.
- Ayala, R. V. (2020) Link between eating disorder risk, self-esteem, and body image among Puerto Rican high school student-athletes. *Journal of Physical Education and Sport*, 20(1), 170-178. <https://doi.org/10.7752/jpes.2020.01023>.
- Baguley, B. J., Skinner, T. L., & Wright, O. R. (2019) Nutrition therapy for the management of cancer-related fatigue and quality of life: a systematic review and meta-analysis. *British Journal of Nutrition*, 122(5), 527-541. <https://doi.org/10.1017/S000711451800363X>.
- Büyük, E. T., & Duman, G. (2014). Farklı Okullarda Okuyan Lise Öğrencilerinin Yeme Tutum ve Davranışlarının Değerlendirilmesi. *Journal of Pediatric Research*, 1(4), 212-217. <https://doi.org/10.4274/jpr.58076>
- Büyük, E. T., & Özdemir, E. (2018). Lise Öğrencilerinin Beden Algısı İle Yeme Tutumu Arasındaki İlişki. *International Anatolia Academic Online Journal Health Sciences*, 4(2), 1-12. <https://dergipark.org.tr/tr/download/article-file/534422>
- Casagrande, M., Boncompagni, I., Forte, G., Guarino, A., & Favieri, F. (2019). Emotion and overeating behaviour: effects of alexithymia and emotional regulation on overweight and obesity. *Eat and Weight Disorders- Studies on Anorexia Bulimia and Obesity*, 1-13. <https://doi.org/10.1007/s40519-019-00767-9>.
- Christian, C., Brosos, L. C., Vanzhula, I. A., Williams, B. M., Ram, S. S., & Levinson, C. A. (2019) Implementation of a dissonance-based, eating disorder prevention program in Southern, all-female high schools. *Body Image*, 30, 26-34. <https://doi.org/10.1016/j.bodyim.2019.05.003>.
- Dunn, T. M., Hawkins, N., Gagliano, S., & Stoddard, K. (2019) Individuals who self-identify as having "orthorexia nervosa" score in the clinical range on the Eating Attitudes Test-26. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 24, 1025-1030. <https://doi.org/10.1007/s40519-019-00651-6>.
- Ebem, V. (2019) Investigation of social appearance levels of high school students in terms of different variables (Example of Bitlis and Yozgat province), Ağı Ibrahim Cecen University. Master Dissertation, Social Sciences Institute. <https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSonucYeni.jsp> Accessed 30 August 2020.
- Ebrahim, M., Alkazemi, D., Zafar, T. A., & Kubow, S. (2019) Disordered eating attitudes correlate with body dissatisfaction among Kuwaiti male college students. *Journal of Eating Disorders*, 7(1), 37-51. <https://doi.org/10.1186/s40337-019-0265-z>.
- Gerrard, O., Galli, N., & Santurri, L. (2020) Examining body dissatisfaction in college men through the exploration of appearance anxiety and internalization of the mesomorphic ideal. *J Am Coll Health*, 1-7. <https://doi.org/10.1080/07448481.2019.1704412>.
- Hart, T. A., Flora, D. B., Palyo, S. A., Fresco, D. M. C., & Holle, R. G. (2008). Development and examination of the social appearance anxiety scale. *Assessment*, 15(1), 48-59. <https://doi.org/10.1177/1073191107306673>.
- Hasan, H. Ç. (2017). Ergenlerde yeme bozukluğu görülme sıklığı ve ruhsal semptomlar ile ilişkisi. *Turkish Journal of Public Health*, 15(2), 96-105. <http://tjph.org/ojs/index.php/>
- Houtepen, L. C., Heron, J., Suderman, M. J., Fraser, A., Chittleborough, C. R., & Howe, L. D. (2020) Associations of adverse childhood experiences with educational attainment and adolescent health and the role of family and socioeconomic factors: A prospective cohort study in the UK. *PLoS Medicine*, 17(3), 1-21. <https://doi.org/10.1371/journal.pmed.1003031>.
- Levinson, C. A., Vanzhula, I. A., & Christian, C. (2019) Development and validation of the eating disorder fear questionnaire and interview: Preliminary investigation of eating disorder fears. *Eating Behaviors*, 35, 1-9. <https://doi.org/10.1016/j.eatbeh.2019.101320>.
- Li, Y. (2019) Linking body esteem to eating disorders among adolescents: A moderated mediation model. *Journal of Health Psychology*, 1-16. <https://doi.org/10.1177/1359105319886048>.
- Michael, M. K., Joubert, L., & Witard, O. C. (2019) Assessment of Dietary Intake Patterns and Eating Attitudes in Recreational and Competitive Adolescent Rock Climbers: A Pilot Study. *Frontiers in Nutrition*, 6, 64. <https://doi.org/10.3389/fnut.2019.00064>.
- Mohiti, S., Rasouli, A., Shiri-Shahsavari, M. R., & Javadi, M. (2019) Associations of Eating Disorder with Sleep Status and Anthropometric Measurements in Female Adolescents in Zanjan, Iran. *Journal of Human Environment and Health Promotion*, 5(3), 127-131. <https://doi.org/10.29252/jhehp.5.3.6>.
- Radix, A. K., Rinck, M., Becker, E. S., & Legenbauer, T. (2019) The mediating effect of specific social anxiety facets on body checking and avoidance. *Frontiers in Psychology*, 9, 2661. <https://doi.org/10.3389/fpsyg.2018.0266>.

- Sánchez-Cabrero, R., Martínez-López, F., & Euán-Ramírez, R. G. (2020) Body image of people over 50 in Spain measured using the BSQ test. *BMC Research Notes*, 13(1), 50-54. <https://doi.org/10.1186/s13104-020-09102-0>
- Savasir, I., & Erol, N. (1989). Yeme tutum testi: anoreksiya nevroza belirtileri indeksi. *Türk Psikoloji Dergisi*, 7, 19-25. <https://toad.halileksi.net/wp-content/uploads/2022/07/yeme-tutum-testi-anoreksiya-nervoza-belirtileri-indeksi-toad.pdf>
- Tayfur, S. N., & Evrensel, A. (2020) Investigation of the relationships between eating attitudes, body image and depression among Turkish university students. *Rivista di Psichiatria*, 55(2), 90-97. <https://doi.org/10.1708/3333.33023>.
- Trekels, J., & Eggermont, S. (2017). Linking magazine exposure to social appearance anxiety: The role of appearance norms in early adolescence. *Journal of Research on Adolescence*, 27(4), 736-751. <https://doi.org/10.1111/jora.12311>.
- Uzdil, Z., Özenoğlu, A., & Ünal, G. (2017). Lise öğrencilerinde yeme tutumlarının beslenme alışkanlıkları, antropometrik ve demografik özellikleri ile ilişkisi. *Düzce Üniversitesi Sağlık Bilimleri Enstitüsü Dergisi*, 7(1), 11-18. <https://dergipark.org.tr/pub/duzcesbed/issue/31210/66711>.
- Vardar, E., & Erzenin, M. (2011). Ergenlerde yeme bozukluklarının yaygınlığı ve psikiyatrik eş tanıları iki aşamalı toplum merkezli bir çalışma. *Türk Psikiyatri Dergisi*, 22(4), 205-212. <https://search.trdizin.gov.tr/en/yayin/detay/135418>.
- Verma, K., & Kaushik, P. (2017) Social appearance anxiety and fear of negative evaluation in college-going students with acne vulgaris. *International Journal of Psychology and Psychiatry*, 5(2), 63-75. <https://doi.org/10.5958/2320-6233.2017.00011.6>.
- Wang, H., Hu, R., Du, H., Fiona, B., Zhong, J., Yu, & M. (2018) The relationship between sleep duration and obesity risk among school students: a cross-sectional study in Zhejiang, China. *Nutrition & Metabolism*, 15(1), 48-59. <https://doi.org/10.1186/s12986-018-0285-8>.
- Yildirim, E., & Tastan, N. (2020). The predictive role of narcissistic personality tendencies and social appearance anxiety on problematic internet use among university students. *Kirkuk University Journal-Scientific Studies*, 10, 79-100. <https://dergipark.org.tr/tr/download/article-file/952345>. Accessed 30 August 2020.

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Evaluation of The Palatal Ruga Morphologies of Young Adult Individuals Attending A Dental School in Turkey

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Abstract

The aim of this study is to evaluate the change of palatal rugae morphology. The dental plaster models of 232 (133 females and 99 males) individuals aged between 18-40 years (mean age \pm standard deviation: 32.3 ± 5.4) were examined to evaluate palatal rugae morphology. The length, shape, and direction of rugae were recorded. Types for length, shape, and direction were compared with Friedman and Wilcoxon's signed rank tests regarding the number of occurrences. The differences between genders were assessed using the Mann-Whitney non-parametric tests. Primary ruga type is 5 to 10 mm / 10 mm or more. The most common rugae was the primary type and no significant difference was found in terms of rugae length by gender. The most common rugae was curved rugae. No significant difference was found between genders. The results of this study showed that no statistically significant differences were found between genders for the length and direction of rugae.

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1. Introduction

Forensic medicine plays a very important role in criminal and civil law. In this context, the science of dentistry is also used in human identification. This branch of science is known as forensic dentistry and forensic odontology (Gadicherla et al., 2017). Determining the age, gender, and ethnicity of people is difficult, especially in mass disasters (Sheikhi et al., 2018).

Ethnicity is defined as a category of people who identify with one another based on similarities such as common ancestry, language, social, cultural, or national experiences (Peoples & Baley, 2011). The most common identification methods used include visual identification, fingerprinting, dental record comparisons, and D.N.A. (deoksiribonükleik acid) profiling (Muthusubramanian et al., 2005; Saraf et al., 2011). These techniques are reported to have some limitations (Buchner, 1985; Muthusubramanian et al., 2005). D.N.A. profiling is an ideal method often used in forensic medicine. However, using it in large populations can be expensive and time-consuming (Muthusubramanian et al., 2005). Visual identification and fingerprints are methods that have limitations for post-mortem identification due to variations in time, temperature, and humidity (Morlang, 1982). In addition, these methods are useless when the body is burned or rotten (Subramanian & Jagannathan, 2015). However, it has been shown that the durability of dental tissues in these conditions has a significant advantage in terms of identification (Anderson et al., 1995; Nambiar et al., 1977).

Among the oral tissues, palatal rugae are permanent, unique to each individual, and can establish identity through discrimination (Muthusubramanian et al., 2005). Palatal rugae or transverse palatine folds are asymmetrical irregular elevations of the mucosa, which are located in the anterior third of the hard palate (Verma et al., 2014). Palatal rugae, due to their internal position, are protected from trauma and high temperatures by lips, cheek, tongue, and buccal pad of fat teeth and bone and do not demonstrate age-related changes (Muthusubramanian et al., 2005).

The aim of this study is to evaluate the change of palatal rugae morphology according to gender in patients attending a dental school in Turkey.

2. Material and Methods

The human subject protocol was approved by the Ethics Committee of Gazi University, Faculty of Dentistry, Ankara, Turkey (confirmation number: 17/09/2018-E.34993-21071282-050.99-) by the Helsinki Declaration of 1975, as revised in 2013.

In this study, the palatal rugae morphology of 232 individuals aged between 18-40 years who applied to Gazi University Faculty of Dentistry for several dental treatments was evaluated. The sample size was determined as 232 with the G-power 3.1 program with a power value of 0.95, an error level of 0.05, and an effect size of 0.2.

The participants who applied to the Oral Diagnosis Clinic of Gazi University Faculty of Dentistry, Department of Dento-maxillofacial Radiology for various reasons, needed to obtain a dental plaster model due to their treatment (prosthetic rehabilitation due to tooth deficiency, parafunctional habit-preventing night plaque such as nocturnal bruxism, etc. Patients meeting the following criteria were included in the study; no systemic disease, no orthodontic treatment before, absence of missing teeth in the upper jaw, or removal of missing teeth with fixed prosthetic restorations. Participants who agreed to participate in the study were informed and written consent was obtained from volunteers. Then, master models of individuals whose upper jaws were measured as a requirement for treatment in Gazi University Faculty of Dentistry, Department of Prosthodontics, were obtained with hard plaster material. Incisive papilla and median raphe regions were marked with a pencil in the prepared plaster models and were used as anatomical landmarks. The borders of the palatal rugae on the model were drawn with a pencil to make a more precise evaluation. Palatal rugoscopy was performed according to the closed classification; in this context, the rugae on both sides were evaluated separately as the right and left, with the median raphe being the midline.

The length, shape of the rugas, and the direction of rugas recorded on the prepared special forms for the study. Rugae longer than 5 mm were defined as primary rugae, rugae between 3-5 mm long were defined as secondary rugae, and rugae shorter than 3 mm were defined as fragmentary rugae (Thomas & Kotze, 1983). The shape of the rugas was called curved, wavy, straight, and circular (Kapali et al., 1997.) (Fig. 1).

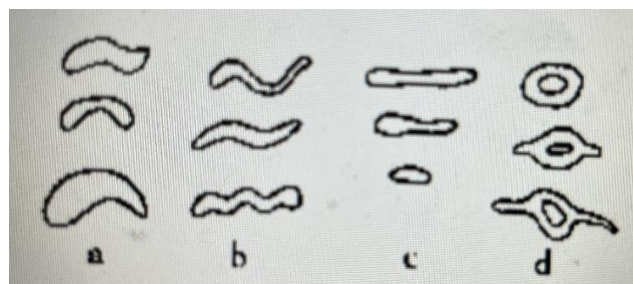


Fig.1. a) curved b) wavy c) straight d) circular

To evaluate the directions of the rugae, a line perpendicular to the median raphe was drawn according to the angle formed, those that formed a positive angle were defined as forward-looking rugae, those that created a negative angle were defined as backward-oriented rugae, and those that form 0° were defined as vertical rugae. Rugas that branch towards the midline were recorded as convergent and rugae that unite towards the midline were recorded as divergent. In line with the data obtained, it was examined whether gender and age factors affect rugae morphology (Kapali et al., 1997).

3. Results

A total of 232 people (133 females; 99 males) with a mean age of 32.3 (standard deviation 5.4) were included in the study. Test results regarding the comparison of rugae length types according to the number of occurrences are given in Table 1. Accordingly, there is a significant difference between the frequency of occurrence of ruga length types on the right ($p < 0.05$) and left ($p < 0.05$) sides. The most common rugae was the primary type. There is no significant difference was found in terms of rugae length by gender (Table 2) ($p > 0.05$).

Table 1. Rugae length types

Types of rugae length	Right-side	Left-side
	Mean Rank	Mean Rank
Primary	2,76	2,85
Secondary	1,92	1,80
Fragmentary	1,32	1,34
Friedman Test		
Chi-Square	290,94	321,85
Asymp. Sig.	0,000	0,000

According to shape, the most observed rugae was curved (Table 3). Only, the distribution of a number of left side-wavy rugae differs significantly between males and females (Table 4) ($p < 0.05$). It can be said that the number of left wavy rugae was higher in males than in females.

Table 2. The relationship between rugae length and gender

Variables	Gender	Mean	SD	Median	Minimum	Maximum	Z	p-value
Right Side-Primary Rugae	Male	2,66	,82	3,00	1,00	4,00	-0.773	0.439
	Female	2,75	,98	3,00	1,00	5,00		
Right Side-Secondary Rugae	Male	1,87	1,23	1,50	1,00	8,00	-0.360	0.719
	Female	1,77	1,01	1,00	1,00	5,00		
Right Side-Fragmentary Rugae	Male	1,33	,65	1,00	1,00	3,00	-0.428	0.669
	Female	1,55	1,06	1,00	1,00	5,00		
Left Side-Primary Rugae	Male	3,13	,99	3,00	1,00	5,00	-0.348	0.728
	Female	3,22	,99	3,00	1,00	6,00		
Left Side-Secondary Rugae	Male	1,80	1,23	1,00	1,00	6,00	-0.287	0.774
	Female	1,68	,80	1,00	1,00	4,00		
Left Side-Fragmentary Rugae	Male	1,33	,49	1,00	1,00	2,00	-0.476	0.634
	Female	1,48	,68	1,00	1,00	3,00		

Z: Mann-Whitney U test

SD: Standard deviation

Table 3. Shapes of palatal rugae

Palatal rugae shapes	Right-side	Left-side
	Mean Rank	Mean Rank
Curved	3,59	3,59
Wavy	2,64	2,69
Straight	2,03	1,97
Circular	1,74	1,76
Friedman Test		
Chi-Square	372,737	381,619
Asymp. Sig.	0,000	0,000

There is a statistically significant difference in terms of the number of occurrences of rugae direction types on the right side (Table 5) ($p < 0.05$). Accordingly, convergent type is more common than the divergent type. No significant difference was found between the number of rugae in terms of gender for each type of direction and side (Table 6) ($p > 0.05$).

