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Gökben Hızlı Sayar<sup>1\*</sup>

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# RELATION OF ATTENTION-DEFICIT/HYPERACTIVITY DISORDER SYMPTOMS AND INCREASED ACCIDENTS IN AIRPORT WORKERS

## HAVALİMANI ÇALIŞANLARINDA DİKKAT EKSİKLİĞİ VE HİPERAKTİVİTE BOZUKLUĞU BELİRTİLERİ İLE ARTMIŞ ARAÇ KAZASI RİSKİ İLİŞKİSİ

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## Abstract

Attention-Deficit/Hyperactivity Disorder (ADHD) is a chronic and debilitating disorder characterized by inattentiveness and impulsiveness, the most commonly encountered symptoms of hyperactivity. Adults with ADHD can suffer performance loss and loss of employment. It has been determined that individuals with ADHD have difficulty driving. Hypothesis of the research was that “the airport workers with a history of workplace driving accident have higher level of symptoms of ADHD, compared to the workers without a history of workplace driving accidents”. A total of 138 accidents involving vehicles occurred between 2012 and 2014 at Havaş, where the research was conducted. The research participants were given a questionnaire (study group was 110 workers involved in an accident; control group was 111 workers, matched with the study group for sex and age, although they were not involved in an accident) comprising Adult ADHD Self-Report Scale (AASRS) and Adult ADHD DSM-IV Based Diagnostic Screening and Rating Scale (A-ADHDS). Using these scales, the participants were evaluated with respect to their accident status, performance, attendance and demographics. Diagnosis of ADHD was encountered only one employee in study group. A-ADHDS Hyperactivity subscale score was found to be significantly higher in study group compared to control group. Scores of the other subscales of A-ADHDS and AASRS found to be similar in groups. These results suggest that although there found to be no significant differences in rates of ADHD diagnosis in workers with a history of driving accident and the control group; the former may have higher rates of hyperactivity symptoms. Informing the workers and the employers about the effects and consequences of ADHD symptoms in workplace, screening the symptoms of ADHD in those to be employed in critical areas requiring driving skills might decrease the risk of workplace accidents.

**Keywords:** attention deficit, hyperactivity, impulsiveness, workplace accident,

## Özet

*Dikkat Eksikliği ve Hiperaktivite Bozukluğu (DEHB), hiperaktivitenin yaygın belirtileri olan dikkatsizlik ve dürtüsellik ile tanımlanan, kronik ve yeti yitimine sebep olan bir bozukluktur. DEHB’li yetişkinler yaptıkları işlerle performans ve iş kayıpları yaşayabilirler. DEHB’li kişilerin sürüş zorlukları olduğu tespit edilmiştir. Bu araştırmanın hipotezi “araç kazası yapmış olan havalimanı çalışanlarının DEHB puanları, araç kazası yapmamış olanlara kıyasla daha yüksektir” olarak belirlenmiştir. Çalışmanın yapıldığı Havaş’ta 2012-2014 yılları arasında toplam 138 araç kazası gerçekleşmiştir. Kaza yapanlardan araştırmaya katılmayı kabul eden 110 personele ve onlarla yaş ve cinsiyet bakımından eşleştirilmiş kaza yapmamış personelden oluşan 111 kişilik kontrol grubuna Erişkin Dikkat Eksikliği Hiperaktivite Bozukluğu Öz Bildirim Ölçeği (EDHÖ) ve DSM-IV’e Dayalı Erişkin DEB/ DEHB Tanı ve Değerlendirme Envanteri (E-DEHB) uygulanmıştır. Katılımcılar, ölçek maddeleri ile kaza yapma durumu, performans, devam durumları ve demografik açıdan incelenmiştir. Araştırmada kaza yapanlar arasında DEHB tanısı alan bir kişiye rastlanmıştır.*

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**Kaza yapan grupta kontrol grubuna kıyasla E-DEHB Aşırı Hareketlilik alt ölçek toplam puanının anlamlı derecede daha yüksek olduğu, diğer alt ölçek puanlarında ise bir farklılık olmadığı saptanmıştır. Bu sonuca göre kaza yapan ve yapmayan havalimanı çalışanlarında DEHB tanısı bakımından farklılık bulunmamakla birlikte kaza yapanların aşırı hareketlilikle ilgili belirtileri daha yüksek oranda gösterdikleri düşünülmektedir. DEHB'nin belirtileri, çalışma yaşamına etkisi ve sonuçları konusunda çalışanlar ve yöneticilerin bilgilendirilmesi; sürücülük becerisi gerektiren kritik işlerde çalışacak olan kişilerde DEHB belirtilerinin taranması kaza oranını azaltabilecektir.**

**Anahtar Kelimeler:** dikkat eksikliği, hiperaktivite, dürtüsellik, iş kazası

## 1. Giriş

Dikkat Eksikliği ve Hiperaktivite Bozukluğu (DEHB), hiperaktivitenin yaygın belirtileri olan dikkatsizlik ve dürtüsellik ile tanımlanan bir bozukluktur. Erken çocukluk döneminde kendini göstermeye başlayan bu belirtiler, erişkin dönemde de psikolojik ve sosyal alanlar ile eğitim/meslek alanlarında sorunlar yaşamalarına neden olabilir (Moffitt et al., 2015). DEHB tanısı alan yetişkinlerin ailesosyal ve mesleki alanlarda problemler yaşama riski artmıştır (R. A. Barkley, 2004).

Yapılan araştırmalarda, tedavi edilmeyen DEHB belirtilerinin dikkat eksikliği, dürtüsellik ve hiperaktivitenin, okul ve iş performansını bozabildiği, özgüveni zedeleyebildiği, ilişkileri yıpratılabildiği ve hayatın pek çok alanında başarı ve tatmin elde etme olasılığını düşürerek sigara ve madde kullanımına, yaralanmaya, araç kazalarına ve başka birtakım psikiyatrik sorunların oluşumuna dair riskleri arttırdığı ileri sürülmektedir. (Adamou et al., 2013; Russell a. Barkley, 2002; Okie, 2006)

DEHB'nin etkilediği en önemli konulardan biri de sürücülüktür. Sürücülük saliseler içinde karar vermeyi ve konsantre olmayı, sürdürülebilir dikkati gerektirir. Bir anlık dikkat kaybı veya dürtüsellikle yapılan tek bir hatalı seçim, ağır sonuçlar doğurabilir. DEHB'li kişilerin yaşamlarının diğer alanlarında olduğu gibi sürücülükte de; ehliyetlerinin alıkonulması veya iptali, ağır yaralamalı veya yüksek hasarlı kazalar olmak üzere sürüşle ilgili pek çok zorlukları olduğu tespit edilmiştir (Goldstein, Ellison, Barkley, & Gordon, 2002). Sürücü hataları nedeniyle ehliyetine bir süreliğine veya geri verilmemek üzere el konulan DEHB'li kişiler 42% iken, DEHB'li olmayan kişiler 28% 'dir. Araba kazalarında, DEHB'li sürücüler 49% iken DEHB'li olmayan sürücüler 16% 'dir. Vurup kaçma şeklinde yaşanan ("hit-and-run accidents") kazaların oranı DEHB'li kişilerde 14% iken DEHB tanısı olmayan kişilerde 2% 'dir. Hiperaktivite bozukluğu olan genç yetişkinler, ehliyet sınavını yapan yetkililer tarafından kolayca dikkati çelinebilir ve dürtüsel davranış puanları yüksek olarak değerlendirilmişlerdir (R a Barkley, 1998). Araştırmalar DEHB'li kişilerin tedavi olmalarının, sürücülüklerinin güvenli olması bakımından gerekli olduğunu göstermektedir (R. A. Barkley, 2004).