Table 4. The relationship between rugae shape and gender

Variables	Gender	Mean	SD	Median	Minimum	Maximum	Z	p-value
Right Side-Curved Rugae	Male	2,91	1,25	3,00	1,00	7,00	-0.137	0.891
	Female	3,02	1,55	3,00	1,00	8,00		
Right Side-Wavy Rugae	Male	1,78	,90	2,00	1,00	4,00	-1.049	0.294
	Female	1,59	,73	1,00	1,00	4,00		
Right Side-Straight Rugae	Male	1,52	,79	1,00	1,00	4,00	-0.084	0.933
	Female	1,44	,58	1,00	1,00	3,00		
Right Side-Circular Rugae	Male	2,00	1,73	1,00	1,00	4,00	-0.711	0.477
	Female	1,44	1,33	1,00	1,00	5,00		
Left Side-Curved Rugae	Male	3,16	1,44	3,00	1,00	7,00	-1.220	0.222
	Female	3,46	1,63	3,50	1,00	8,00		
Left Side-Wavy Rugae	Male	2,11	1,09	2,00	1,00	5,00	-2.136	0.033*
	Female	1,74	,97	1,00	1,00	5,00		
Left Side-Straight Rugae	Male	1,47	,64	1,00	1,00	3,00	-0.335	0.738
	Female	1,43	,73	1,00	1,00	4,00		
Left Side-Circular Rugae	Male	1,00	,00	1,00	1,00	1,00	0.000	1.000
	Female	1,00	,00	1,00	1,00	1,00		

Z: Mann-Whitney U test; SD: Standard deviation * p<0.05

4. Discussion

Table 5. Directions of rugae

Rugae directions	Right-side	Left-side
	Mean Rank	Mean Rank
Convergent	27,56	33,52
Divergent	26,74	30,31
Wilcoxon Signed		
Z	-2,470 ^b	-1,582 ^b
Asymp. Sig.	0,013	0,114

Palatal rugoscopy, which has been used successfully to identify an individual based on pattern analysis, has proven to be significantly unique among individuals in terms of shape, length, width, salience, number, and orientation. Therefore, postmortem rugae details can be compared with antemortem records (Purohit et al., 2015).

Table 6. The relationship between the number of rugae direction and gender

Vaiables	Gender	Mean	SD	Median	Minimum	Maximum	Z	P value
Right Side-Covergent (Konvex) Rugae	Male	1,14	,38	1,00	1,00	2,00	-1.195	0.232
	Female	1,00	,00	1,00	1,00	1,00		
Right Side-Divergent Rugae	Male	1,00	,00	1,00	1,00	1,00	-0.894	0.371
	Female	1,05	,22	1,00	1,00	2,00		
Left Side-Covergent (Konvex) Rugae	Male	1,70	1,34	1,00	1,00	5,00	-1.679	0.093
	Female	1,06	,25	1,00	1,00	2,00		
Left Side-Divergent Rugae	Male	1,11	,32	1,00	1,00	2,00	-0.765	0.445
	Female	1,04	,21	1,00	1,00	2,00		

Z: Mann-Whitney U test SD: Standard deviation

Palatal rugae are transverse, irregular, and asymmetrical projections of the mucous membrane behind the papillae in the anterior part of the palate (Gondivkar et al., 2011). They appear as localized epithelial thickening near the incisive papillae during the 3rd month of intrauterine life and are fully formed by 12 to 14 of prenatal life (Nayak et al., 2007). They may then experience changes in size due to growth, but their shape remains constant (Gandikota et al., 2012; Gondivkar et al., 2011).

Muthusubramanian et al. (2005) performed a rugae analysis in burn victims and cadavers in 2005 to simulate rugae identification in cases of burning and decomposition. When examining subjects with third-degree pan facial burns after storing them for 72 hours in a mortuary at 5 degrees and 30 to 40 percent relative humidity, they reported that 93 percent of the palatine rugae were normal and 77 percent of the palatine rugae

showed no color change (Muthusubramanian et al., 2005).

Our study analyzed the rugae patterns on dental casts made from the subjects' impressions. Stone castings offer the advantage of simulating the oral cavity in the forensic laboratory: they are easy to use, straightforward to analyze, low cost, and easy to fabricate. Sognaes argued that using casts made from jaws rather than dentures gives a more reliable result (Sognaes, 1977, as cited in Rajan et al., 2013). Observing rugae shapes using stone molds, which is a subjective study, is relatively easy and less time-consuming (Gadicherla et al., 2017), and does not require complex instruments (Bharath et al., 2011). Being unique to each person makes the palatal rugae ideal for forensic personal identification.

There is a consensus in the literature that the palatal rugae pattern is personal, similar to fingerprints (Palliwal et al., 2010; Santos & Serra, 2011). Another advantage of the palatal rugae is that it is protected by the cheeks, lips, and tongue in the mouth.

Therefore, the probability of their morphology changing is very low in the event of trauma, chemical attack, and fire (Nayak et al., 2007). It has been shown that the palatal rugae remain unchanged after various treatments such as tooth movement, palate enlargement, and tooth extraction (Barbieri et al., 2013; Muthusubramanian et al., 2005).

In the present study, the most common rugae were the primary type, which was matched with the findings of other studies. (Bharath et al., 2011; Gondivkar et al., 2011; Kapali et al., 1997; Palliwal et al., 2010; Surekha et al., 2012). Surekha et al. (2012) have shown that no difference was found in the total number of rugae for sexes and between the two sides of the palate, in females in general, had slightly more rugae than males, and the left side of the palate showed comparatively more number of rugae than on the right side. Regarding the length of rugae, primary rugae were predominant compared to secondary rugae in both females and males, but this difference is not statistically significant. The predominant rugae shape in males and females was a wavy pattern followed by curved, straight, and circular in that study. Palliwal et al. (2010) have reported that Keralite females showed slightly more secondary rugae than *Madhya Pradesh (M.P.)* females (*two groups of geographically different regions of India, namely, M.P. and Kerala*). Also, Gondivkar et al. (2011) have reported that a statistically significant difference in primary type was noticed which was higher in females than in males.

Kapali et al. (1997) showed that analysis of the number of aboriginal primary rugae failed to reveal any significant differences between sides or sexes.

Bharath et al. (2011) also reported significant differences in the total number and junctional pattern of rugae between men and women. A study of the Japanese population showed that women have fewer rugae than men (Dohke & Osato, 1994). It has been reported that Indian men have more primary rugae on their left side than women, and vice versa in the Tibetan population (Shetty et al., 2005). In our study, the dominant rugae type was curved and primary rugae. Our results differed from who showed that the dominant rugae type was wavy in their studies (Kallianpur et al., 2011; Saraf et al., 2011). Also, Kallianpur et al. (2011) have found secondary and fragmentary palatal rugae forms more common in Nepalese than in Indians.

A study by Saraf et al. (2011) showed that convergent rugae types are more common in males and circular types in females. Also, the number of left wavy rugae was significantly higher in males than females and other rugae shapes were not significantly different between males and females in the present study. Similarly, Sheikhi et al. (2018) have reported that the rugae shape was not significantly different between males and females. Gautam et al. (2017) showed that the average straight pattern was higher in men and the average circular pattern was the least in women.

When the rugae shapes were compared between the sexes, it was revealed that the left-sided wavy rugae were more common in males, which was statistically significant. Chatterjee and Khanna (2011) and Saraf et al. (2011) drew attention to the excess of convergent type rugae in women and circular type rugae in men.

Our study found the convergent type more than the divergent type on the right side. The results did not show a considerable difference in the rugae lengths between sexes. This correlates with the results of studies conducted by Malekzadeh et al., (2018) and Nayak et al. (2007) confirmed the studies conducted by Kapali et al. (1997) and Saraf et al. (2011). In contrast, Dohke and Osato (1994) showed increased rugae lengths in females. The number of primary rugae increased in both sexes, followed by the secondary rugae (Malekzadeh et al., 2018). Fragmented rugae were the least rugae pattern. Malekzadeh et al. (2018) has reported that the primary rugae were more common in males. In contrast, the fragmentary rugae were more common in females on both sides (Chatterjee & Khanna, 2011; Malekzadeh et al., 2018). This result does not agree with the findings of Abdulmajid et al. (2015), observed no difference in rugae length of more than 10 mm among males and females. In addition, Fahmi et al. (2001) showed no significant difference in fragmented rugae within 5 to 10 mm length among males and females. Bajracharya et al. (2014) conducted a study on the Nepalese population to determine an association between sex and the pattern and number of palatal rugae. They found no statistically significant difference in the palatal rugae number and pattern among sex groups. The distribution of different palatal rugae shapes in males and females showed that, in terms of the overall sample, the most prevalent palatal rugae patterns in descending order were primary, secondary, fragmentary, curved, wavy, straight, and circular. There is a general agreement among studies on various populations that wavy and curved configurations are the most prevalent patterns of palatal rugae (Abdellatif et al., 2011; Nayak et al., 2007; Rath & Reginald, 2014).

5. Conclusions

This study examined the length, shape, and direction of the rugae to evaluate the palatal rugae morphology used to determine gender.

The following results were obtained:

- No statistically significant differences were found between genders for the length and direction of rugae.
- There was a statistically significant difference between genders for the wavy shape of the rugae only on the left side.
- The most common rugae was the primary type with a length of more than 5 mm, the most common rugae was curved rugae and the most common rugae direction was convergent type on the right side.

Data Analysis

Data analysis was done using S.P.S.S. software version 28 (IBM SPSS Statistics, Armonk, NY). The normality of the data was examined by the Shapiro-Wilk test. Overall differences between gender groups were assessed using the Mann–Whitney Types for length, shape, and direction and were compared with Friedman and Wilcoxon signed rank tests in terms of the number of occurrences. Data analysis was performed using the IBM SPSS V.22 program, and the results were interpreted at 0.05 significance levels.

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Institutional Review Board Statement

The human subject protocol was approved by the Ethics Committee of Gazi University, Faculty of Dentistry, Ankara, Turkey (confirmation number: 17/09/2018-E.34993-21071282-050.99-) by the Helsinki Declaration of 1975, as revised in 2013.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest

The authors declare no conflict of interest.

Author Contributions

Conceptualization, A.Z.Y., I.P., and S.U.; methodology, A.Z.Y., I.P. and S.U.; software, A.Z.Y., S.U., I.P., and F.K.; validation, A.Z.Y., S.U., I.P., and F.K.; formal analysis, A.Z.Y. and S.U. investigation, A.Z.Y., and S.U.; data curation, A.Z.Y., S.U., I.P., and F.K.; writing-original draft preparation, A.Z.Y., I.P., and F.K.; writing-review and editing, A.Z.Y., S.U., I.P., and F.K.; visualization, A.Z.Y., and I.P.; supervision, A.Z.Y., and I.P.; project administration, A.Z.Y., and I.P. All authors have read and agreed to the published version of the manuscript.

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References

- Abdellatif, A.M., Awad, S.M., & Hammad, S.M. (2011). Comparative study of palatal rugae shape in two samples of Egyptian and Saudi children. *Pediatric Dental Journal*, 21,123-128. [https://doi.org/10.1016/S0917-2394\(11\)70238-5](https://doi.org/10.1016/S0917-2394(11)70238-5)
- Abdulmajid, Z., & Bugaighis, I. (2015). Evaluation of the morphology of palatal rugae in Libyan school children. *Journal of Dental Research*, 2, 024.
- Anderson, L., Juhl, M., Solheim, T., & Burrman, H. (1995). Odontological identification of fire victims: potentialities and limitations. *International Journal of Legal Medicine*, 107,229-234. <https://doi.org/10.1007/BF01245479>. PMID: 7632598.
- Bajracharya, D., Vaidya, A., Thapa, S., & Shrestha, S. (2014). Palatal rugae pattern in Nepalese-subjects. *Orthodontic Journal of Nepal*, 3, 36-39.
- Barbieri, A.A., Scoralick, R.A., Naressi, S.C., Moraes, M.E., Daruge, E.Jr., & Daruge, E. (2013). The evidence of the rugoscopy effectiveness as a human identification method in patients submitted to rapid palatal expansion. *Journal of Forensic Sciences*, 58 Suppl 1,235-238.
- Bharath, S.T., Kumar, G.R., Dhanapal, R., & Saraswathi, T. (2011). Sex determination by discriminant function analysis of palatal rugae from a population of coastal Andhra. *Journal of Forensic Sciences*, 3, 58-62. <https://doi.org/10.4103/0975-1475.92144>.
- Buchner, A. (1985). The identification of human remains. *International Dental Journal*, 35,307-311.
- Chatterjee, S., & Khanna, M. (2011). Dimensional analysis of various rugae patterns in north Indian population subset. *Journal of Forensic Dental Sciences*, 1; 3 (2), 86-88. <https://doi.org/10.4103/0975-1475.92153>
- Dohke, M., & Osato, S. (1994). Morphological study of the palatal rugae in Japanese 1. Bilateral differences in the regressive evaluation of the palatal rugae. *Japanese Journal of Oral Biology*, 36,125-140.
- Fahmi, F.M., Al-Shamrani, S.M., & Talic, Y.F. (2001). Rugae pattern in a Saudi population sample of males and females. *The Saudi Dental Journal*, 13, 92-95.
- Gadicherla, P., Saini, D., & Bhaskar, M. (2017). Palatal rugae pattern: An aid for sex identification. *Journal of Forensic Dental Sciences*, 9,48-49. https://doi.org/10.4103/jfo.jfds_108_15.
- Gandikota, C., Venkata, Y.P., Challa, P., Juvvadi, S.R., & Mathur, A. (2012). Comparative study of palatal rugae pattern in class II div 1 and classI individuals. *Journal of Pharmacy Bioallied Sciences*, 4 Suppl 2,358-363. <https://doi.org/10.4103/0975-7406.100271>
- Gautam, N., Patil, S.G., Krishna, R.G., Agastya, H., Mushtaq, L., & Kumar, K.V. (2017). Association of Palatal Rugae Pattern in Gender Identification: An Exploratory Study. *The Journal of Contemporary Dental Practice*, 18(6), 470-473.