Havaalanları, çalışanlar bakımından, sınırlı sürelerde, koordinasyon ve organizasyon becerisi gerektiren, çok katı kuralların hüküm sürdüğü ve sürekli tetikte olunması gereken iş yerleridir. Havaalanında uçaklara ekipman hizmeti vermek üzere çalışan kişilerin, en ufak bir dikkat kaybı, dürtüsel veya kurallara aykırı tek bir davranışı uçuş ve yer emniyeti açısından son derece büyük zararlara, can ve mal kayıplarına yol açar.

Hava alanlarında hava araçlarının hizmet almak için park ettiği apron ve/veya hizmet araçlarının kullandığı servis yollarının her ikisini de kapsayan bölümüne "Ramp Sahası" adı verilir. Ramp sahası, ulusal/uluslararası standart ve 25 km hız sınırı gibi oldukça sınırlayıcı kuralların hüküm sürdüğü alanlardır (SHGM, 2014).

Uluslararası Hava Taşımacılığı Birliği (IATA) 2007 yılı verilerine göre dünya çapında her yıl yaklaşık 27,000 uçak hasarlı ramp kazası ve vakasının gerçekleştiği (her bin kalkıştan birinde) tahmin edilmektedir. Bu kazalarda 243.000 kişinin yaralandığı veyaralanma oranının 1000 kalkışta 9 olduğu saptanmıştır. Dünya çapında büyük havayollarının, rampte gerçekleşen kazalar nedeniyle ortaya çıkan maliyetinin yılda en az 10 milyar ABD Doları olduğu sanılmaktadır (R C Kessler, Lane, Stang, & van Brunt, 2009). Ramp kazalarının, havaalanı operasyonunu etkilediği, yaralanmaya, uçak, tesis ve yer ekipmanının hasarıyla sonuçlandığı bilinmektedir (Flight Safety Foundation, 2007).

PAT sahalarında gerçekleşen bu kazaların 2013-2014 ortalamalarına bakıldığında; araçların başka araçlarla kaza yapma oranı %63, araçların uçaklarla yaptığı kazaların oranı %11, araçların PAT sahalardaki aydınlatma direği, körük gibi tesislere çarparak yaptığı kazaların oranı %15 ve diğer kategorideki kaza oranı %11'dir.

Bu çalışmanın amacı, uçaklara verilen hizmet sırasında kaza yapan araç sürücülerinin, dikkat eksikliği ve hiperaktivite bozukluğu belirtilerine sahip olmaları halinde bu durumun kazaya olan etkisinin araştırılmasıdır. Çalışmanın yapıldığı Havaş'ta yaşanan iş kazalarının yaklaşık %10'u araç kazasıdır ve 2012-2014 yılları arasında toplam 138 araç kazası gerçekleşmiştir. Bu kazaların % 98'i Ramp sahasında olmuştur. Çalışmada, bu kazaları yapan ve şu anda çalışmakta olan 110 sürücünün DEHB belirtileri ve bu puanın gerçekleşen kazalar ile ilişkisi araştırılmıştır.

## 2. Yöntemler ve Gerekçeler

Araştırma, kendi kendine anket doldurma yöntemi ile yapılmış ve gerekli izin hem HAVAŞ'tan hem de Üsküdar Üniversitesi Girişimsel Olmayan Araştırmalar Etik Kurul'undan alınmıştır. Araştırma için kendisine soru formu verilen katılımcıların tamamının anketleri eksiksiz olarak doldurması sağlanmıştır. Araştırmada, HAVAŞ çalışanlarının kaza yapanlar ve yapmayanlar ayrımında betimsel açıdan incelenmesi, kaza yapan ve yapmamış deneklerin iş performansı, işe devam devam durumları, DEHB belirtileri açısından incelenmiştir.

Araştırmanın evrenini HAVAŞ çalışanları oluşturmaktadır. HAVAŞ çalışan sayısı yaklaşık 3800-4000 arasında de-

ğışmektedir. Araştırmancının katılımcıları 2012-2014 yılları arasında HAVAS'ın görev sırasında araç kazası yapmış ve kaza yapmamış çalışanlar seçilmiştir. HAVAS'ta çalışan ve son üç yıldır araç kazası yapmış personel sayısı, 138 kişidir. Araştırmaya kaza yapan çalışanların arasından araştırmaya katılmayı kabul eden 110 kişi, kaza yapmayan çalışanların arasından ise araştırma grubu ile yaş ve cinsiyet açısından eşleştirilmiş 111 kişi seçilmiştir. Örneklem hacmi (n) 221 kişidir.

Örneklem, HAVAS'ın Adana, Adıyaman, Ankara, Antalya, Batman, Muğla, Elazığ, Gaziantep, İstanbul, İzmir, Kayseri, Konya, Nevşehir, Şırnak, Trabzon illerinde çalışan personelden oluşmaktadır. Örneklem yöntemi olarak kotalı örneklem yapılmış ve kaza yapan, yapmayan ayrımı göz önünde tutulmuştur. Araştırma katılımcıları ağırlıklı olarak erkektir. Araştırma için hesaplanan örneklem ana kütleli temsil etmek için yeterlidir.

Katılımcılar, araştırmaya bilgilendirilmiş onam formunu okuyarak ve gönüllü olarak katılmışlar ve kendilerine sunulan tüm soruları gerçekten okuyarak ve anlayarak cevaplamışlardır. Katılımcıların verdikleri yanıtlar, kendi durumlarını gerçeğe uygun olarak samimi bir şekilde yansıtmaktadır. Katılımcıların cevapları kendi düşüncelerini yansıtmakta olup başkalarından etkilenmemişlerdir. Katılımcılar verdikleri yanıtları kişisel deneyimlerine göre yanıtlamışlardır.

### 2.1. Sosyodemografik Form

Araştırmacılar tarafından oluşturulan bu formda yaş, cinsiyet, halen düzenli kullanılan ilaçlar, varsa daha önce alınan bedensel-psikiyatrik tanılar, alkol kullanımı, uyuşturucu madde kullanımı, çocukluk döneminde DEHB tanısı konulma durumu maddelerine yer verilmiştir.

### 2.2. Erişkin Dikkat Eksikliği Hiperaktivite Bozukluğu Öz Bildirim Ölçeği (EDHÖ)

Dünya Sağlık Örgütü tarafından erişkinlerde DEHB tanınması amacıyla geliştirilen bir ölçektir (Ronald C Kessler et al., 2005). Her bir maddesinin 0 ile 4 arasında derecelendirildiği beşli Likert tipinde olan ölçeğin 'dikkat eksikliği' ve 'hiperaktivite/dürtüsellik' olmak üzere her biri dokuz sorudan oluşan iki alt ölçeği vardır. Sorular her belirtinin son altı ay içinde hangi sıklıkta ortaya çıktığını belirlemeye yöneliktir. İki alt ölçeğin herhangi birinden 24 puan ve üzerinde alanların "yüksek olasılıkla DEHB", 17-23 puan alanların "olasılıkla DEHB" olduğu, 0-16 puan alanların DEHB olmadıkları bildirilmiştir. Ölçeğin, Türkçe geçerlik ve güvenilirliği Doğan ve ark. 2009 tarafından yapılmıştır (Doğan, Öncü, Varol-Saraçoğlu, & Küçüköğücü, 2009).

### 2.3. DSM-IV'e Dayalı Erişkin DEB/ DEHB Tanı ve Değerlendirme Envanteri (E-DEHB)

(Turgay, 1995) Turgay tarafından geliştirilen ölçeğin standardizasyon çalışması 2006 yılında Günay ve ark. tarafından gerçekleştirilmiştir. E-DEHB geliştirilirken DSM-IV tanı ölçütlerindeki 18 belirti alınarak ölçeğin birinci dikkat eksikliği ve ikinci aşırı hareketlilik bölümü oluşturu-

lmıştır. Üçüncü bölüm hazırlanırken DSM-IV'e girmeyen ama konu ile ilgili yapılan ve çeşitli yayınlarda sözü edilen belirtiler taranmış ve DEHB ile ilişkili özellikler alt ölçeği oluşturulmuştur. Puanlamada birinci bölümdeki toplam 9 sorudan en az altı tanesine 2 veya 3 cevabı alınmışsa "bireyde dikkat eksikliği olabileceği", ikinci bölümde toplam 9 sorudan en az altısına 2 veya 3 cevabı alınmışsa "bireyde aşırı hareketlilik/ dürtüsellik olabileceği" bildirilmiştir. Üçüncü bölümdeki sorulara verilen cevaplar toplanarak DEB/ DEHB ile ilişkili özellikler puanı bulunmaktadır (Günay et al., 2006).

Bununla birlikte çalışılan kişilerin performans puanları ve devamsızlık bilgileri HAVAS İnsan Kaynakları ve Eğitim Müdürlüğü ile Personel Müdürlüğü'nden katılımcıların izni ile elde edilmiştir.

### 2.4. Veri Girişi ve Yapılan Analizler

Anketlerin tamamlanmasının ardından açık sorular için kodlama yapılmış ve veriler optik okuma yöntemi ile bilgisayara girilmiştir. Veri girişi hataları incelenerek ve bazı kontrolleri yapılarak mantık hataları düzeltilmiştir. Araştırma kapsamında betimsel istatistikler, hipotez testleri (güvenirlilik analizleri, normallik testleri, Mann Whitney U testi, KWH, Fisher kesin ki kare testi, Pearson ki kare testi) yapılmıştır. Analizler için SPSS 20.0 versiyon programından yararlanılmıştır.

### 3. Bulgular

Araştırmada toplam 221 Havaş personeli yer almıştır. Örneklem içinde kaza yapmış olan 111 kişi araştırma grubu olan "kaza yapan" grubunu; bu gruba yaş, cinsiyet, eğitim düzeyi bakımından eşleştirilmiş 110 kişi ise kontrol grubu olan "kaza yapmayan" grubunu oluşturmuştur. Örneklemde bulunan 221 kişinin 218'i erkek, 3'ü kadındır. Bunların yaş ortalamaları 33,67±6.24 olarak, yaş aralığı ise 19-52 olarak bulunmuştur. Katılımcıların şirketteki ortalama kıdem yılları 4,99±3.75 yıl, kıdem aralığı ise 0-19 yıl olarak saptanmıştır. Grubun eğitim süresi ortalaması 11.28±4.51 yıl bulunmuştur.

Katılımcıların %100'ü geçmişte psikiyatrik bir tedavi görmediklerini bildirmişlerdir. Katılımcıların %99'u çocuklukta hiperaktivite tanısı almamıştır. Kaza yapan grupta çocuklukta DEHB tanısı aldığını bildiren 1 olgu bulunmaktadır.

Araştırmaya katılan 221 kişi farklı iş tanımlarına sahipti. Örneklemde en büyük kısmını %41,63 (n=92) ile işçi şoförler, %23.08 (n=51) ile makinistler ve %21.27 (n=47) ile operatör şoförler oluşturmaktaydı. Kaza yapan çalışanların, meslekteki ilk altı yıllarında kaza yapma oranı toplam kaza oranının % 65'ini oluşturmaktadır.

Kaza yapan ve yapmayan gruplarda son üç yıl içinde kullandıkları izinler ve izinli ya da izinsiz olarak işe gelmeme süreleri ile belirlenen iş gücü kaybı verileri incelendiğinde iki grubun benzer oranlarda ücretli ya da ücretsiz izin kullanıyor olmalarına rağmen kaza yapmış olan grubun istatistiksel olarak anlamlı biçimde daha fazla ücretsiz devamsızlığı olduğu dikkat çekmektedir (11,00±10,60 vs 2,17±1,47 p<0.01).

İşveren tarafından yıllık olarak hesaplanan iş verimlili-

ği performans ortalamaları ise kaza yapan ve yapmayan gruplar arasında farklı bulunmamıştır.

EDHÖ ve E-DEHB aracılığı ile incelenen örnekleme bu ölçeklere göre DEHB tanısı alan kişi saptanmamıştır. Kaza yapan ve yapmayan gruplar için EDHÖ A bölümü toplam puanı, EDHÖ B bölümü toplam puanı, E-DEHB dikkat eksikliği bölümü toplam puanı, E-DEHB aşırı hareketlilik bölümü toplam puanı, E-DEHB dürtüsellik bölümü toplam puanı ve E-DEHB DEB/DEHB ile ilişkili özellikler toplam puanı ortalamaları hesaplanmıştır. Kaza yapan ve yapmayan gruplar arasında EDHÖ alt ölçek puanları arasında bir farklılık izlenmezken E-DEHB alt ölçek puanlarında Aşırı Hareketlilik alt ölçeği puanının kaza yapan grupta istatistiksel olarak anlamlı biçimde daha yüksek olduğu saptanmıştır ( $p=0.04$ ). E-DEHB alt ölçek puanlarının kaza yapan ve yapmayan gruplarda karşılaştırılması Tablo 1’de verilmiştir.

EDHÖ alt ölçek puanlarının kaza yapan ve yapmayan gruplarda karşılaştırılması Tablo 2’de verilmiştir.

**Table 1:** E-DEHB alt ölçek puanlarının kaza yapan ve yapmayan gruplarda karşılaştırılması

| ÖLÇEK   | Son 3 Yılda Kaza Yapma Durumu |                |        |               |                |          | P    |
|---|-------------------------------|----------------|--------|---------------|----------------|----------|------|
|   | Ortalama                      | Kaza yapan     |        | Kaza yapmayan |                | Ortalama |      |
|   |                               | Standart Sapma | Medyan | Ortalama      | Standart Sapma | Medyan   |      |
| E-DEHB Dikkat Eksikliği Toplam Puanı              | 3,88                          | 3,71           | 3      | 3,64          | 3,85           | 3        | 0.75 |
| E-DEHB Aşırı Hareketlilik Toplam Puanı            | 2,38                          | 2,51           | 1      | 1,82          | 2,02           | 1        | 0.04 |
| E-DEHB Dürtüsellik Toplam Puanı                   | 0,94                          | 1,28           | 0      | 0,68          | 1,05           | 0        | 0.07 |
| E-DEHB DEB/DEHB ile İlişkili Özellik Toplam Puanı | 9,29                          | 10,32          | 6      | 7,4           | 9,02           | 3        | 0.52 |