- Gondivkar, S.M., Patel, S., Gadbaile, A.R., Gaikwad, R.N., Chole, R., & Parikh, R.V. (2011). Morphological study of the palatal rugae in western Indian population. *Journal of Forensic Legal Medicine*, 18,310-312. [https:// doi: 10.1016/j.jflm.2011.06.007](https://doi.org/10.1016/j.jflm.2011.06.007)
- Kallianpur, S., Desai, A., Kasetty, S., Sudheendra, U., & Joshi, P. (2011). Anthropometric analysis of facial height, arch length, and palatal rugae in the Indian and Nepalese population populations. *Journal of Forensic Dental Sciences*, Jan; 3(1), 33-37. [https:// doi: 10.4103/0975-1475.85294](https://doi.org/10.4103/0975-1475.85294).
- Kapali, S., Townsend, G., Richards, L., & Parish, T. (1997). Palatal rugae patterns in Australian aborigines and Caucasians. *Australian Dental Journal*, 42(2), 129-133.
- Malekzadeh, A.R., Pakshir, H.R., Ajami, S., & Pakshir, F. (2018). The Application of Palatal Rugae for Sex Discrimination in Forensic Medicine in a Selected Iranian Population. *Iranian Journal of Medical Sciences*, 43(6), 612-622.
- Morlang, W.M. (1982). Forensic dentistry. *Aviation, Space, and Environmental Medicine*, 53, 27-34.
- Muthusubramanian, M., Limson, K.S., & Julian, R. (2005). Analysis of rugae in burn victims and cadavers to simulate rugae identification in cases of incineration and decomposition. *The Journal of Forensic Odonto-Stomatology*, 23, 26-29.
- Nambiar, P., Jalil, N., & Singh, B. (1997). The dental identification of victims of an aircraft accident in Malaysia. *International Dental Journal*, 47, 9-15. [https:// doi: 10.1111/j.1875-595x.1997.tb00671.x](https://doi.org/10.1111/j.1875-595x.1997.tb00671.x).
- Nayak, P., Acharya, A.B., Padmini, A.T., & Kaveri, H. (2007). Differences in the palatal rugae shape in two populations of India. *Archives Oral Biology*, 52,977-982. [https:// doi: 10.1016/j.archoralbio.2007.04.006](https://doi.org/10.1016/j.archoralbio.2007.04.006)
- Palliwal, A., Wanjari, S., & Parwani, R. (2010). Palatal rugoscopy: Establishing identity. *Journal of Forensic Dental Sciences*, 2,27-31.[https:// doi: 10.4103/0974-2948.71054](https://doi.org/10.4103/0974-2948.71054).
- Peoples, J., & Bailey, G. (2011). *Humanity. An Introduction to Cultural Anthropology*. 9th ed. Canada: Cengage Learning; p. 389.
- Purohit, S.C., Shah, V., Manjunatha, B.S., Handge, K., Reddy, & N.M., G.S.S. (2015). Palatal Rugae: A Tool for Sex Identification in Forensic Odontology. *Research Journal of Pharmaceutical Biological and Chemical Sciences*, (3), 1351-1357.
- Rajan, V.P., John, J.B., Stalin, A., Priya, G., & Abuthagir, A.k. (2013). Morphology of palatal rugae patterns among 5-15-year-old children. *Journal of Pharmacy and Bioallied Sciences*. Jun; 5 (Suppl 1), S 43-47. [https:// doi: 10.4103/0975-7406.113295](https://doi.org/10.4103/0975-7406.113295). PMID: 23946575
- Rath, R., & Reginald, B.A. (2014). Palatal rugae: An effective marker in population differentiation. *Journal of Forensic Dental Sciences*, 6, 46-50. [https:// doi: 10.4103/0975-1475.127771](https://doi.org/10.4103/0975-1475.127771)
- Santos, K.C., & Serra, M.D. (2011). Evaluation of a digital methodology for human identification using palatal rugoscopy. *Brazilian Journal of Oral Sciences*, 10, 199-203.
- Saraf, A., Bedia, S., & Indurkar, A., Degwekar, S., Bhowate, R. (2011). Rugae patterns as an adjunct to sex differentiation in forensic identification. *Journal of Forensic Odonto-Stomatology*, 29, 14-19.
- Sheikhi, M., Zandi, M., & Ghazizadeh, M. (2018). Assessment of palatal rugae pattern for sex and ethnicity identification in an Iranian population. *Dental Research Journal*, 15, 50-56. [https:// doi: 10.4103/1735-3327.223611](https://doi.org/10.4103/1735-3327.223611)
- Shetty, S.K., Kalia, S., Patil, K., & Mahima, V.G. (2005). Palatal rugae pattern in Mysorean and Tibetan populations. *Indian Journal of Dental Research*, 16, 51-55.
- Subramanian, P., & Jagannathan, N. (2015). Palatal rugoscopy as a method of sex determination in forensic science. *Asian Journal of Pharmaceutical and Clinical Research*, Jan; 8(2), 136-138.
- Surekha, R., Anila, K., Reddy, V.S., Hunasgi, S., Ravikumar, S., & Ramesh, N. (2012). Assessment of palatal rugae patterns in Manipuri and Kerala population. *Journal of Forensic Dental Sciences*, 4, 93-96. [https:// doi: 10.4103/0975-1475.109896](https://doi.org/10.4103/0975-1475.109896).
- Thomas, C.J., & Kotze, T. (1983). The palatal rugae pattern: a new classification. *Journal of The Dental Association of South Africa*, 38(3), 153-157.
- Verma, K., Verma, P., Bansal, N., Basavaraju, S., Sachdeva, S., & Khosa, R. (2014). Correlation of Palatal Rugoscopy with Gender, Palatal Vault Height and ABO Blood Groups in Three Different Indian Populations. *Annals of Medical and Health Science Research*, Sep; 4(5), 769-774. [https:// doi: 10.4103/2141-9248.141556](https://doi.org/10.4103/2141-9248.141556).

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Knowledge and Attitudes of Adults Visiting Family Health Centers in Ankara about Traditional and Complementary Medicine Practices During the Pandemic

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Abstract

This study aims to evaluate the knowledge, attitudes, and practices regarding Traditional and Complementary Medicine (TCAM) among adults before and during the pandemic. This study is a cross-sectional research conducted in 9 Family Physician Centers in 3 central districts of Ankara. The minimum sample size was calculated as 360, and 372 adults were reached. In the pre-pandemic period, the number of individuals who heard about TCAM applications was 234 (62.9%), out of which 83 (35.5%) have applied. Individuals over 40 were more likely to have heard of TCAM methods ($p < 0.0001$). During the pandemic period, 19.9% of the participants applied any of the TCAM methods. The most frequently applied method was cupping (36.8%), and the most frequently declared reason was "to strengthen the immune system". The frequency of applying TCAM methods was higher among individuals with chronic illnesses ($p = 0.026$). TCAM methods are frequently utilized by adults in the population. Almost one-fifth of the adults have used any TCAM method during the pandemic period. There is a need for comprehensive studies to investigate the reasons that push people to use TCAM and ensure that the methods are applied by health personnel under healthy conditions.

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1. Introduction

The search for solutions to illnesses by utilizing past experiences and natural resources has led to the development and growth of "Traditional and Complementary Medicine (TCAM)" practices (Arslan et al.,2016). In developing countries, the use of TCAM practices is quite prevalent. In developed countries, the prevalence of TCAM is also increasing, driven by its accessibility and affordability. In Turkey, various studies indicate a usage rate between 54.3% and 65.8% (Fadıloğlu Ç. & Özçelik H. ,2009; PMB,2008). The World Health Organization (WHO) declared COVID-19 pandemic on March 11, 2020. Since December 2019, there have been approximately 760 million cases and 6.9 million deaths reported globally, with actual numbers believed to be much higher (WHO, 2023). The COVID-19 pandemic was accompanied by an "infodemic," characterized by the rapid spread of inaccurate and non-scientific information related to COVID-19 in both traditional media and online platforms, often inciting fear and anxiety among the public. Discussions around immunization efforts particularly exacerbated this phenomenon. Factors such as the rapid spread of the virus, delays in vaccine and medication development, changes in treatment protocols, distrust in the efficacy of pharmacological methods like vaccines and drugs, fear of side effects, and the perceived need for frequent administration have driven individuals to seek TCAM practices both for protection against the virus and for the treatment of the disease (Nugraha RV et al., 2020). This study aims to evaluate the knowledge, attitudes, and practices regarding TCAM during the pandemic among adults visiting family health centers.

2. Material and Method

This study is cross-sectional research conducted between April 1, 2023, and July 1, 2023, on individuals aged 18 and above who visited family health centers in the Etimesgut, Keçiören, and Pursaklar districts of Ankara, the capital of Türkiye with 25 districts. The study was conducted in 3 family health centers randomly selected from each of the 3 aforementioned central districts. According to 2023 Turkish Statistical Institute (TSI) data (Türkiye İstatistik Kurumu-TÜİK, 2023), the adult population in Ankara is 2,165,415 (48.7%) males and 2,282,019 (51.3%) females with a total of 4,447,434 individuals. It was estimated that 15,000 adults visited these 9 family health centers in a week, forming the study population. Data was collected for one week in May 2023. The sample size was calculated using the OpenEpi software, with a confidence interval of 95%, $\alpha=0.05$, $d=5\%$, and an assumed average prevalence of 60% (Fadıloğlu Ç & Özçelik H,2009; Barnes P.M.,2008). The minimum sample size was calculated as 360 individuals. The study was conducted with 409 participants; however, 21 individuals with insufficient literacy skills and 16 who did not complete at least 90% of the survey were excluded, resulting in a final sample size of 372 participants.

Data were collected using a questionnaire about the participants' sociodemographic characteristics, personal and family medical history, and hearing and using TCAM practices pre-pandemic and pandemic periods.

Ethical approval of the study is obtained from the Gazi University Ethical Committee (07.02.2023, research code: 2023-124).

3. Findings

The data were analyzed using IBM SPSS version 20.0. Descriptive statistics were presented as frequencies, percents, mean±standard deviations, and medians (min, max). Pearson, Yates' Corrected and Fisher's Exact Chi-square tests were used for data analysis. A p-value of less than 0.05 was considered statistically significant.

Among the study group, 254 (68.3%) were female. The participants' median age was 36 (18,92) and mean age was 37.25±10.4 years. Before the pandemic, 234 (62.9%) individuals had heard of TCAM practices. Individuals over 40 were more likely to have heard of TCAM methods (p<0.0001). No significant association was found between hearing about TCAM methods and other characteristics (Table 1).

Table 1. Distribution of Individuals by General Characteristics

Descriptive Features	n (%)	Heard about TCAM Methods Before the Pandemic		Statistical Analysis Chi-square value; p
		Yes n (%)*	No n (%)*	
Age Group				
≤30	88 (23,7)	44 (50.0)	44 (50.0)	15.287; 0.000
31-40	180 (48,4)	110 (61.1)	70 (38.9)	
≥41	104 (28,0)	80 (76.9)	24 (23.1)	
Gender				
Female	254 (68,3)	158 (62.2)	96 (37.8)	0.167; 0.682
Male	118 (31,7)	76 (64.4)	42 (35.6)	
Education Level				
Primary Education	105 (28,2)	64 (61.0)	41 (39.0)	1.337; 0.512
High School	129 (34,7)	78 (60.5)	51 (39.5)	
Bachelor's/Master's Degree	138 (37,1)	92 (66.7)	46 (33.3)	
Marital Status				
Married	297 (79,8)	186 (62.6)	111 (37.4)	0.048; 0.826
Single	75 (20,2)	48 (64.0)	27 (36.0)	
Employment Status				
Regular Employment	162 (43,5)	104 (64.2)	58 (35.8)	4.951; 0.084
Irregular Employment	23 (6,2)	19 (82.6)	4 (2.9)	
Unemployed	187 (50,3)	111 (59.4)	76 (40.6)	

Number of People in Household				
3 or less	107 (28,8)	71 (66.4)	36 (33.6)	0.946; 0.623
4	149 (40,1)	90 (60.4)	59 (39.6)	
5 or more	116 (31,2)	73 (62.9)	43 (37.1)	
Perceived Income Level				
Poor	54 (14.5)	33 (61.1)	21 (38.9)	5.180; 0.075
Moderate	235 (63.2)	140 (59.6)	95 (40.4)	
Good	83 (22.3)	61 (73.5)	22 (26.5)	
Presence of Chronic Illness				
Yes	78 (21,0)	54 (69.2)	24 (30.8)	1.693; 0.193
No	294 (79,0)	180 (61.2)	114 (38.8)	
Regular Medication Use				
Yes	96 (25.8)	63 (65.6)	33 (34.4)	0.411; 0.522
No	276 (74.2)	171 (62.0)	105 (38.0)	
Smoking Status				
Smoker	88 (23,7)	51 (58.0)	37 (42.0)	1.210; 0.271
Non-smokers	284 (76,3)	183 (64.4)	101 (35.6)	
Perceived Health Status score				
≤5	105 (28,2)	70 (66.7)	35 (33.3)	0.888; 0.346
≥6	267 (71,8)	164 (61.4)	103 (38.6)	
Total				
	372 (100.0)	234 (62.9)	138 (37.1)	

The number of individuals who heard and applied any of the TCAM methods was 83 (35.5%). The rate was higher among female participants and those with high school or higher education levels (each $p < 0.05$) (Table 2). The most frequently applied TCAM methods were cupping (%36.1), leech therapy (hirudotherapy) (%19.0), phytotherapy (%19.0) and acupuncture (%12.6). These methods are followed by ozone application 5 (3.1%), apitherapy (1.9%), mesotherapy (1.9%), hypnosis (1.3%), music therapy (1.3%), homeopathy (1.3%), reflexology (0.6%), and others (1.9%). Most of the applications were done by non-

health personnel (30.8%) or by health personnel in places other than health centers (28.6%). Self-application at home was 20.9 %. Only 19.7% of those who applied TCAM methods had the application done by a healthcare professional at a health center. Fifty participants (60.2%) stated that they had benefited from the application. The main information sources about TCAM applications were the Internet (28.7%), TV Programs/News (26%), and Neighbors/ Relatives/ Friends (25.8%), respectively. Health institutions/ health personnel as an information source are ranked fourth with 10.6%.

Table 2. Usage of TCAM Methods Among Participants Before the Pandemic by Sociodemographics, Personal Background, and Perceived Health Status

Descriptive Features	n* (%)	Usage of TCAM Methods Before the Pandemic		Statistical Analysis Chi-square value; p
		Yes n (%)*	No n (%)*	
Age Group				
≤30	44 (18.8)	9 (20.5)	35 (79.5)	5.777; 0.056
31-40	110 (47.0)	45 (40.9)	65 (59.1)	
≥41	80 (34.2)	29 (36.3)	51 (63.7)	
Gender				
Female	158 (67.5)	64 (40.5)	94 (59.5)	5.391; 0.030
Male	76 (32.5)	19 (25.0)	57 (75.0)	
Education Level				
Primary Education	64 (27.4)	14 (21.9)	50 (78.1)	7.158; 0.028
High School	78 (33.3)	31 (39.7)	47 (60.3)	
Bachelor's/Master's Degree	92 (39.3)	38 (41.3)	54 (35.8)	
Marital Status				
Married	186 (79.5)	69 (37.1)	117 (62.9)	0.730; 0.393
Single	48 (20.5)	14 (29.2)	34 (70.8)	

Employment Status				
Regular Employment	104 (44.4)	41 (39.4)	63 (60.6)	1.627; 0.443
Irregular Employment	19 (8.1)	5 (26.3)	14 (73.7)	
Unemployed	11 (47.4)	37 (33.3)	74 (66.7)	
Number of People in Household				
3 or less	71 (30.3)	24 (33.8)	47 (66.2)	0.393; 0.822
4	90 (38.5)	31 (34.4)	59 (65.6)	
5 or more	73 (31.2)	28 (38.4)	45 (61.6)	
Perceived Income Level				
Poor	33 (14.1)	14 (42.4)	19 (57.6)	0.927; 0.629
Moderate	140 (59.8)	47 (33.6)	93 (66.4)	
God	61 (26.1)	61 (26.1)	22 (36.1)	
Presence of Chronic Illness				
Yes	54 (23.1)	20 (37.0)	34 (63.0)	0.013; 0.911
No	180 (76.9)	63 (35.0)	117 (65.0)	
Regular Medication Use				
Yes	63 (26.9)	22 (34.9)	41 (65.1)	0.000; 1.000
No	171 (73.1)	61 (35.7)	110 (64.3)	
Smoking Status				
Smoker	51 (21.8)	17 (33.3)	34 (66.7)	0.038; 0.845
Non-smokers	183 (77.2)	66 (36.1)	117 (63.9)	
Perceived Health Status score				
≤5	70 (29.9)	20 (28.6)	50 (71.4)	1.669; 0.196
≥6	164 (70.1)	63 (38.4)	101 (61.6)	
Total				
	234 (100.0)	83 (35.5)	151 (64.5)	

During the pandemic period, 74 (19.9%) of the participants applied any of the TCAM methods. The frequency was higher among individuals with chronic illnesses ($p=0.026$) (Table 3). No significant association was found between applying TCAM methods and other characteristics (Table 3). The most frequently applied TCAM method was cupping (36.8%), followed by phytotherapy (26.3%), ozone

application (14.0%), acupuncture (13.2%) leech therapy (hirudotherapy) (9.7%). The declared reasons for the application of TCAM during the pandemic were to strengthen the immune system (50.0%), in addition to medical (drug) treatment (33.3%), and not trusting the medical treatment (16.7%).