**Table 2:** EDHÖ alt ölçek puanlarının kaza yapan ve yapmayan gruplarda karşılaştırılması

| ÖLÇEK                      | Son 3 Yılda Kaza Yapma Durumu |                |        |               |                |          | P    |
|----------------------------|-------------------------------|----------------|--------|---------------|----------------|----------|------|
|                            | Ortalama                      | Kaza yapan     |        | Kaza yapmayan |                | Ortalama |      |
|                            |                               | Standart Sapma | Medyan | Ortalama      | Standart Sapma | Medyan   |      |
| EDHÖ A Bölümü Toplam Puanı | 3,87                          | 4              | 4,39   | 3,56          | 4              | 0.20     |      |
| EDHÖ B Bölümü Toplam Puanı | 6,55                          | 4,99           | 7      | 5,4           | 5,17           | 4        | 0.36 |

Kaza yapan ve yapmayan gruplarda EDHÖ A alt ölçeği puanları her bir madde için karşılaştırıldığında “İnsanlar doğrudan sizinle konuştuklarında bile, ne sıklıkta size ne söylediklerine konsantre olmakta güçlük çekersiniz?”; “Zor kısımlarını bitirdiğiniz bir işin son detaylarını tamamlamakta ne sıklıkta zorluk çekersiniz?”; “Çok düşünmeyi gerektiren bir iş yapacağınızda ne sıklıkta başlamayı gerektiriyor ya da kenara atıyorsunuz?” soruları için verilen cevap ortalamasının Likert tipi sınıflamada kaza yapmış

olan grup için anlamlı biçimde daha yüksek olduğu saptanmıştır.

Kaza yapan ve yapmayan gruplarda EDHÖ B alt ölçeği puanları her bir madde için karşılaştırıldığında “Sıraya girmeniz gerektiği durumlarda ne sıklıkta sıranızı beklemekte zorluk çekersiniz?” sorusu için verilen cevap ortalamasının Likert tipi sınıflamada kaza yapmış olan grup için anlamlı biçimde daha yüksek olduğu saptanmıştır.

Kaza yapan ve yapmayan gruplarda E-DEHB dikkat eksikliği alt ölçeği puanları her bir madde için karşılaştırıldığında “Günlük etkinliklerde unutkanlık” maddesi için verilen cevap ortalamasının Likert tipi sınıflamada kaza yapmış olan grup için anlamlı biçimde daha yüksek olduğu saptanmıştır.

Kaza yapan ve yapmayan gruplarda E-DEHB Aşırı Hareketlilik alt ölçeği puanları her bir madde için karşılaştırıldığında “el ve ayakların kıpır kıpır olması, oturduğu yerde duramama”, “oturulması gereken durumlarda yerinden kalkma”, “sürekli hareket halinde olma ya da sanki motor takılıymış gibi hareket etme” maddeleri için verilen cevap ortalamasının Likert tipi sınıflamada kaza yapmış olan grup için anlamlı biçimde daha yüksek olduğu saptanmıştır.

Kaza yapan ve yapmayan gruplarda E-DEHB Dürtüsellik alt ölçeği puanları her bir madde için karşılaştırıldığında “Sıra beklemekte zorluk çekme” maddesi için verilen cevap ortalamasının Likert tipi sınıflamada kaza yapmış olan grup için anlamlı biçimde daha yüksek olduğu saptanmıştır. Sonuçlar Tablo 19’da verilmiştir.

Kaza yapan ve yapmayan gruplarda E-DEHB DEB/DEHB ile ilişkili özellikler alt ölçeği puanları her bir madde için karşılaştırıldığında “Hedeflerine ulaşamama ve başarısızlık hissi”, “Aynı anda pek çok işle/projeyle uğraşma; bu işleri takipte tamamlamakta güçlük”,

“Duygudurumda sık oynamalar”, “Aniden parlama, tepki gösterme”, “Parmaklarda tempo tutma, ayak sallama ya da ayak vurma”, “Sık iş değiştirme”, “Zamanı ayarlama güçlüğü”, “alkol kullanımı”, “çökkünlük”, “Sebepsiz yere sinirli ve gergin olma”, “Hayal kırıklığı ve cesaretsizlik hissi” maddeleri için verilen cevap ortalamasının Likert tipi sınıflamada kaza yapmış olan grup için anlamlı biçimde daha yüksek olduğu saptanmıştır.

#### 4. Tartışma

Bu çalışmanın yapıldığı HAVAŞ’ta, havaalanında uçaklara yer hizmeti veren araç sürücülerinin kurallara uyması ve sahip oldukları dikkat becerilerinin yeterliliği uçuş ve yer emniyeti bakımından hayati derecede önemlidir. DEHB tanısı olan bireylerin çalışma yaşamında karşılaştıkları zorlukların, havaalanı çalışanı için yaratacağı risk göz ardı edilemez önemdedir. DEHB tanısı ya da belirtileri olan personelin iş kazası oranının daha yüksek olduğunun saptanması durumunda işe alım sürecinde bu belirtilerin titizlikle değerlendirilmesi, uygun tedaviye yönlendirilmeleri önem taşıyacaktır.

Ülkemizde de HAVAŞ’ta gerçekleşen yer araç kazalarının sayısının 2012 yılında 41, 2013 yılında 43 ve 2014 yılında 54 olduğu bildirilmiştir. Kaza yapan çalışanların, ilk altı



ylında kaza yapma oranı toplam kaza oranının % 65'ini oluşturmaktadır. Bu oran deneyim süresinin kaza üzerinde etkili olduğu anlamına gelebilir.

DEHB, yetişkinlerde % 4-6 görülmesine rağmen örneklemimizde katılımcıların %100'ü geçmişte psikiyatrik bir tedavi görmediklerini ve %99'u çocuklukta hiperaktivite tanısı almadıklarını bildirmişlerdir. Kaza yapan grupta, çocuklukta DEHB tanısı aldığı bildirilen 1 olgu bulunmaktadır. Katılımcıların hasta görünme ve iş kaybetme kaygısı nedeniyle ile kendilerini iyi gösterme çabasına girmiş olabilecekleri düşünülmektedir. Çalışmada, EDHBÖ puanına göre DEHB tanısı alan yalnızca 1 katılımcı olması nedeniyle ölçek puanları tanı için kullanılmamış, alt ölçeklerin ve her bir maddenin grup ortalaması hesaplanarak gruplar arası karşılaştırma yapılmıştır.

Kaza yapan ve yapmayan gruplarda son üç yıl içinde kullandıkları izinler ve izinli ya da izinsiz olarak işe gelmeme süreleri ile belirlenen iş gücü kaybı verileri incelendiğinde, iki grubun benzer oranlarda ücretli ya da ücretsiz izin kullanıyor olmalarına rağmen kaza yapmış olan grubun istatistiksel olarak anlamlı biçimde daha fazla ücretsiz devamsızlığı olduğu dikkat çekmektedir. Bu bulgu, literature ile uyumludur. Kaza yapan ve yapmayan gruplar arasında, EDHÖ alt ölçek puanları arasında bir farklılık izlenmezken E-DEHB alt ölçek puanlarında "Aşırı Hareketlilik" alt ölçeği toplam puan ortalamasının kaza yapan grupta istatistiksel olarak anlamlı biçimde daha yüksek olduğu saptanmıştır.

Erişkin DEHB, toplum tarafından çok fazla bilinmediği için DEHB'li birey, bu bozukluğun sonucu olarak yaşadığı konsantrasyon olamama, sabırsızlık, organize olamama, motor takılmış gibi konuşma, düşündüğünü yer ve zaman göz etmeksizin hemen ifade etme, aniden beklenmedik şekilde sinirlenme, engellemeye karşı dayanıksızlık, tatlimatları takip edememe, unutkanlık, konuşan kişinin sözünü kesme, dinlerken sıra bekleyememe, duygu ve heyecanlarını kontrol edememe, düşük tolerans, olumsuz yaklaşım, gibi davranış bozukluklarını, kişilik özelliklerine atfedilerek etiketlenme riski ile karşı karşıyadır.

DEHB'li kişiler, sürücülük becerisi için gereken odaklanma, detaylara dikkat etme, organize olmak ve hız sınırına uyma konularında zorluklar yaşarlar (R. A. Barkley, 2004; El Farouki et al., 2014). Vaa, 2014 yaptığı bir metaanalizin sonucunda DEHB tanısı olan sürücülerin dikkati uyarılması nedeni ile daha hızlı araç kullandıklarını savunmuştur (Vaa, 2014). Bizim araştırmamızda kaza yapanlar arasında DEHB'ye rastlanmamıştır. Bu nedenle araştırma kapsamındaki kaza yapan sürücülerin, bu hastalıkların etkisiyle kaza yaptığını söylemek güçtür. Bununla birlikte havaalanı gibi kaza riski yüksek olan ve çok tehlikeli iş sınıfındaki işlerin yapıldığı yerlerde, dikkatsizlik ve dürtüsellik eğilimi yüksek olan çalışanların söylenenleri dinlemekte zorluk, sıra bekleyememe, zamanı ayarlama güçlüğü gibi belirtiler nedeni ile artmış kaza riskine sahip oldukları düşünülebilir.

Bu sonuçlara göre araştırmamızın hipotezlerinden "araç kazası yapmış olanların DEHB puanları, araç kazası yapmamış olanlara kıyasla daha yüksektir" sayıltısı bazı ölçek maddeleri ve E-DEHB Aşırı Hareketlilik alt ölçeği için doğrulanırken EDHÖ alt ölçekleri ve E-DEHB Dikkat Eksikliği, Dürtüsellik, DEB/DEHB İlişkili Özellikler alt ölçekleri için

doğrulanmamıştır.

Araştırmanın kısıtlılıkları arasında araştırmada kaza yapan ve yapmayan HAVAŞ çalışanlarının kendilerini değerlendirmesinin istenmiş olması bulunmaktadır. Çalışanların kendilerini yanlış değerlendirmiş olma ihtimali bulunmaktadır. Çalışma diğer çalışmalarda olduğu gibi hastane ortamında yapılmadığından, klinisyen görüşü içermemektedir.

Havaalanları gibi ufak bir dikkat kaybının, dürtüsel ya da kurallara aykırı tek bir davranışın uçuş ve yer emniyeti açısından son derece büyük zararlara, can ve mal kayıplarına yol açabileceği ortamlarda çalışacak olan kişilere işe alım sürecinde DEHB ölçekleri uygulanabilir. Bu uygulamaların hayata geçirilebilmesi için, test ve ölçekleri kullanabilme ehliyetine sahip psikologların istihdamına yönelik İş Sağlığı ve Güvenliği kapsamında yeni yasa ve düzenlemelerin çalışılmasına ihtiyaç vardır.

## 5. Sonuç

Bu araştırmanın sonuçları araçla iş kazası yapmış olan havalimanı yer çalışanlarında yaş, cinsiyet ve eğitim bakımından eşleştirilmiş ancak iş yerinde araç kazası yapmamış olanlara kıyasla daha yüksek oranda aşırı hareketlilik belirtileri gösterdiğine işaret etmektedir.

İşe alım süreçlerine ve istihdam aşamalarında fiziksel olduğu kadar ruh sağlığına da gereken önem verilmeli ve kişilerin hem farklı fiziksel, bilişsel yetenekleri hem de bunlarla ilgili sınırlılıkları olabileceği göz önünde bulundurulmalıdır.

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# RECOGNITION MEMORY IMPAIRMENT AND THE ROLE OF DMSO, ALA AND VITAMIN C DURING TRAUMATIC BRAIN INJURY IN ALBINO RATS

## TANIMA HAFIZASI BOZUKLUĞU VE ALBİNO SIÇANLARINDAKİ TRAVMATİK BEYİN YARALANMALARI ESNASINDA DMSO, ALA VE C VİTAMİNİN ROLÜ

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**Abstract**

Expression of cognitive and functional disorders is a common clinical development of traumatic brain injury (TBI) that is essentially determined by the site and severity of the insult. The present study sought to examine the effects of closed-head TBI on memory in albino rats, in order to further examine the potential efficacy of an acute antioxidants treatment with Dimethyl Sulfoxide (DMSO), Vitamin C and Alpha  $\mu$ - lipoic acid (ALA). The rat model of closed-head injury by weight drop method was applied on anesthetized rats. The treatment protocol included single oral administration of DMSO, Vitamin C and ALA in three different doses (22.5, 45 and 67.5 mg/kg) 1hr post-TBI and continued for two weeks. The Novel Object Recognition Test as well as the Modified Neurological severity score (mNSS) were employed to assess post-TBI memory and neurological function respectively. Our results revealed a recognition memory deficit that was significant 7 days after TBI up to 14 days post-TBI. Most importantly, DMSO, Vitamin C and ALA were able to attenuate the memory impairment by TBI. The mNSS of the treated groups decreased significantly than the non-treated group in the first and second week. Conclusively, the use of antioxidants can help in the management of TBI by reducing oxidative stress and improving cognitive function.

**Keywords:** traumatic brain injury, impairment, memory, neurological severity score

**Özet**

*Bilişsel ve işlevsel bozukluklar, esasen hasarın meydana geldiği bölge ve şiddetine bağlı olarak belirlenen travmatik beyin yaralanmasının (TBI) yaygın görülen bir klinik gelişmesi olarak ifade edilebilir. Mevcut çalışma, Dimetil Sülfoksit (DMSO), C vitamini ve Alfa lipoik asit (ALA) içeren bir akut antioksidan tedavisinin potansiyel etkinliğini daha derinden inceleyebilmek adına kapalı kafa travmatik beyin yaralanmasının albino siçanlarının hafızaları üzerindeki etkilerini araştırmayı amaçlamaktadır. Ağırılık düşürme yöntemiyle kapalı kafa yaralanmasının siçan modeli oluşturulmuş siçanlar üzerinde uygulandı. Tedavi protokolü, travmatik beyin yaralanmasından bir saat sonra DMSO, C vitamini ve ALA'nın üç farklı doz halinde (22.5, 45 ve 67.5 mg/kg) ve tek seferde ağızdan alınmasını öngörmüştür. Travmatik beyin yaralanması sonrası sırasıyla mevcut hafızayı ve nörolojik işlevi değerlendirmek üzere Değiştirilmiş Nörolojik Şiddet Skorunun (mNSS) yanı sıra Yeni Nesne Tanıma Testi uygulanmıştır. Elde edilen sonuçlar, travmatik beyin yaralanmasını takip eden yedi ila on dört gün boyunca önemli ölçüde tanıma hafızası eksikliğini ortaya çıkarmıştır. Daha da önemlisi; DMSO, C vitamini ve ALA, travmatik beyin yaralanmasından kaynaklı hafıza bozukluğunu azaltma eğilimi göstermiştir. Müdahalede bulunan deney gruplarına ait Değiştirilmiş Nörolojik Şiddet Skoru'nda (mNSS) müdahale edilmeye güruptakilere nazaran birinci ve ikinci haftada önemli ölçüde düşüş gözlenmiştir. Sonuç olarak antioksidan kullanımı, oksidatif stresi azaltarak ve bilişsel işlevi geliştirerek travmatik beyin yaralanması tedavisine katkıda bulunabilir.*