Three hundred fourteen (84.4%) of the participants was vaccinated with any of the COVID vaccines.

There was no difference in terms of vaccination status between the participants who had heard of TCAM methods before the pandemic and those who had not ($p = 0.235$). The rate of non-vaccination was higher in the participants who applied TCAM methods both before the pandemic ($p < 0.0001$) and during the pandemic ($p = 0.004$) compared to those who did not.

4. Discussion

In our study, 62.9% of participants had heard of TCAM methods before the pandemic, with an application rate of 22.3%. During the pandemic, this rate was 19.9%. A similar study by Ak and Aksakal conducted in family health centers in Ankara found a TCAM usage rate of 32.6% among adults (Ak & Baran Aksakal, 2020). Research by Torres-Zeno et al. reported that TCAM usage rates in Puerto Rico before the pandemic ranged from 55.7% to 92.1%, depending on the specific method used (Torres-Zeno et al., 2016). Youn et al., 2022, in a multinational cross-sectional study at the beginning of the pandemic, reported TCAM application frequencies of 47.5% in Germany, 41.3% in the USA, 17.5% in Japan, 77.7% in China, 43.3% in Malaysia, 85.8% in Vietnam, 52.5% in Russia, 42.1% in Kazakhstan, and 48.0% in the United Arab Emirates (Youn et al., 2022). The prevalence of TCAM practices varies due to socio-economic levels, spiritual beliefs, access to healthcare, and integration into health systems. These factors might explain the differences in TCAM usage frequencies across countries.

The average age of the participants was around 37 years, with nearly half of the participants aged between 30 and 40. While individuals over 40 were more likely to have heard of TCAM methods, there was no significant difference in applying these methods between age groups before or during the

pandemic. In contrast, another study conducted in family health centers in Ankara found that individuals over 60 used TCAM methods more frequently (Ak & Baran Aksakal, 2020). Karataş and colleagues, in an online survey, reported that 65% of their participants were 40 and above, with higher TCAM usage in this age group (Karataş et al., 2021). Generally, as health-related issues are expected to increase with age, individuals may seek alternative or complementary methods alongside standard treatments to manage their health problems and improve their quality of life. However, this trend was not observed in our study.

While there was no difference in TCAM usage between genders during the pandemic, women used these methods more frequently before the pandemic. A study in Isparta also found higher TCAM usage among women (Öztürk et al., 2005). Research by Kristoffersen et al., 2017, reported that being female was a determinant of TCAM usage (Kristoffersen et al., 2017). Another research by Kristoffersen et al., 2014, highlights that women are more concerned about their health, more proactive in improving it, and may face barriers in meeting their healthcare needs, leading them to prefer TCAM methods (Kristoffersen et al., 2014). In-depth interviews with women in Norway revealed that barriers in communication, understanding, and treatment of their illnesses led them to use TCAM methods (Salamonsen et al., 2012; Salamonsen et al., 2010).

Variables such as economic status, education level, and age can influence the use of modern healthcare services. Individuals with lower perceived income may use TCAM methods more frequently. However, our study did not find a significant relationship between perceived income level, regular employment status, and the frequency of using TCAM methods

before or during the pandemic. Öztürk et al. found that individuals with poorer financial status used TCAM methods more frequently (Öztürk et al., 2012). In contrast, Kristoffersen et al. 2017, found an association between income level and TCAM usage in univariate analyses, which was not confirmed in further analyses (Kristoffersen et al., 2017). Similar to our study, Ibrahim et al. found no association between income level and TCAM usage (Ibrahim et al., 2018). Karataş and colleagues reported higher TCAM usage among individuals with higher income levels (Karataş et al., 2021).

In our study, the frequency of TCAM usage before the pandemic was lower among primary education graduates, while no significant difference was found during the pandemic across educational levels. A study in Iraq found higher TCAM usage among individuals with lower educational levels (Ibrahim et al., 2018), whereas Karataş et al. reported higher usage among those with higher educational levels (Karataş et al., 2021). A study in Isparta also found that individuals with lower educational levels used TCAM methods more frequently (Öztürk et al., 2005). However, Nural and Çakmak's research found no relationship between educational level and TCAM usage (Nural & Çakmak, 2018). The relationship between educational level and TCAM usage is complex. Individuals with higher educational levels may have better economic well-being, making modern healthcare services more accessible and reducing the reliance on TCAM methods. Conversely, easier access to accurate information may influence decisions related to TCAM usage. Additionally, factors such as the characteristics of the research groups and cultural influences in traditional societies might contribute to varying results across studies.

In our study, those diagnosed with a chronic disease were more likely to use TCAM methods during the pandemic. A study conducted in Ankara reported a chronic disease prevalence of 37.9%, with higher TCAM usage among individuals with chronic illnesses (Ak & Baran Aksakal, 2020). Similar findings were reported in studies conducted in Kayseri and Isparta (Karataş et al., 2021; Öztürk et al., 2005). A study in India found a TCAM usage rate of 63.9% among hypertensive patients (Nugraha et al., 2020), and another in Germany reported that half of the patients with kidney failure used TCAM methods (Kristoffersen et al., 2017). Demographic transitions, such as declining fertility rates, population policies, increased life expectancy, and medical-technological advancements, have led to an aging global population. This demographic transition, coupled with an increase in the burden of non-communicable chronic diseases, may drive individuals to seek TCAM methods alongside modern medical practices. Additionally, challenges in accessing healthcare services during the pandemic, the uncertainty surrounding COVID-19, and its high mortality and morbidity rates among individuals with chronic diseases may have further encouraged.

Ethical Statement

Ethical approval of the study is obtained from the Gazi University Ethical Committee dated 07.02.2023 with the research code of 2023-124.

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Presentation Information

The findings of this study have not been presented at any conference or journal.

Conflicts of Interest

The authors declare no conflicts of interest regarding this study.

Author Contributions

EI: Conceived and designed the analysis; Collected the data; Contributed data or analysis tools; Performed the analysis; Wrote the paper.

FNBA: Conceived and designed the analysis; Collected the data; Contributed data or analysis tools; Performed the analysis; Wrote the paper.

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References

- Ak, N., Baran Aksakal. F.N.,(2020) Some Knowledge and Attitudes of Those Applying to Some Family Health Centers Regarding Traditional and Complementary Medical Practices. *Journal of Traditional Medical Complementary Therapies*, 3(2). <https://doi:10.5336/jtracom.2020-73537>
- Arslan, M., Şahne, B.S., Şar, S (2016). Examples of traditional treatment systems in the world: an overview. *Mersin University Faculty of Medicine Lokman Hekim Journal of Medical History and Folkloric Medicine*, 6(3):100-5
- Ibrahim, I.R., Hassali, M.A., Saleem, F., Al Tukmagi, H.F., Dawood, O.T.,(2018) Use of complementary and alternative medicines: a cross-sectional study among hypertensive patients in Iraq. *Journal of*

- Pharmaceutical Health Services Research.* ;9(1):59-65 <https://doi: 10.4103/0975-7406.199349>
- Karataş, Y., Khan, Z., Bilen, Ç., Boz, A., Özagil, ESG., Abussuutoğlu ,A.B., et al.(2021) Traditional and complementary medicine use and beliefs during COVID-19 outbreak: a cross-sectional survey among the general population in Turkey. *Advances in Integrative Medicine*, 8(4):261-6. <https://doi.org/10.1016/j.aimed.2021.09.002>
- Kristoffersen, A.E., Sirois, F.M., Stub, T., Hansen, A.H.,(2017), Prevalence and predictors of complementary and alternative medicine use among people with coronary heart disease or at risk for this in the sixth Tromsø study: a comparative analysis using protection motivation theory. *BMC Complementary and Alternative Medicine*, 17:1-9. <https://doi: 10.1186/s12906-017-1817-x>
- Kristoffersen,A.E., Stub, T., Salamonsen, A., Musial, F., Hamberg, K.,(2014), Gender differences in prevalence and associations for use of CAM in a large population study. *BMC Complementary and Alternative Medicine*, 14(1):1-9. <https://doi: 10.1186/1472-6882-14-463>
- Nugraha, R.V., Ridwansyah. H., Ghozali. M., Khairani,A.F., Atik,N. ,(2020) Traditional herbal medicine candidates as complementary treatments for COVID-19: A review of their mechanisms, pros and cons. *Evidence-Based Complementary and Alternative Medicine*, (1):2560645. <https://doi.org/10.1155/2020/2560645>
- Nural, N., Çakmak, S.,(2018) Use of Complementary and Alternative Therapies by Individuals with Chronic Diseases. *Journal of Traditional Medical Complementary Therapies*, 1(1). doi: 10.5336/jtracom.2023-96486
- Özçelik, H., Fadiloğlu, Ç. (2009),Kanser hastalarının tamamlayıcı ve alternatif tedavi kullanım nedenleri. *Türk Onkoloji Dergisi*, 24(1):48-52.
- Öztürk, M., Uskun, E., Özdemir, R., Çınar, M., Alptekin,F., Doğan, M.,(2005), People's preference for

- traditional treatment in Isparta Province. *Turkiye Klinikleri Journal of Medical Ethics-Law and History*, 13(3):179-86.
<https://doi.org/10.17098/amj.44789>
- Barnes, P.M. (2008). Complementary and alternative medicine use among adults and children: United States, 2007. *Natl Health Stat Rep*. 2008:1-23.
- Salamonsen, A., Kruse, T., Eriksen, S.H.,(2012), Modes of embodiment in breast cancer patients using complementary and alternative medicine. *Qualitative Health Research*, 22(11):1497-512.
<https://doi.org/10.1177/1049732312457077>
- Salamonsen, A., Launsø, L., Kruse, T., Eriksen, S.,(2010), Understanding unexpected courses of multiple sclerosis among patients using complementary and alternative medicine: a travel from recipient to explorer. *International Journal of Qualitative Studies on Health and Well-being*, 5(2):5032.
<https://doi.org/10.3402/qhw.v5i2.5032>
- Torres-Zeno, R.E., Ríos-Motta, R., Rodríguez-Sánchez, Y., Miranda-Massari, JR., Marín-Centeno H.,(2016) Use of complementary and alternative medicine in Bayamón, Puerto Rico. *Puerto Rico Health Sciences Journal*, 35(2):69-75.
- Türkiye İstatistik Kurumu (TÜİK). Address Based Population Registration System 2023 [Available from:
<https://biruni.tuik.gov.tr/medas/?kn=95&locale=tr>.
- World Health Organization (WHO). Coronavirus disease (COVID-19) .(2023). [Available from:
[https://www.who.int/news-room/fact-sheets/detail/coronavirus-disease-\(covid-19\)](https://www.who.int/news-room/fact-sheets/detail/coronavirus-disease-(covid-19)).
- Youn, B. Y., Moon, S., Mok, K., Cheon, C., Ko, Y., Park, S., ... & Ko, S. G. (2022). Use of traditional, complementary and alternative medicine in nine countries: A cross-sectional multinational survey. *Complementary Therapies in Medicine*, 71, 102889.
<https://doi.org/10.1016/j.ctim.2022.102889>
- Öztürk, M., Uskun, E., Özdemir, R., Çınar, M., Alptekin, F., Doğan, M. Isparta İli'nde halkın geleneksel tedavi tercihi. *Turkiye Klinikleri Journal of Medical Ethics-Law and History*. 2005;13(3):179-86.

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Neuroprotective and Nootropic Effect of *Bacopa monnieri* (L.) Wettst. (Brahmi) through Its *in vivo* Data Focused on Alzheimer's Disease

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Abstract

Bacopa monnieri (L.) Wettst. (Plantaginaceae) (BM), known as "brahmi", is a reputed medicinal plant, particularly in Ayurvedic medicine. Since BM has been traditionally used for memory dysfunction, experimental studies at the pre-clinical level support the nootropic effect of the plant relevant to Alzheimer's disease (AD) demonstrated through various mechanisms. It has been reported that saponins (*e.g.* bacosides, bacopasides, and bacopasaponins) are largely responsible for the memory-enhancing and other neuropharmacological effects of BM. Bacosides, which are non-polar molecules that can easily cross the blood-brain barrier, are reported to directly lead to anti-inflammatory and antioxidant effects in the brain. BM extracts rich in bacosides are considered advantageous due to their higher nootropic efficacy. The findings suggest that only bacoside enrichment increases anti-amnesic activity; other components also contribute to the extract with a synergism. Adverse side effects of BM in humans have rarely been reported. In the current review, we aimed to scrutinize *in vivo* data derived from the studies related to the cognitive-enhancement effect of BM with a special focus on AD.

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1. Introduction

Bacopa monnieri (L.) Wettst. (Plantaginaceae) (BM) is a member of the genus *Bacopa*, which has about 100 taxa worldwide. It is a perennial and creeping plant growing in various parts of the world, such as southern and northern India, Nepal, Sri Lanka, China, Vietnam, Australia, Africa, the Arabian Peninsula, America, and the Caribbean. Known as "brahmi" in India and "water hyssop, thyme-leaved gratiola, herb of grace, and Indian pennywort" in English, the plant has been widely used in Ayurvedic medicine for hundreds of years. Brahmi (BM) is recognized as a "natural nootropic/brain tonic" in Ayurvedic medicine (Suhdakaran et al., 2020).

Since the primary therapeutic activity of BM is to improve cognitive function or cognitive dysfunction, much of the research has focused on the mechanisms associated with this effect. The triterpene saponins (especially bacosides) in the plant are responsible for enhancing the transmission of nerve impulses. Bacosides have been found to help repair damaged neurons by increasing kinase activity, synthesis, and restoration of neuronal synaptic activity, and, ultimately, nerve impulse transmission (Singh & Dhawan, 1997). According to the results of animal studies, bacosides have antioxidant activity against oxidative damage in the hippocampus, frontal cortex, and striatum. *In vivo* studies have also shown that BM extracts modulate the expression of some enzymes involved in the formation and clearance of reactive oxygen species in the brain (Chowdhury et al., 2002). *In vitro* reports imply the protective effect of BM against DNA damage both in human fibroblasts and astrocytes (Russo et al., 2003). Since there are many

studies on the nootropic effect of BM, this review aims to summarize *in vivo* data of the plant. For this purpose, Web of Science (WoS), PubMed, Scopus, ResearchGate, and Google Scholar academic databases were used for the literature summary.

2. *In vivo* studies related to the nootropic effect of BM

CDRI 08 is the ethanol extract of BM, a nootropic plant, standardized over 55% bacosides. CDRI 08 reduced oxidative stress and memory dysfunction induced by decabrominated diphenylether-209 (PBDE-209) in mice (Verma et al., 2015). The effect of CDRI 08 on *N*-methyl-D-aspartate receptor (NMDA-R1, NR1 variant) expression and repressor element-1 silencing transcription factor (REST)/neuron-restrictive silencer factor (NRSF) binding to the NR1 promoter, male mouse pups were given CDRI 08 orally at doses of 40, 80 or 120 mg/kg in combination with PBDE-209 (20 mg/kg). Results showed that NR1 expression increased and REST/NRSF binding to the NR1 promoter decreased after post-natal exposure to PBDE-209. Furthermore, CDRI 08 supplementation significantly restored NR1 expression and binding of REST/NRSF to the NR1 promoter, close to the control value at a dose of 120 mg/kg. In conclusion, the findings suggest that CDRI 08 acts on the glutamatergic system, possibly through the expression and regulation of NR1. In another study (Rastogi et al., 2012), by selecting the optimum dose of bacoside, dose-dependent activity on the neurotransmitter acetylcholine, a biomarker of aging biomarker lipofuscin and senile dementia of Alzheimer's type (SDAT) biomarker neurotransmitter acetylcholine was screened in the brains of the aged female Wistar rats. The designated dose of bacosides at 200 mg/kg

(b.w.) was administered orally to middle-aged and aged rats for 3 months. Its protective effect against age-related changes in the neurotransmission mechanism, oxidative stress markers, behavioral paradigms as well as hippocampal neuronal loss was further investigated. According to the results, bacosides may act as impending natural agents in preventing the harmful effects of aging and preventing age-related pathologies such as SDAT.