**Anahtar Kelimeler:** travmatik beyin yaralanması, bozukluk, hafıza, nörolojik şiddet skoru

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## 1. Introduction

Traumatic brain injury (TBI) is a major health and socioeconomic challenge throughout the world (Peeters et al., 2015). It is widespread all over the world and anybody can be a victim. Because outcome resulting from TBI are usually not instantly discernable, the society is mostly ignorant of the effect of TBI (Koskinen & Alaranta 2008). The major effect of TBI is the significant disabilities its victims are surviving with after recovery. Such deficits can include impaired thinking or memory, movement, sensation (e.g., vision or hearing), or emotional functioning. These problems not only affect individuals but can have long-term impact on families and communities. In the United States for example, TBI is linked with the death of about 51,000 people each year and causes long-term disability that affects an approximate 70,000 to 90,000 persons yearly (Thurman & Guerrero, 1999).

TBI is a complex disease process based on its pathophysiology (Masel & DeWitt 2010) that causes structural damage and functional deficits due to both primary and secondary injury mechanisms leading to neuronal cell death (Davis, 2000). Cell death can be acute or chronic (Raghupathi, 2004). Both acute cell death and delayed apoptosis contribute to functional deficits after TBI. However, even mild TBI with no remarkable cell death can lead to cognitive deficits, which are possibly related with diffuse axonal injury (DAI) (Niogi et al., 2008). Among the factors leading to functional deficit are biochemical cascades which occur in response to primary and secondary injury. These mechanisms generate oxidative stress.

Oxidative stress (OS) is one of the characteristics of TBI that can initiate the pathophysiology ensuing disruption and protracted neuronal function. OS an imbalance between oxidant and antioxidant agents can result in neural dysfunction and death. After TBI, a group of oxidant such as ROS and RNS are produced resulting in oxidative damage of macromolecules in the brain, while antioxidant defense enzymes decrease. This imbalance is directly related to the pathogenesis of TBI (Rodríguez-Rodríguez et al., 2014). Therefore, the development of antioxidant strategies is of key interest in ongoing efforts to optimize brain injury treatment. Vitamin C (ascorbic acid) is a water-soluble antioxidant that is found throughout the body as the ascorbate anion (Harrison et al., 2014). It inhibits peroxidation of membrane phospholipids and acts as a scavenger of free radicals (Straber and Stevens 1997). The high concentration of vitamin C (10-fold higher than its plasma levels) and its asymmetric distribution in different regions of the brain indicates its vital role in the brain (Harrison et al., 2014).

Dimethyl sulfoxide is a dipolar, aprotic and highly hygroscopic solvent with a broad spectrum of biological activities that suggest efficacy as neuroprotectant (Lu and Mattson, 2001). ALA, or just lipoic acid (LA), is a unique and potent antioxidant that can deliver antioxidant activity in both fat- and water-soluble mediums (Hirai et al., 2001). Loss of mitochondrial function entails a reduction of the energy-transducing systems partly due to oxidative/nitrative damage.

At present there is no single pharmacological agent capable of fully restoring cognitive and motor –sensory function post TBI. Nevertheless, the possibility of an effective treatment is based upon the fact that even though some of the neural injury is due to the primary mechanical events (i.e. shearing of nerve cells and blood vessels), the majority of posttraumatic neuronal damage and degeneration is due to a pathochemical and pathophysiological cascade of secondary events occurring during the first minutes, hours and days following the injury which exacerbate the damaging effects of the primary injury. The aim of this study is to assess the effect of antioxidants (DMSO, ALA and Vitamin C) on recognition memory of rats induced with TBI.

## 2. Materials and Methods

### 2.1. Source of Experimental Chemicals

Ascorbic acid, (vitamin C), and  $\alpha$ - lipoic acid, were obtained from Sigma® Chemicals Limited Paderborn, Germany. Dimethylsulfoxide was obtained from Cayman® Chemical Company, Ann Arbor, USA. Ketamine hydrochloride was obtained from Rotexmedica®, Trittau, Germany.

### 2.2. Experimental Animals

Fifty five apparently healthy albino rats of winstar strain weighing between 180-200g were purchased from the Animal House of the Biological Sciences, Usmanu Danfodiyo University, Sokoto Nigeria. The rats were allowed to acclimatize to the research laboratory. The experimental animals were subjected to a 12 hours light/12 hour dark schedule. The rats were fed with growers mash of vital® feed and clean water was given ad-libitum.

### 2.3. Experimental design

The experimental animals were randomly divided into eleven groups of five rats each. TBI was induced in groups 1 to 9 and treated with three different doses of Vitamin C, DMSO and ALA for two weeks. Group 10 was not treated (traumatized not treated) while group 11 was used as negative control (non-traumatized non-treated).

### 2.4. Induction of TBI

Head injury was induced in the entire experimental animals except in the negative control group by weight drop method using an acceleration impact devise of Marmaru (1994) as modified by Heath and Vink (1995). The experimental rats were properly restrained and anaesthetized using a dissociative anaesthetic agent Ketamine at a dose rate of 80mg/kg body weight.

They were intubated and ventilated on room air with a Harvard Rodent ventilator. The skull was exposed by midline incision and a stainless steel disc measuring 10mm in diameter and 3mm in depth was cemented centrally along the control suture between the lambda and the bregma with a polyacrylamide adhesive.

The experimental animals were secured in the prone position on a 10cm deep foam bed. Injury was induced by dropping an eighty gram (80g) brass weight from a distance of 1m. The stainless steel disc was immediately removed from the skull and the animal was allowed to recover in the cage.

### 2.5. Neurological Assessment

Animals were examined with a modified neurological severity score (mNSS). This evaluation was performed by the modified method of Leonov et al., (1990). The total score of 18 points consisted of three components: consciousness and respiration, cranial nerve function and sensor motor function and coordination. 18 different tasks were used to evaluate these functions. One point is given for failure to perform a task and 0 for success. Scores ranged from zero in healthy uninjured animals to a maximum of 18 indicating severe neurological dysfunction with failure in all tasks. The mNSS immediately after trauma reflects the initial severity of injury.

Immediately after initial evaluation of mNSS the rats were assigned to one of the treatment groups, evenly distributed to achieve homogenous groups.

### 2.6. Novel object recognition test

The NOR task was used to evaluate recognition memory in rats as described by Rachmany et al (2013). This task is based on the innate tendency of rodents to explore new objects within their environment. The use of this natural tendency allows one to determine whether a rat can discriminate between a familiar and a novel object. Rats were individually habituated to an open field arena with an object (a). After 5 minutes, the rat is removed and a novel object (b) is introduced before putting back the rat into the arena. Exploratory behavior was analyzed over a 5 min period. Exploration of an object was defined as rearing on the object, sniffing it at a distance of less than 2 cm and/or touching it with the nose. Successful recognition was represented by preferential exploration of the novel object over the familiar object. The time spent by each rat exploring the novel object over the familiar object was recorded and used to generate a preference index. A discrimination preference index was calculated as following: (time spent near the new object minus time spent near the old object) / (time spent near the new object plus time spent near the old object). After each session, the objects and arena were thoroughly cleaned with 70% ethanol to prevent odor recognition.