The memory-enhancing (acute and chronic) potentials of commercial extracts of BM (200 mg/kg, *p.o.*), *Ginkgo biloba* L. (150 mg/kg, *p.o.*), and *Lavandula angustifolia* Mill. (200 mg/kg, *p.o.*) and their mixtures (BM and *L. angustifolia* at 100 mg/kg, *G. biloba* at 75 mg/kg, *p.o.*) were compared for their synergistic/additive effects in scopolamine-induced amnesia in mice by Morris water maze (MWM) test and elevated plus maze (EPM) tests. In the MWM test, escape latency and accumulated path length parameters were significantly ($n: 8, p < 0.05$) reduced in animals given BM, *G. biloba*, and *L. angustifolia* and their mixtures (Rehman et al., 2021). Furthermore, in the experiments (acute on the 7th day and chronic on the 15th day), the crossings at the platform position and the time spent in the platform quadrant were significantly augmented. On the other hand, transfer latency in the EPM test was reduced in treated animals compared to the saline group ($n: 8, p < 0.05$). The mixture indicated a synergistic effect on memory enhancement in mice compared with each extract individually.

Prenatal stress (PNS) affects the neurodevelopment of offspring, causing anxiety-like behaviors and memory deficits. A related study (Sivasangari & Rajan, 2020) investigated whether pretreatment administration of

BME (CDRI 08/BME) affects PNS-induced changes in signaling molecules and behavioral changes in Wistar rat offspring. Pregnant rats were randomly divided into control and PNS groups and BME was administered. Animals were first placed in a social defeat cage to induce PNS and exposed to social defeat from the 16-18th gestational day. BME treatment was applied to pregnant rats inserted in the PNS + BME group from the 10th day of gestation until the 23rd postnatal day of their offspring. PNS-induced anxiety-like behaviors and increased levels of poor memory, corticosterone, adrenocorticotrophic hormone, glucocorticoid receptor, pro-apoptotic caspase-3, and 5-HT_{2C} receptor. On the other hand, anti-apoptotic B cell leukemia (B cell leukemia, Bcl-2), 5-HT_{1A} receptor, some synaptic proteins (synaptophysin and synaptotagmin-1), calmodulin-dependent protein kinase II/neurogranin phosphorylation, NMDARs (2A and 2B), postsynaptic density protein 95 levels decreased. It was determined that BME inhibited PNS-induced changes in anxiety-like behaviors and memory impairments, also due to its antioxidant properties.

The effects of the alcohol extract of BM on olfaction were studied in olfactory deficits in olfactory bulbectomized (OBX) mice and the molecular mechanisms underlying this effect (Le et al., 2013). OBX mice were given BM (50 mg/kg, *p.o.*) or the reference drug tacrine (2.5 mg/kg, *i.p.*, daily) one week before OBX and continuously 3 days after OBX. The cognitive performance of the animals was analyzed using a modified Y-maze, fear conditioning, and novel object recognition (NOR) tests. Neurochemical and immunohistochemical analyses were carried out in the brain tissues obtained from OBX animals. BM administration ameliorated

memory impairments and reversed the adverse neurochemical and histological changes induced by OBX [except for reduced GluR1 phosphorylation and enhanced cAMP response element binding protein (CREB) phosphorylation]. BM also inhibited the AChE activity in the brains of the mice. These results suggested that BM treatment ameliorated OBX-induced cognitive dysfunction through the improvement of synaptic plasticity-related signaling, protection of brain-derived neurotrophic factor (BDNF) transcription and cholinergic systems from OBX-induced neuronal damage.

Reduced amounts of gamma-aminobutyric acid (GABA)-ergic neurons in the brains of both schizophrenia patients and *in vivo* experimental models suggest that impaired GABAergic function is involved in the pathophysiology of the disease. Decreased GABAergic neurotransmission may also be involved in the cognitive impairment that develops in schizophrenia. The cognitive enhancement and neuroprotective effects of BM on NOR memory and GABAergic neuronal mass, as outlined by the presence of calcium-binding proteins including CBPs, *e.g.* calbindin (CB), parvalbumin (PV), and calretinin (CR), were studied in a sub-chronic (2 mg/kg, *i.p.*) phencyclidine (PCP) mouse model of schizophrenia (Piyabhan et al., 2019). In the novel object recognition task, a discrimination rate (DR) representing cognitive ability was obtained. CB, PV, and CR immune density was measured in the prefrontal cortex, striatum, and cornu ammonis areas. DR decreased in the PCP group, which co-occurred with CB, PV, and CR at decreased levels in the brain except CA1-3 in the CR and cognitive enhancement effect experiment in the striatum. PCP + BM indicated a greater DR score with intensified CB in the prefrontal cortex and striatum,

increased PV in the prefrontal cortex and CA1-3, and increased CR levels in the prefrontal cortex. This study demonstrated both partial refurbishment of cognitive deficit and neuroprotective activity of BM. In another similar study (Mishra et al., 2018), brahmi vati (BV) containing BM was prepared in strict adherence to the traditional Ayurvedic formula. A bacoside A-rich fraction of BM (BA) was obtained by extraction and fractionation and administered at a dose of 32.5 mg/kg (b.w.) to different animal groups for 7 days. BV showed significant anticonvulsant, memory enhancing, and anti-schizophrenic activity and caused higher brain glutathione levels and much lower AChE activity compared to control groups and BA.

In a study on whether dietary intake of BM leaf powder tends to modulate endogenous markers of oxidative stress, protein oxidation, redox status [low glutathione (GSH), thiol status], the response of antioxidant defenses (enzymatic), and cholinergic function in various brain regions of prepubertal (PP) mice, it was determined whether a BM-enriched diet (4, 5 and 1%) for 4 weeks revealed a significant reduction in key oxidative markers [malondialdehyde (MDA) levels, reactive species production, hydroperoxide (HP) levels, and protein carbonyls] in both the strophasm and mitochondria of all brain regions of PP mice (Shinomol & Muralidhara, 2011). This was accompanied by increased levels of reduced GSH, thiols, and improved actions of antioxidant enzymes [catalase (CAT), glutathione peroxidase (GPx), and superoxide dismutase (SOD)]. The significant decrease in the activity of AChE in all brain regions revealed the potential of BM leaf powder to modulate cholinergic function. Based on these results, it was reported that dietary intake of BM leaf powder provides a neuroprotective advantage, and

BM is effective as a prophylactic/therapeutic agent for neurodegenerative disorders involving oxidative stress.

The exact molecular mechanism of the role of CDRI 08, a standardized BM extract, in the improvement of diabetes mellitus (DM)-induced memory impairments is unknown. In a study by Pandey et al. (2015), low doses of CDRI 08 (50- or 100 mg/kg, b.w.) can significantly improve spatial memory in streptozocin (STZ)-DM2 mice. Thus, it was reported to be linked to upregulation of *α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid* (AMPA) receptor GluR2 subunit gene expression along with a noteworthy decline in oxidative stress and in the hippocampus. In addition to the effect of reversing DM2-induced high oxidative stress and decreased GluR2 subunit expression and improving spatial memory impairment, treatment of DM2 mice with a higher dose of CDRI 08 (150 mg/kg, b.w. or above) indicated antidiabetic effect. The results provide evidence for the molecular basis of the memory-enhancing and antidiabetic role of BM extract in STZ-induced DM2 mice.

In another study on the ability of BME to improve memory *via* improved cell proliferation and neuroblast differentiation in the dentate gyrus, 7-week-old mice were administered BME once daily for 4 weeks and a NOR memory test was implemented (Kwon et al., 2018). The mice were then euthanized, followed by immunohistochemistry analysis for Ki67, double cortin (DCX) and phosphorylated CREB as well as BDNF western blot analysis. BME-treated mice exhibited moderate increases in the exploration of novel objects compared to familiar objects. Ki67 and DCX immunohistochemistry indicated that BME

administration to the dentate gyrus induced cell proliferation and neuroblast differentiation. In addition, administration of BME increased BDNF protein expression and CREB phosphorylation in the hippocampal dentate gyrus. These data suggest that BME enhances NOR by rising cell proliferation and neuroblast differentiation in the dentate gyrus, which may be closely related to high levels of BDNF and CREB phosphorylation in the dentate gyrus.

In a study to determine the effect of alcohol extract of BM (BME) on cognitive function and neurodegeneration in an animal model of ethylcholine aziridinium ion (AF64A)-induced AD, male Wistar rats were given BME orally at doses of 20, 40 and 80 mg/kg (b.w.) (Uabundit et al., 2010). The effect of BME on the spatial memory of rats was tested using the MVM test and the density of neurons. Cholinergic neurons were identified using histological techniques 7 days after AF64A administration. In the MWM test, the extract led to a rise in the escape latency time ($p < 0.01$). In addition, cholinergic neuron densities were also decreased. These findings suggest that BM has a cognitive-enhancing potential and neuroprotective effect against AD.

To further clarify the pharmacological properties and usefulness of BME, which is considered a new herbal anti-dementia agent, whether BME affects neuronal repair was investigated using a trimethyltin (TMT)-induced neuronal loss/self-repair mouse model in the hippocampus (Pham et al., 2019). Mice pretreated with TMT (2.8 mg/kg, *i.p.*) on day 0 were administered BME (50 mg/kg, *p.o.*) once daily for 15–30 days. Cognitive performance of animals, 17–20th days (Phase I) and 32–35th illuminated twice with the object location test and the modified Y maze test on

days (Phase II) or with the passive avoidance test in Phase II. TMT lessened hippocampus-dependent spatial working memory and amygdala-dependent fear-induced memory. BME administration significantly prevented TMT-induced cognitive deficits. The protective effect of BME on spatial memory deficits was confirmed by Nissl staining of hippocampal tissues and organotypic hippocampal slice cultures stained by propidium iodide. Immunohistochemical analyses performed on 17th and 32nd days disclosed that 30 days of BME administration augmented 5-bromo-2'-deoxyuridine (BrdU)-immunopositive cell quantity in the dentate gyrus part of TMT-treated mice. However, 15 days of application with BME did not cause any effect. The obtained outcomes proposed that BME ameliorated TMT-induced cognitive dysfunction mainly by protecting hippocampal neurons from TMT-induced hippocampal lesions and partly by inducing neuroregeneration in dentate gyrus regions.

Saini et al. (2012) evaluated the neuroprotective capacity of BM, which is a medicinal plant in ayurvedic medicine efficient for cognitive impairment in dementia induced with colchicine. Intracerebroventricular administration of colchicine (15 µg/5 µL) caused cognitive impairment in rats as assessed by EPM. This was accompanied by enhanced lipid peroxidation (LPO) and a significant increase in oxidative stress in terms of protein carbonyl levels. However, a diminution in the activity of antioxidant enzymes was detected in animals administered colchicine. BM (50 mg/kg, b.w.) supplementation reversed the memory impairment observed in rats treated with colchicine. BM weakened oxidative damage, as evidenced by reduced LPO and protein carbonyl levels and the restoration of antioxidant

enzyme activities. The activity of membrane-bound enzymes (Na⁺K⁺ ATPase and AChE) was changed in brain regions administered colchicine, and BM administration repaired the activity of the enzymes, which were comparable to the values in control. The results demonstrate the therapeutic potential of BM in treating cognitive decline associated with AD.

3. Conclusion

The studies suggest that BM may enhance cognitive function and protect against neurodegenerative diseases by reducing oxidative stress, inflammation, and Aβ accumulation in the brain. As can be seen from our literature summary, the molecular basis of the neuroprotective effectiveness of bacosides is ascribed to surface expression of neuroreceptors such as AMPA, NMDA, and GABA in various parts of the brain and the regulation of mRNA translation. The general mechanisms of action that provide the neuroprotective activity of the plant are also reported as antioxidant, AChE inhibition, choline acetyltransferase activation, Aβ reduction, cerebral blood flow increase, monoamine potentiation, and modulation. Additionally, it may promote neuronal growth and synaptic plasticity, contributing to improved memory and learning abilities. In order to clinically detect these effects of the plant and to confirm the pre-clinical data, more clinical studies should be conducted by comparing the effects with reference drugs. These studies should be standardized, and the accepted neuropsychological tests should be applied. Besides, more research is needed to fully understand the mechanisms and potential benefits of BM for its neuroprotective nootropic effects on AD.

Ethical Statement

Since this is a review, ethical approval was not obtained.

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Conflicts of Interest

The authors declare that there is no conflict of interest between them.

Author Contributions

Both of the authors contributed to the literature search, data collection, writing and editing the text.

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References

- Chowdhuri, D.K., Parmar, D., Kakkar, P., Shukla, R., Seth, P.K., & Srimal, R.C. (2002). Antistress effects of bacosides of *Bacopa monnieri*: modulation of Hsp70 expression, superoxide dismutase and cytochrome P450 activity in rat brain. *Phytotherapy Research*, 16(7), 639-645. <https://doi:10.1002/ptr.1023>
- Kwon, H.J., Jung, H.Y., Hahn, K.R., Kim, W., Kim, J.W., Yoo, D.Y., Yoon, Y.S., Hwang, I.K., & Kim, D.W. (2018). *Bacopa monnieri* extract improves novel object recognition, cell proliferation, neuroblast differentiation, brain-derived neurotrophic factor, and phosphorylation of cAMP response element-binding protein in the dentate gyrus. *Laboratory Animal Research*, 34(4), 239-247. <https://doi:10.5625/lar.2018.34.4.239>
- Le, X.T., Pham, H.T., Do, P.T., Fujiwara, H., Tanaka, K., Li, F., Van Nguyen, T., Nguyen, K.M., & Matsumoto, K. (2013). *Bacopa monnieri* ameliorates memory deficits in olfactory bulbectomized mice: possible involvement of glutamatergic and cholinergic systems. *Neurochemistry Research*, 38(10), 2201-2215. <https://doi:10.1007/s11064-013-1129-6>
- Mishra, A., Mishra, A.K., & Jha, S. (2018). Effect of traditional medicine brahmi vati and bacoside A-rich fraction of *Bacopa monnieri* on acute pentylentetrazole-induced seizures, amphetamine-induced model of schizophrenia, and scopolamine-induced memory loss in laboratory animals. *Epilepsy Behavior*, 80, 144-151. <https://doi:10.1016/j.yebeh.2017.12.040>
- Pandey, S.P., Singh, H.K., & Prasad, S. (2015). Alterations in hippocampal oxidative stress, expression of AMPA Receptor GluR2 subunit and associated spatial memory loss by *Bacopa monnieri* extract (CDRI-08) in streptozotocin-induced diabetes mellitus type 2 mice. *PLoS One*, 10(7), e0131862. <https://doi:10.1371/journal.pone.0131862>
- Pham, H.T.N., Phan, S.V., Tran, H.N., Phi, X.T., Le, X.T., Nguyen, K.M., Fujiwara, H., Yoneyama, M., Ogita, K., Yamaguchi, T., & Matsumoto, K. (2019). *Bacopa monnieri* (L.) ameliorates cognitive deficits caused in a trimethyltin-induced neurotoxicity model mice. *Biological and Pharmaceutical Bulletin*, 42(8), 1384-1393. <https://doi:10.1248/bpb.b19-00288>
- Piyabhan, P., Tingpej, P., & Duansak, N. (2019). Effect of pre- and post-treatment with *Bacopa monnieri* (brahmi) on phencyclidine-induced disruptions in object recognition memory and cerebral calbindin, parvalbumin, and calretinin immunoreactivity in rats. *Neuropsychiatric Disease Treatment*, 15, 1103-1117. <https://doi:10.2147/NDT.S193222>
- Rastogi, M., Ojha, R.P., Prabu, P.C., Devi, B.P., Agrawal, A., & Dubey, G.P. (2012). Prevention of age-associated neurodegeneration and promotion of healthy brain ageing in female Wistar rats by long term use of bacosides. *Biogerontology*, 13(2), 183-195. <https://doi:10.1007/s10522-011-9367-y>
- Rehman, M.U., Ali, N., Jamal, M., Kousar, R., Ishaq, M., Awan, A.A., Hussain, I., Sherkheli, M.A., & Ul Haq, R. Comparison of acute and chronic effects of *Bacopa monnieri*, *Ginkgo biloba*, and *Lavandula angustifolia* and their mixture on learning and memory in mice. *Phytotherapy Research*, 35(5), 2703-2710. <https://doi:10.1002/ptr.7016>
- Russo, A., Borrelli, F., Campisi, A., Acquaviva, R., Raciti, G., & Vanella, A. (2003). Nitric oxide related toxicity in cultured astrocytes: effect of *Bacopa monnieri*. *Life Sciences*, 73, 1517-1526. [https://doi:10.1016/s0024-3205\(03\)00476-4](https://doi:10.1016/s0024-3205(03)00476-4)
- Saini, N., Singh, D., & Sandhir, R. (2012). Neuroprotective effects of *Bacopa monnieri* in experimental model of dementia. *Neurochemistry Research*, 37(9), 1928-1937. <https://doi:10.1007/s11064-012-0811-4>
- Shinomol, G.K., & Muralidhara. (2011). *Bacopa monnieri* modulates endogenous cytoplasmic and mitochondrial oxidative markers in prepubertal mice brain. *Phytomedicine*, 18(4), 317-326. <https://doi:10.1016/j.phymed.2010.08.005>
- Singh, H.K., & Dhawan, B.N. (1997). Neuropsychopharmacological effects of the Ayurvedic nootropic *Bacopa monnieri* Linn. (Brahmi). *Indian Journal of Pharmacology*, 29(5), S359-S365. (doi not available)

- Sivasangari, K., & Rajan, K.E. (2020). Standardized *Bacopa monnieri* extract ameliorates learning and memory impairments through synaptic protein, neurogranin, pro-and mature BDNF signaling, and HPA axis in prenatally stressed rat offspring. *Antioxidants (Basel)*, 9(12), 1229. [https://doi: 10.3390/antiox9121229](https://doi.org/10.3390/antiox9121229)
- Sudhakaran, M.V. (2020). Botanical pharmacognosy of *Bacopa monnieri* (Linn.) Pennell. *Pharmacognosy Journal*, 12(6), 1559-1572. [https://doi: 10.5530/pj.2020.12.214](https://doi.org/10.5530/pj.2020.12.214)
- Uabundit, N., Wattanathorn, J., Mucimapura, S., & Ingkaninan, K. (2010). Cognitive enhancement and neuroprotective effects of *Bacopa monnieri* in Alzheimer's disease model. *Journal of Ethnopharmacology*, 127(1), 26-31. [https://doi: 10.1016/j.jep.2009.09.056](https://doi.org/10.1016/j.jep.2009.09.056)
- Verma, P., Gupta, R.K., Gandhi, B.S., & Singh, P. (2015). CDRI-08 Attenuates REST/NRSF-mediated expression of NMDAR1 gene in PBDE-209-exposed mice brain. *Evidence-Based Complementary and Alternative Medicine*, 2015, 403840. [https://doi: 10.1155/2015/403840](https://doi.org/10.1155/2015/403840)

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Artificial Intelligence and Its Areas of Use in Healthcare

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Abstract

Artificial intelligence (AI) is computer systems that can perform tasks that require human intelligence. It consists of data based on machine learning, deep learning and artificial neural networks. AI; with the increase in data collection and the ability to store large numbers of data, its use in the field of health has increased. It has been increasing rapidly recently. AI is being used more and more frequently with its features that help physicians in diagnosis, treatment planning, prognosis prediction and application of treatments. In this review, it is aimed to specify AI and its areas of use in the healthcare system.

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1. Introduction

Technology has recently become a big part of our lives. In the 21st century, Industry 4.0, also called the 4th Industrial Revolution, has come to the fore with computer and information technologies. Developments such as robots, 3D software and AI are examined under the title of Industry 4.0. As the number of electronic devices in our lives increases, it has become necessary to store the data recorded by these devices. This stored data can be used and analyzed by AI (Ding et al., 2023; Taş, 2018).

AI is used when the definition of the problem at hand is known, but the method (algorithm) of the solution is unknown; it is the name given to all human-made systems that infer, learn or discover a correct and efficient solution method. In short, AI is automatic systems that can produce algorithms (Köröglü, 2017).

Terms such as AI, machine learning, deep learning, artificial neural networks are basically related to data. Although data has many meanings in the literature, in its simplest sense it is the source of information. Information is obtained by processing data.

Algorithms are structures that allow us to systematically examine our ability to solve complex problems. Algorithms break down these complex problems into small units that can be easily realized through analysis. When these successive units are performed sequentially, the problem is solved. The use of machines for algorithms, that is, the use of AI, was first made by Alan Turing in 1950 (Köröglü, 2017).

The concept of AI was first put forward by John McCarthy at a conference held at Dartmouth in 1956. An AI program that plays a chess game created with LISP, a programming language used in AI, has been produced (Doğan & Türkoğlu, 2019).

Artificial intelligence; must be able to communicate successfully with language skills, preserve what they perceive, use the information they have stored, adapt to new conditions, have computer vision to perceive objects, and be able to move robotic objects with or without commands (Ding et al., 2023).

2. Classification of Artificial Intelligence

AI can be classified as weak, strong and super. Weak AI has also been called “narrow AI”. It uses a trained program to solve single or specific tasks. Nowadays, weak AI is mostly used (Ding et al., 2023). Since powerful and super AI may create ethical problems, it should be studied carefully (Karabağ, 2021). AI today is categorized with machine learning and deep learning as a subclass. Machine learning forms the basis of AI studies.

2.1. Machine Learning

Machine learning is the general name of computer algorithms created for a problem using data obtained within that problem. Since the aim is to develop the algorithm with the best performance, many machine learning algorithms have been developed. Some of these are k-nearest neighbor algorithm, simple Bayes classifier, decision trees, logistic regression analysis, k-means algorithm, support vector machines and artificial neural networks (Atalay & Çelik, 2017).

In machine learning, there is a data-based system and algorithms that can learn with data are created.

The 'machine' in the term machine learning basically refers to a computer. These machines learn from the data we collect. There are three different methods in machine learning.

2.1.1. Supervised Learning

In supervised learning, training data consists of data collected for the answer we are looking for and known answers (outputs). The machine evaluates these mathematically and creates a model. This learning is stored in models and used to evaluate data whose answer is unknown.

2.1.2. Unsupervised Learning

We may not always have training data as in supervised learning. Obtaining logical results in problem analysis from the machine without training data is unsupervised learning. In this type of learning, data is classified and sets are created from the ones closest to each other.

2.1.3. Reinforcement Learning

In the reinforcement learning method, there is no training data, as in unsupervised learning. However, there is a consultant who evaluates the answers obtained. This consultant compares the resulting response with the initial data and characterizes it as good or bad. Thus, a feedback, or reinforcement, is provided for the model formed (Atalay & Çelik, 2017).

2.2. Deep Learning

Deep learning; it is an AI method, a subbranch of machine learning, that uses multi-layered neural networks in areas such as object and speech recognition and natural language processing. While machine learning has data based on certain rules, deep learning can use data such as video, audio recording, and images. For this reason, while machine learning data is subjected to preprocessing, this is not necessary in deep learning (Yılmaz, 2021). In addition, today's developing data storage systems have enabled the number of data to increase. Deep learning has been developed to solve more complex problems (Türk, 2021). In recent years, this increasing data structure has created the field of "Big Data" and machine learning is becoming much easier. Another reason deep learning is used today is because of the computational resources to run larger models. By introducing hidden layers in artificial neural networks, the memory used and the processor capacity for calculation increases. The greater the number of hidden layers, the deeper the network. With more hidden layers, there is also a need for faster computers with larger memories.

In the literature, deep learning neural networks consist of input, hidden and output layers. The reason why they are called hidden layers is that they contain concepts that help understand the relationships in the data that are necessary to determine the model, rather than the values in the data. Most deep learning networks use a technique called convolution, which constrains the neural connections in the network to capture them naturally.

Thus, deep learning consists of convolutional neural networks (ESA). There are multiple trainable sections placed sequentially in ESA. After the input data is received, the training process is carried out by layer by layer operations and at the end, the output data is obtained for comparison with the correct result. An error occurs equal to the difference between the produced result and the desired result. When the network makes a lots of errors, the loss is high, and when it makes fewer errors, the loss is low.

3. Use in Healthcare

The use of computer-based diagnosis in practice is increasing day by day, thanks to its ability to detect and diagnose lesions that may not be noticeable to the human eye. Over the past two decades, advances in medical imaging technology and related research have revolutionized the storage of medical imaging data in digital format. These data should be processed in a way that can be used with AI to optimize compliance and patient outcomes and increase the accessibility and efficiency of the current healthcare system (Özkesici & Yılmaz, 2021). AI helps the healthcare sector with robotic developments for a more efficient process by improving patient care and treatment costs (Hoşgör & Güngördü, 2022). They can undertake tasks such as arranging patient appointments, reminding patients about their appointments and medications, reminding the physician about the patient's history and warning them about systemic diseases. AI can learn about diseases using a single source of information or multiple sources to diagnose a particular disease.

AI applications in medicine and dentistry are used in subjects such as early diagnosis, treatment planning,

prediction of treatment outcome and disease prognosis (Ding et al., 2023). In the field of dentistry, studies such as caries detection, dental plaque, detection of periapical lesions, detection of root fractures, root canal system anatomy, tooth numbering, dental age determination, detection of dental anomalies, detection of anatomical structures and implant planning have been carried out (Hwang et al., 2019, Amasya et al., 2020, Türk, 2021; Agrawal & Nikhade, 2022; Kaya et al., 2022; Schönewolf et al., 2022; Duman et al., 2023; Akdoğan & Özdemir, 2024).

Amasya et al (2020), have created a basis for developing an algorithm that helps detect bone age by using AI to detect the maturation of cervical vertebrae. Duman et al (2023), conducted a study on using an AI algorithm to diagnose teeth with taurodontism in panoramic radiography. You et al (2020), developed an AI algorithm to detect plaques in primary teeth and tested its accuracy. Zheng et al (2021), aimed to evaluate and compare deep learning to aid the clinical diagnosis of deep caries and pulpitis on periapical radiographs.

Using AI for diagnosis after long working hours helps dentists save time and make accurate determinations. Determining the number and length of implants in implant planning, detecting proximal caries and determining the number of roots and canals in posterior teeth by examining superposed teeth and tooth roots in detail, accelerating endodontics by determining the canal length by detecting the anatomical apex, determining the treatment plan by detecting caries and lesions and determining the dental caries in bone. Helping the

treatment plan in orthodontics by determining age and contributing to early diagnosis of oral cancer while examining intra-oral lesions are just some of what AI brings to dentistry (Saghiri et al., 2012(a), Saghiri et al., 2012(b), Uthoff et al., 2018, Hiraiwa et al., 2019, Amasya et al., 2023, Akdoğan & Özdemir, 2024). It is thought that AI will have a stronger place in the field of health in the future, thanks to the studies that have been done and the basis that these studies provide for future studies.

4. Conclusion

AI is a computer system on which a lot of research has been done recently. The use of AI in the field of healthcare is gaining momentum. It has a wide range of services, from planning patient appointments to robotic surgeries. With this review, AI is introduced and its fields of study in health are specified. Especially in dentistry, every study has the capacity to form the basis of another study. More work needs to be done in this field, which is expected to be present in many areas of dentistry in the future.

Ethical Statement

There is no need to obtain ethics committee permission for this study due to in review format reason. However, the study was conducted in accordance with ethical principles.

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Presentation Information

The findings of this study have not been presented at any conference or journal.

Conflicts of Interest:

The authors declare no conflicts of interest regarding this study. Any institution or organization providing funding for this research did not have any role in the design, data collection, analysis, interpretation, or publication to influence or distort the findings.

Author Contributions:

The contributions of the authors are as follows: Suna Deniz BOSTANCI participated in data collection and prepared the draft of the paper; Mehmet BANİ conducted the final revision of the manuscript.

References

- Agrawal, P. & Nikhade, P. Artificial intelligence in dentistry: Past, present, and future. *cureus*. (2022) ,14(7), doi: 10.7759/cureus.27405.
- Akdoğan, C. & Özdemir, H. (2024). Yapay zeka'nın diş hekimliği pratiğine kazanımları. *Türk Diş Hekimleri Araştırma Dergisi*, 2(3), 278-287.
- Amasya, H., Yıldırım, D., Aydoğan, T., Kemaloğlu, N., & Orhan, K. (2020). Cervical vertebral maturation assessment on lateral cephalometric radiographs using artificial intelligence: comparison of machine learning classifier models. *Dentomaxillofac Radiology*, 49(5).
- Atalay, M. & Çelik, E. (2017). Büyük veri analizinde yapay zeka ve makine öğrenmesi uygulamaları-artificial intelligence and machine learning applications in big data analysis. *Mehmet Akit Ersoy Üniversitesi Sosyal Bilimleri Enstitüsü Dergisi*, 9(22), 155-172.
- Ding, H., Wu, J., Zhao, W., Matinlinna, J., Burrow, M., & Tsoi, J. (2023). Artificial intelligence in dentistry, A review. *Frontiers in Dental Medicine*, 4(1), 1-10.
- Doğan, F. & Türkoğlu, İ. (2019). Derin öğrenme modelleri ve uygulama alanlarına ilişkin bir derleme, *Dicle Üniversitesi Mühendislik Fakültesi Mühendislik Dergisi*, 10(2), 409-445.
- Duman, S., Yılmaz, E. F., Eşer, G., Çelik, Ö., Bayrakdar, I. S., Bilgir, E., & Orhan, K. (2023). Detecting the

- presence of taurodont teeth on panoramic radiographs using a deep learning-based convolutional neural network algorithm. *Oral Radiology*, 39(1), 207-214.
- Hiraiwa, T., Arijji, Y., Fukuda, M., Kise, Y., Nakata, K., Katsumata, A., & Arijji, E. (2019). A deep-learning artificial intelligence system for assessment of root morphology of the mandibular first molar on panoramic radiography. *Dentomaxillofacial Radiology*, 48(3), 1-3.
- Hoşgör, H. & Güngördü, H. (2022). Sağlıkta yapay Zekanın kullanım alanları üzerine nitel bir araştırma. *Avrupa Bilim ve Teknoloji Dergisi*, 1(35), 395-407.
- Hwang, J. J., Jung, Y. H., Cho, B. H., & Heo, M. S. (2019). An Overviwe of deep learning in the field of dentistry. *Imaging science in dentistry*, 49(1), 1-7.
- Katabağ, M. (2021) Ahlaki değerlerin kodlanabilmesi bağlamında yapay zeka etiğine kurumsal bir bakış. *TRT Akademisi*, 13(6), 748-767.
- Kaya, E., Gunec, H. G., Gokyay, S. S., Kutal, S., Gulum, S., & Ateş, H. F. (2022). Proposing a CNN method for primary and permanent tooth detection and enumeration on pediatric dental radiographs. *Journal of Clinical Pediatric Dentistry*, 46(4), 293-298.
- Koroğlu, Y. (2017). Yapay zekanın teorik ve pratik sınırları. Boğaziçi Üniversitesi Yayinevi, 1-10.
- Özkesici, M. Y. & Yılmaz S. (2021). Oral ve maksillofasial radyoloji'de yapay zeka. *Sağlık Bilimleri Dergisi*, 30(3), 346-351.
- Saghiri, M. A., Asgar, K., Boukani, K., Lotfi, M., Aghili, H., Delvarani, A., & Garcia-Godoy, F. (2021a). A new approach for locating the minor apical foramen using an artificial neural network. *International endodontic journal*, 45(3), 257-265.
- Saghiri, M. A., Garcia-Godoy, F., Gutmann, J. L., Lotfi, M., & Asgar, K. (2021b). The reliability of artificial neural network in locating minor apical foramen: a cadaver study. *Journal Of endodontics*, 38(8), 1130-1134.
- Schönewolf, J., Meyer, O., Engels, P., Schlickerrieder, A., Hickel, R., Gruhn, V., & Kühnisch, J. (2022). Artificial intelligence-based diagnostics of molar-incisor-hypomineralization(MIH) on intraoral photographs. *Clinical Oral Investigation*, 26(9), 5923-5930.
- Setzer, F. C., Shi, K. J., Zhang, Z., Yan, H., Yoon, H., Mupparapu, M., & Li, J. (2020). Artificial intelligence for the computer-aided detection of periapical lesions in cone-beam computed tomographic images. *Journal of endodontics*, 46(7), 987-993.
- Taş, H. Y. (2018). Dördüncü sanayi devrimi'nin (Endüstri 4.0) çalışma hayatına ve istihdama muhtemel etkileri, *OPUS Uluslararası Toplum Araştırmaları Dergisi*, 16(9), 1817-1836.
- Türk, E. (2021). Gömülü mandibular üçüncü molar dişlerin pozisyon özelliklerinin yapay zeka ile değerlendirilmesi. (Uzmanlık Tezi). *Süleyman Demirel Üniversitesi*, Isparta.
- Uthoff, R. D., Song, B., Sunny, S., Patrick, S., Sureshi, A., Kolar, T., & Wilder-Smith, P. (2018). Point-of-care, smartphone-based, dual-modality, dual-view- oral cancer screening device with neural network classification for low-resource communities. *PLoS One*, 13(12), 1-21.
- Yılmaz, A. (2021). *Derin öğrenme*: İstanbul