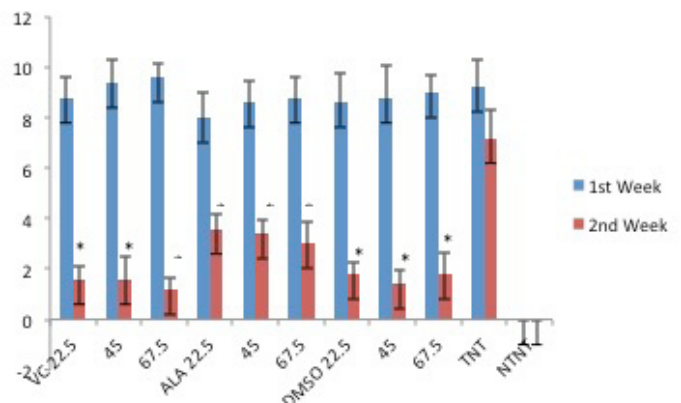
### 2.7. Statistical analysis

All results were expressed as Mean  $\pm$  Standard Deviation (M  $\pm$  SD) and analyzed using SPSS version 22. One-way analysis of variance (ANOVA) followed by Tukey post-Hoc test was used to compare the means of treated groups with traumatized non treated and non-traumatized non treated groups. Comparison between different doses of the treatments was also conducted. Differences are considered statistically significant at  $p < 0.05$ .

## 3. Results

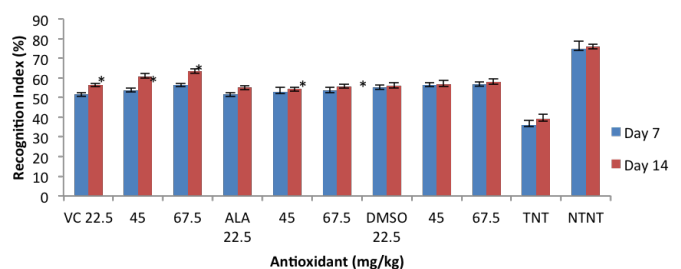
The result of this study indicated that all the traumatically head injured rats recorded poor mNSS in the first week (VC 22.5mg-8.8 $\pm$ 0.84, 45mg-9.4 $\pm$ 0.89, 67.5mg-9.6 $\pm$ 0.55, ALA 22.5mg-8 $\pm$ 1.00, 45mg-8.6 $\pm$ 0.89, 67.5mg-8.8 $\pm$ 0.84, DMSO 22.5mg-8.6 $\pm$ 1.14, 45mg-8.8 $\pm$ 1.30, and 67.5mg-9 $\pm$ 0.71) which significantly ( $p = 0.0001$ ) improved in the second week (VC 22.5mg-1.6 $\pm$ 0.54, 45mg-1.6 $\pm$ 0.54, 67.7mg-1.2 $\pm$ 0.44, ALA22.5mg-3.6 $\pm$ 0.54, 45mg-3.4 $\pm$ 0., 67.5mg-543.2 $\pm$ 1.00, DMSO 22.5mg-1.8 $\pm$ 0.44, 45mg-1.4 $\pm$ 0.54 and 67.5mg-1.8 $\pm$ 0.83) while the scores of the TNT group showed no significant improvement between the first (9.2 $\pm$ 1.09) and second week (7.2 $\pm$ 1.09).

The result revealed that TBI caused memory deficit seven days Post injury as observed in the recognition index of the traumatized non treated group (36.2 $\pm$ 2.28). However treatment with DMSO, ALA and vitamin C prevented the occurrence of the deficit as indicated by the NORT in these groups (figure2).



**Figure 1:** Modified Neurological Severity Score of the various groups

Bars with asterisk are statistically significant at  $p$  value of 0.0001 Key; DMSO – dimethyl sulfoxide, ALA – alpha lipoic acid, VC – vitamin C, TNT – traumatized non treated NTNT-Non Traumatized Non treated



**Figure 2:** Effects of vitamin C, ALA, and DMSO on Object Recognition Following TBI. Bars with asterisk are statistically significant with  $p$  values of 0.0001, 0.0002, 0.0001, 0.0005 and 0.04 respectively

Key; DMSO – dimethyl sulfoxide, ALA – alpha lipoic acid, VC – vitamin C, TNT – traumatized non treated NTNT-Non Traumatized Non treated

The findings of this study revealed that TBI induction by weight drop method causes deficit in memory 7 days post induction. This was demonstrated using NORT carried out

on all the experimental animals. DMSO, vitamin C and ALA had promoting effect on memory in comparison with TNT rats. Previously, Siopi et al, 2012 demonstrated that rat model of CHI causes memory deficit 3 weeks post induction while Tsenter et al, 2008 reported impairment of memory by CHI (at its peak) only 3 days post injury in rat model.

Oral administration of 22.5, 45 and 67.5mg/kg bw of DMSO in this work attenuated the impeding effect of TBI on memory of rats by having significantly ( $p < 0.05$ ) higher recognition index than TNT group. In another work, DMSO has shown improvement in memory after observed memory deficit in rats with head injury (de la Torre, 1995).

The observed effect of DMSO on memory in this study can be attributed to one or combination of the following. DMSO restores acetyl cholinesterase activity, which has an essential role in learning and memory processes. Since mitochondrial dysfunction is one of the important factors in cognitive dysfunction following TBI, the Preventive role of DMSO on mitochondrial damage during intracellular calcium overload and other destructive processes following TBI (Sams, 1967) might be one of the mechanisms.

Oxidative stress is considered to be a probable cause of memory deficit due to white matter degeneration (which is associated with memory disorders) and impairment in hippocampal function (Silver et al., 2004), therefore the antioxidant effect of DMSO also contribute to the mechanism.

The result of this study also showed that acute treatment with three doses of vitamin C prevented the impairment of memory by TBI seven days post induction through 14 days. Similarly, Arz, et al., (2004) reported that oral supplementation of vitamin C could attenuate the risk of dementia in aged mice. Shahidi et al. (2008) showed that intraperitoneal (i.p) administration of vitamin C could improve learning and memory in intact rats. Two different studies also showed that i.p. injection of vitamin C could be useful in retention of memory in the scopolamine treated rats and impede amnesia in homocysteine administered rats (Lee, et al., 2001).

This outcome can be due to the ability of vitamin C to modulate neurotransmitter system such as serotogenic and cholinergic which has essential role in cognition (Lee et al., 2001). It might also be due to the scavenging and reducing effect of this vitamin on ROS and free radicals which causes lipid peroxidation and oxidative stress. lipid peroxidation and oxidative stress can interfere with hippocampal function which has a role in memory process (Naber et al., 2000).

Administration of ALA in this work indicated that impairment of cognitive memory by TBI was successfully mitigated. Since mitochondrial dysfunction can lead to memory impairment (Zhanga & Gou qaing, 2001), preventive and restorative effect of ALA on mitochondria during neurodegenerative diseases (Saeed et al., 2008), might probably be the reason for the observed effect. Previous work on ALA supplementation by Moriera et al, (2007) showed amelioration of cognitive decline in AD patients.