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The Effect of Infant Massage on Postpartum Depression and Maternal Attachment: A Literature Review

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Abstract

The postpartum period can be both exciting and challenging for mothers. During this time, women may potentially experience postpartum depression (PPD) due to various factors such as hormonal changes, breastfeeding and sleep problems, increased stress load, infant care, and adjustment to maternal roles. PPD poses a serious risk to both maternal and infant health. Infant massage, with its positive effects on PPD and maternal attachment, has been encouraged as a practice taught to mothers in recent years. This review examines the effects of infant massage on mothers during the postpartum period. Findings suggest that infant massage may be an effective method in reducing PPD symptoms and strengthening maternal attachment. By enhancing the emotional bond between mother and baby, reducing stress, and increasing oxytocin levels, infant massage contributes to alleviating symptoms of PPD. It is important for nurses to educate and promote infant massage among mothers during the postpartum period. Infant massage may play a significant role in reducing PPD risk and enhancing mother-infant attachment. Further research could evaluate the long-term effects of infant massage and its effects on mothers from different demographic groups in more detail. This review demonstrates that infant massage is a beneficial practice for mothers during the postpartum period and highlights the importance of nurses promoting this practice.

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1. Introduction

The postpartum period is an exciting, yet equally challenging time in women's lives. New mothers experience immense joy with the birth of their baby, but they also face significant physical and emotional changes and adaptation. Factors such as hormonal changes, breastfeeding and sleep problems, increased stress load, infant care, and adjustment to maternal roles during this period can make women emotionally vulnerable and potentially lead to serious psychological disorders such as postpartum depression (PPD) (Klein et al., 2024).

PPD is a serious mood disorder associated with biological changes in hormone levels and other postpartum-related factors (Yu et al., 2021). According to the Diagnostic and Statistical Manual of Mental Disorders: DSM-5™ criteria, PPD is defined as depressive symptoms that begin during pregnancy or within four weeks following childbirth (American Psychiatric Association, 2013). Postpartum depressive symptoms can persist up to 12 months after childbirth (Centers for Disease Control and Prevention, 2008; World Health Organization, 2016). According to a comprehensive meta-analysis examining the prevalence of PPD worldwide, it was found to be 17.22% (Wang et al., 2021). Another meta-analysis revealed that approximately one in eight women experiences depressive symptoms postpartum, with one in fifteen experiencing severe depression, and the prevalence is higher in low- and middle-income countries compared to developed countries (Bai et al., 2023). In Turkey, meta-analytical studies have indicated a prevalence of PPD ranging from 21.2% to 25% (Karaçam et al., 2018; Özcan et al.,

2017). Although the exact cause of PPD remains unclear, it is known to be influenced by biological, psychological, and psychosocial factors, along with various risk factors. Pregnancy and postpartum hormonal changes, age, history of previous depression, body image disturbance due to weight changes, low self-esteem, unwanted pregnancy, obstetric stressors, increased daily life stress with the addition of infant care, difficult infant temperament, poor marital relationship and inadequate social support, low socioeconomic status, and domestic violence are mentioned as factors predisposing to PPD (Cafiero & Zabala, 2024; Klein et al., 2024; Ozkan-Sat & Söylemez, 2024; Sharma & Khera, 2024; Stewart & Vigod, 2019; Wang et al., 2024). Women experiencing PPD may exhibit frequent crying, appetite disturbances, sleep problems, feelings of helplessness, emotional instability, guilt feelings, anhedonia, indifference, low energy, fatigue, irritability, decreased concentration, memory and libido, along with symptoms such as decreased libido (Cafiero & Zabala, 2024; Sharma & Khera, 2024; Stewart & Vigod, 2019; Wang et al., 2024). Additionally, symptoms such as suicidal ideation can be observed in women with PPD. In a study, it was stated that the risk of suicidal behavior in women with PPD is three times higher compared to women without depression (Yu et al., 2024). Moreover, the disturbing thought of harming their babies in women with advanced PPD to psychosis is a worrying situation for maternal and infant health (Brockington, 2017; Spinelli & Bramante, 2022).

The depressive symptoms experienced by the mother can affect her daily activities and have a negative impact on infant care. Furthermore, the depression experienced by the mother can have significant negative effects on her infant's emotional, behavioral, cognitive, and language development (Cafiero & Zabala, 2024; Saharoy et al., 2023). PPD can also affect maternal-infant attachment (Cafiero & Zabala, 2024). Maternal-infant attachment forms the basis for healthy emotional development. A healthy bond established between mother and baby helps babies feel secure, emotionally satisfied, and adapt to the world (Epstein, 2023). The first year of motherhood involves getting to know and establishing a strong bond with the baby. During this process, the mother's ability to identify and provide appropriate responses to the baby's needs is directly proportional to her capacity for bonding with the baby. A mother who forms a healthy bond with her baby can respond appropriately to the baby's needs to the same extent (Lang, 2018; Shoghi et al., 2018). However, mothers experiencing PPD may struggle with the attachment process, which can negatively affect their baby's emotional development (O'Dea et al., 2023). Depression and maternal attachment are closely related concepts. Both through the effect of depression on the mother's attachment process and the effect of the quality of the mother's attachment on depressive symptoms, they are interrelated (Li, 2023; Özşahin et al., 2020; Śliwerski et al., 2020).

Therefore, it is important to address these two factors together, as a positive change in one can positively affect the other (Li, 2023).

Infant massage has been encouraged as a practice taught to mothers in recent years due to its positive effects on both depression and maternal attachment (Geary et al., 2023). Infant massage is a traditional practice used by mothers in many cultures for thousands of years (Hétu, 2023; Katona, 2021; McClure, 2017). Recent research has revealed numerous physiological and emotional benefits of infant massage for both mother and baby (Chan et al., 2018; Erçelik & Yılmaz, 2023; Midtsund et al., 2019; Moussa et al., 2021; Mrljak et al., 2022). This review aims to examine the effects of infant massage on PPD and maternal attachment experienced by mothers during the postpartum period. Additionally, it will help better understand the role of infant massage as a preventive approach to improving maternal health.

2. Infant Massage

Infant massage is essentially a technique performed on the baby's body using gentle touches, soft movements, and light pressure (Field, 1994; McClure, 2017). Infant massage has positive effects on both maternal and infant health with its physiological, emotional, and psychological benefits (Nousia, 2023). The roots of infant massage can be traced back to ancient times. In India, as part of Ayurvedic medicine, it is known that babies were massaged to improve their physical and emotional health (Field, 1994; McClure, 2017).

More commonly in Africa and Asia, infant massage is widely used to promote healthy development and strengthen immune systems by massaging babies for several months after birth. Infant massage is also a common practice worldwide outside Africa and Asia (Auckett, 1979; Field, 1994; McClure, 2000). Modern applications of infant massage began to gain popularity in the West in the 1970s. Dr. Frederick Leboyer, observing Indian infant massage in 1979, shared his research and recommendations on the benefits of infant massage for mothers and babies in his book, contributing to the spread of infant massage in Western culture (Leboyer & Elbrecht, 2013). Two important figures in spreading infant massage in Western societies are Tiffany Field and Vimala McClure. Tiffany Field established the Touch Research Institute in Miami, United States, in 1992, and made numerous scientific contributions to the literature on the effects of touch and massage on human health (the University of Miami School of Medicine, 2024). Vimala McClure, on the other hand, founded the International Association of Infant Massage (IAIM) in the United States in 1976, providing guidance on the implementation and education of infant massage. She has been training infant massage educators and promoting the spread of infant massage worldwide through representations established in 100 countries (International Association of Infant Massage, 2024). The IAIM program, established by Vimala McClure, is based on the combination of Indian and Swedish massage, gentle yoga movements, and reflexology principles. The IAIM infant massage program is based on specific principles and techniques. The program teaches parents massage techniques while encouraging them to practice on their babies simultaneously, helping

them to build a stronger bond with their infants. The training includes massage and relaxation techniques, understanding infant cues, and bonding activities. The program respects different cultural practices and traditions. The IAIM program consists of weekly sessions over 5 weeks and is conducted by certified instructors who regularly form groups for implementation (McClure, 2017).

3. The Effects of Massage on Postpartum Depression

When examining the effects of infant massage on PPD, it is observed that various psychological and physiological factors come together to contribute significantly to the reduction of depression symptoms and the improvement of the mother's well-being. Infant massage is believed to affect PPD symptoms through a set of physiological mechanisms involving hormonal processes (Field, 2016). It has been found that individuals showing depression symptoms have low levels of oxytocin (Tuman et al., 2021). Gentle touches and skin contact during infant massage have been found to increase oxytocin levels in both mothers and babies (Moussa et al., 2021). The increase in oxytocin levels is believed to contribute to a decrease in anxiety levels and a transition to a calmer state of mind (Nagahashi-Araki et al., 2022), thus aiding in reducing PPD symptoms. A systematic review focusing on the effects of mother-led infant massage on PPD symptoms found that mothers who massaged their babies had lower depression scale scores compared to the non-massage group (Geary et al., 2023). Another systematic review also indicated that mother-led infant massage reduced anxiety, stress, and

depressive symptoms, while enhancing mother-infant interaction (McCarty et al., 2023).

Another hormone playing a role in the effects of infant massage on PPD is cortisol. Cortisol is a hormone released during times of stress. High levels of cortisol in the body can lead to stress, anxiety, and depression (Chojnowska et al., 2021). In a study, saliva samples were collected from mothers immediately after massaging their babies, and a significant decrease in cortisol levels was observed compared to saliva samples taken before the massage (McCarty et al., 2024). The decrease in cortisol levels is thought to contribute to a reduction in stress and anxiety, and thus a alleviation of depression symptoms (Chojnowska et al., 2021).

Serotonin and dopamine, known as happiness hormones, are also hormones that could potentially affect PPD. It is known that levels of serotonin and dopamine are low in depressive patients (Jauhar et al., 2023; Mizuno et al., 2023). Serotonin and dopamine are hormones that contribute to mood improvement, pleasure, increased feelings of happiness, and coping with stress (Baixauli, 2017). It has been found that touches during infant massage increase serotonin by 28% and dopamine by 31% (Field et al., 2005).

During massage, activation of the vagal nerve occurs by stimulating pressure receptors under the baby's skin. Vagal activation stimulates the parasympathetic nervous system, leading to a decrease in the baby's heart rate, relaxation, and calming. A mother who relaxes and calms her baby through massage increases her self-confidence and can cope more effectively with daily challenges (Field, 2019).

In addition to hormonal processes and activation of the vagal nerve, infant massage can also provide benefits for PPD through psychological effects. In a systematic review examining 8 eight articles on this topic conducted in 2023, it was reported that women who massaged their babies experienced a decrease in depression symptoms and depression scale scores, an increase in sleep quality, an improvement in overall mood, and were more motivated to engage in touch with their babies. The study also found that mothers developed closer bonds with their babies, experienced a decrease in feelings of guilt, and increased calmness and self-confidence (Geary et al., 2023).

4. The Effects of Infant Massage on Maternal Attachment

There is a strong relationship between PPD and maternal bonding (Li, 2023). The positive effects of infant massage on PPD can also be anticipated to extend to maternal bonding. A systematic review and meta-analysis have found that infant massage enhances mother-infant bonding (Zhang et al., 2023).

When examining the effects of infant massage on maternal bonding, it is evident that it contributes to the strengthening of emotional relationships between mothers and their babies (Nousia, 2023). One significant factor behind this strengthening is the role of oxytocin hormone. Oxytocin, known as the love and bonding hormone, promotes emotional bonding (Shorey et al., 2023). It has been observed that both mothers and babies experience an increase in oxytocin levels due to infant massage (Moussa et al., 2021; Shorey et al., 2023). The increased oxytocin levels facilitate mothers in forming stronger emotional bonds

with their babies (Li et al., 2022; Saharoy et al., 2023; Shorey et al., 2023).

Effective communication between a mother and her baby enables the mother to interpret her baby's responses more accurately, understand her baby better, and respond more sensitively to her baby's needs. Massaging the baby contributes to the mother's ability to understand her baby. This, in turn, leads to the mother feeling more successful and increases her self-confidence. A study found that mothers who massage their babies have higher self-confidence scale scores compared to those who do not (Erçelik & Yılmaz, 2023). Mother's self-confidence also emerges as a factor that enhances the bond between the mother and her baby (Kadiroğlu & Güdücü Tüfekci, 2022).

A decrease in stress levels during infant massage can lead to a more positive interaction between the mother and her baby, strengthening their bond (Bonacquisti et al., 2020; Lutkiewicz et al., 2020). Studies have shown that mothers who massage their babies are more likely to accept the maternal role, feel more competent in this role, experience an increase in the quality of time spent with their baby, have a positive impact on their own parenting skills, and strengthen their self-respect (Chan et al., 2018; Midtsund et al., 2019).

5. The Role of Nurses in Promoting Baby Massage Practice During the Postpartum Period

The postpartum period is a critical time during which nurses play an important role in providing care focused on maternal and infant health. Infant massage emerges as a significant practice supporting the health of both mothers and infants during this period. Nurses

play a vital role in promoting the implementation of infant massage in the postpartum period. Nurses can provide education to parents about the benefits of infant massage to contribute to strengthening the bond between mother and baby. These educational sessions can assist mothers in learning infant massage techniques and confidently applying them. Additionally, nurses can highlight the emotional relaxation and bonding benefits of infant massage by understanding the emotional challenges experienced by mothers in the postpartum period. It is crucial for nurses to provide counseling and guidance to ensure the proper application of infant massage. By listening to mothers' concerns and offering support tailored to their needs, nurses can facilitate the practice of infant massage. Furthermore, nurses can provide information about the physiological and emotional benefits of infant massage and emphasize its positive effects on maternal and infant health. In this way, nurses can contribute to increasing the implementation of infant massage in the postpartum period and play a significant role in supporting maternal and infant health (Erçelik & Yılmaz, 2023; Gürol & Polat, 2012).

6. Conclusion

This review has evaluated the effects of infant massage on mothers during the postpartum period by examining the existing literature and has reached significant findings. It emphasizes the potential positive impact of infant massage on postpartum depression (PPD) and maternal attachment. The data obtained indicate that infant massage may be an effective method for reducing PPD symptoms. This supports the use of infant massage for maintaining and improving maternal mental health. Additionally, a

positive effect of infant massage on maternal attachment has been observed. Mothers who perform infant massage tend to engage in more frequent and in-depth interactions with their infants. This could contribute to mothers forming a healthy attachment with their infants and could be associated with positive long-term child development. However, considering the studies conducted, more randomized controlled trials and long-term follow-up research are needed. Such studies could further evaluate the long-term effects of infant massage and its effects on mothers from different demographic groups in more detail. Educating mothers about infant massage and encouraging this practice during the postpartum period can play a critical role in reducing PPD symptoms and strengthening mother-infant attachment. Nursing practice can take a leading role in adopting infant massage as an intervention that supports both psychological and emotional well-being.

Ethical Statement

Ethics committee approval was deemed unnecessary for this study, given that open access sources were utilized.

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Presentation Information

The findings of this study have not been presented at any conference or journal.

Conflicts of Interest

The authors declare no conflicts of interest regarding this study. Any institution or organization providing funding for this research did not have any role in the design, data collection, analysis, interpretation, or publication to influence or distort the findings.

Author Contributions

The contributions of the authors are as follows: Ceyda Sarper Erkilic contributed to literature search and editing the report. Ayten Şentürk Erenel conducted the supervision and final revision of the manuscript.

References

- American Psychiatric Association, D. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (Vol. 5). American Psychiatric Association Washington, DC.
- Auckett, A. (1979). Baby massage: An alternative to drugs. *The Australian Nurses' Journal, Royal Australian Nursing Federation*, 9(5), 24-27.
- Bai, Y., Li, Q., Cheng, K. K., Caine, E. D., Tong, Y., Wu, X., & Gong, W. (2023). Prevalence of Postpartum Depression Based on Diagnostic Interviews: A Systematic Review and Meta-Analysis. *Depression and Anxiety*, 2023. <https://doi.org/10.1155/2023/8403222>
- Baixaui, E. (2017). Happiness: Role of Dopamine and Serotonin on mood and negative emotions. *Emergency Medicine (Los Angel)*, 7(2), 350. <https://doi.org/10.4172/2165-7548.1000350>
- Bonacquisti, A., Geller, P. A., & Patterson, C. A. (2020). Maternal depression, anxiety, stress, and maternal-infant attachment in the neonatal intensive care unit. *Journal of Reproductive and Infant Psychology*, 38(3), 297-310. <https://doi.org/10.1080/02646838.2019.1695041>
- Brockington, I. (2017). Suicide and filicide in postpartum psychosis. *Archives of women's mental health*, 20(1), 63-69. <https://doi.org/10.1007/s00737-016-0675-8>
- Cafiero, P. J., & Zabala, P. J. (2024). Postpartum depression: Impact on pregnant women and the postnatal physical, emotional, and cognitive development of their children. An ecological perspective. *Archivos Argentinos de Pediatría*,

- e202310217. <https://doi.org/10.5546/aap.2023-10217.eng>
- Centers for Disease Control and Prevention, C. (2008). Prevalence of self-reported postpartum depressive symptoms--17 states, 2004-2005. *Morbidity and Mortality Weekly Report*, 57(14), 361-366.
- Chan, K., Pawi, S., Lee, S., Hii, E., Ooi, C., Arabi, Z., & Hazmi, H. (2018). Experience of mothers' learning and doing infant massage. *Malaysian Applied Biology*, 47(1), 189-194.
- Chojnowska, S., Ptasińska-Sarosiek, I., Kępcza, A., Knaś, M., & Waszkiewicz, N. (2021). Salivary biomarkers of stress, anxiety and depression. *Journal of Clinical Medicine*, 10(3), 517. <https://doi.org/10.3390/jcm10030517>
- Epstein, O. B. (2023). John Bowlby, Attachment Theory, and Attachment-Based Psychoanalytic Psychotherapy. In *Underlying assumptions in psychoanalytic schools* (pp. 78-88). Routledge.
- Erçelik, Z. E., & Yılmaz, H. B. (2023). Effectiveness of infant massage on babies growth, mother-baby attachment and mothers' self-confidence: A randomized controlled trial. *Infant Behavior and Development*, 73, 101897. <https://doi.org/10.1016/j.infbeh.2023.101897>
- Field, T. (1994). Infant massage. *The Journal of Perinatal Education*, 3(3), 7-13.
- Field, T. (2016). Massage therapy research review. *Complementary Therapies in Clinical Practice*, 24, 19-31. <https://doi.org/10.1016/j.ctcp.2016.04.005>
- Field, T. (2019). Pediatric Massage Therapy Research: A Narrative Review. *Children (Basel)*, 6(6). <https://doi.org/10.3390/children6060078>
- Field, T., Hernandez-Reif, M., Diego, M., Schanberg, S., & Kuhn, C. (2005). Cortisol decreases and serotonin and dopamine increase following massage therapy. *International Journal of Neuroscience*, 115(10), 1397-1413. <https://doi.org/10.1080/00207450590956459>
- Geary, O., Grealish, A., & Bright, A.-M. (2023). The effectiveness of mother-led infant massage on symptoms of maternal postnatal depression: A systematic review. *Plos one*, 18(12), e0294156. <https://doi.org/10.1371/journal.pone.0294156>
- Gürol, A., & Polat, S. (2012). The Effects of Baby Massage on Attachment between Mother and their Infants. *Asian Nursing Research*, 6(1), 35-41. <https://doi.org/https://doi.org/10.1016/j.anr.2012.02.006>
- Hétu, S. (2023). Infant massage: Ancient as the world-modern necessity The work of the International Association of Infant Massage (IAIM). *International Journal of Birth & Parent Education*, 11(1).
- International Association of Infant Massage. (2024). *An Inspiring Woman*. Retrieved April 20, 2024 from <https://iaim.net/an-inspiring-woman/>
- Jauhar, S., Cowen, P. J., & Browning, M. (2023). Fifty years on: Serotonin and depression. *Journal of Psychopharmacology*, 37(3), 237-241. <https://doi.org/10.1177/026988112311618>
- Kadiroğlu, T., & Güdücü Tüfekçi, F. (2022). Effect of infant care training on maternal bonding, motherhood self-efficacy, and self-confidence in mothers of preterm newborns. *Maternal and Child Health Journal*, 26, 131-138. <https://doi.org/10.1007/s10995-021-03287-0>
- Karaçam, Z., Çoban, A., Akbaş, B., & Karabulut, E. (2018). Status of postpartum depression in Turkey: A meta-analysis. *Health Care for Women International*, 39(7), 821-841. <https://doi.org/10.1080/07399332.2018.1466144>
- Katona, J. (2021). *What can be learnt from observing a 5-week baby massage group in a Parent Infant Mental Health Service?* Tavistock and Portman NHS Foundation Trust/University of Essex]. <https://repository.tavistockandportman.ac.uk/2679/>
- Klein, S., Blazek, M., & Swietlik, D. (2024). Risk and protective factors for postpartum depression among Polish women - a prospective study. *Journal of Psychosomatic Obstetrics & Gynecology*, 45(1). <https://doi.org/10.1080/0167482X.2023.2291634>
- Lang, C. (2018). *Bağlanma: Doğum Öncesi ve Sonrası Dönemde Bağlanmanın Güçlendirilmesi*. Modern Tıp kitabevi.
- Leboyer, F., & Elbrecht, A. (2013). *Sanfte Hände: die traditionelle Kunst der indischen Baby-Massage*. Kösel-Verlag.
- Li, H. (2023). Maternal-Infant Attachment and its Relationships with Postpartum Depression, Anxiety, Affective Instability, Stress, and Social Support in a Canadian Community Sample. *Psychiatric Quarterly*, 94(1), 9-22. <https://doi.org/10.1007/s1126-022-10011-w>
- Li, Q., Zhao, W. H., & Kendrick, K. M. (2022). Affective touch in the context of development, oxytocin signaling, and autism. *Frontiers in Psychology* 13(967791). <https://doi.org/10.3389/fpsyg.2022.967791>
- Lutkiewicz, K., Bieleninik, Ł., Cieślak, M., & Bidzan, M. (2020). Maternal-infant bonding and its relationships with maternal depressive symptoms, stress and anxiety in the early postpartum period in a Polish sample. *International Journal of Environmental Research and Public Health*, 17(15), 5427. <https://doi.org/10.3390/ijerph17155427>
- McCarty, D., Silver, R., Quinn, L., Dusing, S., & O'Shea, T. M. (2024). Infant massage as a stress management technique for parents of hospitalized extremely preterm infants. *Infant Mental Health Journal*, 45(1), 11-21. <https://doi.org/10.1002/imhj.22095>

- McCarty, D. B., Willett, S., Kimmel, M., & Dusing, S. C. (2023). Benefits of maternally-administered infant massage for mothers of hospitalized preterm infants: a scoping review. *Maternal Health, Neonatology and Perinatology*, 9(1), 6. <https://doi.org/10.1186/s40748-023-00151-7>
- McClure, V. (2000). Infant massage. *The American Journal of Maternal/Child Nursing*, 25(5), 276. <https://doi.org/10.1097/00005721-200009000-00013>
- McClure, V. (2017). *Infant massage: A handbook for loving parents*. Bantam.
- Midtsund, A., Litland, A., & Hjalmhult, E. (2019). Mothers' experiences learning and performing infant massage-A qualitative study. *Journal of Clinical Nursing*, 28(3-4), 489-498. <https://doi.org/10.1111/jocn.14634>
- Mizuno, Y., Ashok, A. H., Bhat, B. B., Jauhar, S., & Howes, O. D. (2023). Dopamine in major depressive disorder: A systematic review and meta-analysis of in vivo imaging studies. *Journal of Psychopharmacology*, 37(11), 1058-1069. <https://doi.org/10.1177/026988112312008>
- Moussa, S., Fawaz, L., Ibrahim, W., Fathelbab Elsayed, M., & Mostafa Ahmed, M. (2021). Effect of infant massage on salivary oxytocin level of mothers and infants with normal and disordered bonding. *Journal of Primary Care & Community Health*, 12, 21501327211012942. <https://doi.org/10.1177/21501327211012942>
- Mrljak, R., Arnsteg Danielsson, A., Hedov, G., & Garmy, P. (2022). Effects of infant massage: a systematic review. *International Journal of Environmental Research and Public Health*, 19(11), 6378. <https://doi.org/10.3390/ijerph19116378>
- Nagahashi-Araki, M., Tasaka, M., Takamura, T., Eto, H., Sasaki, N., Fujita, W., Miyazaki, A., Morifuji, K., Honda, N., & Miyamura, T. (2022). Endogenous oxytocin levels in extracted saliva elevates during breastfeeding correlated with lower postpartum anxiety in primiparous mothers. *Bmc Pregnancy and Childbirth*, 22(1), 711. <https://doi.org/10.1186/s12884-022-05026-x>
- Nousia, A. (2023). Healthy touch and infant massage: Two main factors in infants daily care and healthy development. *European Journal of Education Studies*, 10(6). <https://doi.org/10.46827/ejes.v10i6.4854>
- O'Dea, G. A., Youssef, G. J., Hagg, L. J., Francis, L. M., Spry, E. A., Rossen, L., Smith, I., Teague, S. J., Mansour, K., & Booth, A. (2023). Associations between maternal psychological distress and mother-infant bonding: a systematic review and meta-analysis. *Archives of Women's Mental Health*, 26(4), 441-452. <https://doi.org/10.1007/s00737-023-01332-1>
- Ozkan-Sat, S., & Söylemez, F. (2024). The Association of Domestic Violence During Pregnancy with Maternal Psychological Well-Being in The Early Postpartum Period: A Sample from Women with Low Socioeconomic Status in Eastern Turkey. *Midwifery*, 104000. <https://doi.org/10.1016/j.midw.2024.104000>
- Özcan, N. K., Boyacıoğlu, N. E., & Dinç, H. (2017). Postpartum depression prevalence and risk factors in Turkey: a systematic review and meta-analysis. *Archives of Psychiatric Nursing*, 31(4), 420-428. <https://doi.org/10.1016/j.apnu.2017.04.006>
- Özşahin, Z., Emine, A., & GÖKBULUT, N. (2020). Postpartum depresyon düzeyi ile maternal bağlanma arasındaki ilişki. *İnönü Üniversitesi Sağlık Hizmetleri Meslek Yüksek Okulu Dergisi*, 8(3), 715-724. <https://doi.org/10.33715/inonusaglik.757249>
- Saharoy, R., Potdukhe, A., Wanjari, M., & Taksande, A. B. (2023). Postpartum depression and maternal care: exploring the complex effects on mothers and infants. *Cureus*, 15(7). <https://doi.org/10.7759/cureus.41381>
- Sharma, P., & Khera, K. (2024). A novel tool for risk assessment, screening, diagnosis, assessment, and therapy in postpartum depression. *International Journal of Gynecology & Obstetrics*. <https://doi.org/10.1002/ijgo.15421>
- Shoghi, M., Sohrabi, S., & Rasouli, M. (2018). The Effects of Massage by Mothers on Mother-Infant Attachment. *Alternative Therapies in Health and Medicine*, 24(3), 34-39. <https://www.ncbi.nlm.nih.gov/pubmed/29101776>
- Shorey, S., Asurlekar, A. R., Chua, J. S., & Lim, L. H. K. (2023). Influence of oxytocin on parenting behaviors and parent-child bonding: a systematic review. *Developmental Psychobiology*, 65(2), e22359. <https://doi.org/10.1002/dev.22359>
- Śliwerski, A., Kossakowska, K., Jarecka, K., Świtalska, J., & Bielawska-Batorowicz, E. (2020). The effect of maternal depression on infant attachment: A systematic review. *International Journal of Environmental Research and Public Health*, 17(8), 2675. <https://doi.org/10.3390/ijerph17082675>
- Spinelli, M., & Bramante, A. (2022). Maternal suicide and filicide. In *Key Topics in Perinatal Mental Health* (pp. 185-198). Springer.
- Stewart, D. E., & Vigod, S. N. (2019). Postpartum depression: pathophysiology, treatment, and emerging therapeutics. *Annual Review of Medicine*, 70, 183-196. <https://doi.org/10.1146/annurev-med-041217-011106>
- The University of Miami School of Medicine. (2024). *Touch Research Institute (Archives)*. Mailman Center for Child Development. Retrieved April 20, 2024 from <https://med.miami.edu/centers-and-institutes/mailman-center/community/other->

community-based-programs/touch-research-institute-(archives)

- Tuman, T. C., YILDIRIM, O., & Tufan, A. E. (2021). Evaluation of serum oxytocin levels in patients with depression, generalized anxiety disorder, panic disorder, and social anxiety disorder: A case-control study. *Journal of Surgery and Medicine*, 5(7), 670-675. <https://doi.org/10.28982/josam.922612>
- Wang, X. X., Zhang, L., Lin, X. F., Nian, S. W., Wang, X. Q., & Lu, Y. (2024). Prevalence and risk factors of postpartum depressive symptoms at 42 days among 2462 women in China. *Journal of Affective Disorders*, 350, 706-712. <https://doi.org/10.1016/j.jad.2024.01.135>
- Wang, Z., Liu, J., Shuai, H., Cai, Z., Fu, X., Liu, Y., Xiao, X., Zhang, W., Krabbendam, E., & Liu, S. (2021). Mapping global prevalence of depression among postpartum women. *Translational Psychiatry*, 11(1), 543. <https://doi.org/10.1038/s41398-021-01663-6>
- World Health Organization. (2016). *mhGAP intervention guide for mental, neurological and substance use disorders in non-specialized health settings: mental health Gap Action Programme (mhGAP)*. World Health Organization.
- Yu, H., Shen, Q., Bränn, E., Yang, Y., Oberg, A. S., Valdimarsdóttir, U. A., & Lu, D. (2024). Perinatal depression and risk of suicidal behavior. *JAMA network open*, 7(1), e2350897. <https://doi.org/10.1001/jamanetworkopen.2023.50897>
- Yu, Y., Liang, H.-F., Chen, J., Li, Z.-B., Han, Y.-S., Chen, J.-X., & Li, J.-C. (2021). Postpartum depression: Current status and possible identification using biomarkers. *Frontiers in Psychiatry*, 12, 620371. <https://doi.org/10.3389/fpsy.2021.620371>
- Zhang, Y., Duan, C. L., Cheng, L. Y., & Li, H. H. (2023). Effects of massage therapy on preterm infants and their mothers: a systematic review and meta-analysis of randomized controlled trials. *Frontiers in Pediatrics*, 11. <https://doi.org/10.3389/fped.2023.1198730>