#### 4. Conclusion

The result of this research work indicated the potential roles of these antioxidants in mitigating memory dysfunction associated with TBI. It can therefore be concluded that these antioxidants could have a memory increasing effect and /or neuroprotective role in the management of TBI. However, additional work is recommended to further confirm this effect.

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# DOES RECOLLECTION OCCUR UNINTENTIONALLY? AN ERP STUDY

## DETAYLI HATIRLAMA İSTEMSİZ OLARAK GERÇEKLEŞİR Mİ?

Rahmi Saylik<sup>1\*</sup>

**Abstract**

This study is aimed to investigate whether memories can be recollected unintentionally. To investigate this, electroencephalographic activity (EEG) was recorded from 64 electrodes. Participants performed recognition tasks which consisted of celebrity names in an implicit way. They were asked to decide whether the presented celebrity names were actor/actress or not while event-related potentials (ERPs) recordings were taking place. In the study, ERP results from old names and new names were compared. In this comparison two effects, which were mid-frontal old/new effect (300-500 ms) and parietal old/new effect (500-800 ms), were set. The results show that old names triggered higher activation over a late left lateralized central and left parietal old-new effect (500-800 ms) during implicit task performance. The results indicated that memory can be retrieved unintentionally and this retrieval may be associated with recollection.

**Keywords:** recognition memory, episodic memory, old-new effect, recollection, familiarity, EGG

**Özet**

*Bu çalışma, anıların istemsiz olarak hatırlanmasının mümkün olup olmadığını araştırmayı amaçlamaktadır. Bunu araştırmak için Elektroensefalografik aktivite (EEG) 64 elektrottan kaydedildi. Katılımcılar, ünlülerin isimlerden oluşan tanıma görevlerini örtük biçimde gerçekleştirdiler. Sunulan ünlü isimlerinden aktör / aktris olup olmadığına, olaya ilişkin potansiyeller (ERP) kayıtları yapılırken karar vermeleri istendi. Bu çalışmada, eski ve yeni isimlerin ERP sonuçları karşılaştırıldı. Bu karşılaştırmada, orta önlü eski / yeni efekt (300-500 ms) ve parietal eski / yeni efekt (500-800 ms) olan iki efekt belirlendi. Sonuçlar, eski adların örtük görev performansı sırasında sol yanıl merkezli ve sol parietal eski-yeni efekt (500-800 ms) üzerinde daha yüksek aktivasyona neden olduğunu göstermektedir. Sonuçlar daha önce hafızada kaydedilmiş bilginin istemsiz olarak geri getirilebildiğini ve bu geri getirme durumunun detaylı hatırlama ile ilişkili olabileceğini gösterdi.*

**Anahtar Kelimeler:** tanıma belleği, olaysal bellek, eski-yeni etkisi, hatırlama, aşinalık, EGG

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## 1. Introduction

Recognition memory refers to remembering previously encountered episodes such as events, people or objects (Cruse & Wilding, 2009; Wilding & Ranganath, 2011). It is known that recognition memory is divided in two memory retrieval processes which are recollection and familiarity (Leding, 2015; Park & Donaldson, 2016). Recollection is defined as the retrieval of information with details related to a certain episode such as remembering a name with the other descriptive contexts such as face, occupation or an event including information when or where the event took place (Cruse & Wilding, 2009; Wilding & Ranganath, 2011). On the other hand, familiarity indicates a more superficial retrieval of memories (Bruett & Leynes, 2015; Topolinski, 2012) because it is described as a subjective feeling that certain stimuli (e.g. event, people, objects) may have been encountered in the past, but certain details about the first occurrence of that episode cannot be retrieved (Mandler, 1980; Tulving, 1985; Yovel & Paller, 2004). In a classic example, Mandler (1980) could not recognise his butcher when he saw him on the bus because the butcher was in a completely different context (i.e. butcher on the bus phenomena). The context of the bus was not related to the unit in which the butcher's identity was coded because Mandler had coded the butcher's identity in the context of the butcher's shop (Yovel & Paller, 2004).

One distinctive way to investigate neural correlates of recollection and familiarity in the concept of recognition memory is event-related potentials (ERPs) (Hoppstädter, Baeuchl, Diener, Flor, & Meyer, 2015; Wilding & Ranganath, 2011). ERPs are a particular electroencephalography (EEG) method which allow to determine the specific brain waves that have occurred during the experience of certain events, such as during presentation of a name or face. A considerable number of studies explored the ERP correlates of recollection and familiarity by relying on a phenomenon known as the old/new effect i.e. successful discrimination whether an item previously has been presented before (old) or it has been just newly presented (new) (Hoppstädter et al., 2015; Wilding & Ranganath, 2011). In more detail, in a typical old/new effect investigation there are two main phases which are testing and study phases (Topolinski, 2012; Wilding & Ranganath, 2011). While in the testing phase participants are presented a set of stimuli (e.g. images or names), in the study phase the set of stimuli in the testing phase has been intermixed with new stimuli (e.g. new images or names) and then participants are required to decide whether the stimulus has been seen in testing phase or not (Boehm & Sommer, 2005; Hoppstädter et al., 2015). If they remember that they saw the stimulus previously, they press an employed button which indicate 'old' and if they think they did not saw the stimulus in the testing phase then they should press another employed button which indicates 'new' (Boehm & Sommer, 2005; Hoppstädter et al., 2015).

Numerous experiments on item recognition have indicated that classification of retrieval ERPs depends on a comparison of old/new judgments (Bruett &

Leynes, 2015; Leding, 2015; MacKenzie & Donaldson, 2009; Park & Donaldson, 2016). 'Old' responses refer to recollection meaning that recognition is followed by recalling particular details of the related study episode (MacKenzie & Donaldson, 2009). 'New' responses indicate recognition without a detailed memory and therefore they are assessed on the basis of familiarity (MacKenzie & Donaldson, 2009). A numbers of studies have found that generally recollection is associated with the mid-parietal lobe between 500 ms to 800 ms whereas familiarity is associated with prefrontal lobe activation which occurs between 300 ms to 500 ms (Boehm & Sommer, 2005; Cruse & Wilding, 2009; Wilding & Ranganath, 2011). However, there is still no consensus whether familiarity and recollection should be assessed as a component of implicit memory (i.e. unintentional recollection of memory episodes such as past experiences, and events) or explicit memory (i.e. intentional recollection of memory episodes such past experiences, and events)(Boehm & Sommer, 2005). One view suggested that the course of recollection primarily relies on intentional retrieval which means it occurs explicitly and that familiarity takes place unintentionally/implicitly (Boehm & Sommer, 2005; Boehm, Klostermann, Sommer, & Paller, 2006). However, another view proposed that recollection can take place both intentionally/explicitly and unintentionally/implicitly (Park & Donaldson, 2016; Topolinski, 2012).

The aim of the current study is investigating the process of recognition during unintentional encoding and retrieval using ERPs old/new effect method. To test this, neural correlates of recollection and familiarity in an implicit task were investigated while ERP activities were recorded from 64 electrodes in each participant. In contrast to typical old/new effect studies i.e where participants are required to assess whether they remember the stimuli or not as an explicit task (Wilding & Ranganath, 2011), in the current study participants were presented names of well-known celebrities and they were required to decide whether the image is an actor/actress or non-actor/actress so that the task was performed implicitly. In the study phase, the celebrity names were intermixed with a new set of celebrity names and then participants were asked to decide again whether the presented name is an actor/actress or non-actor/non-actress.If the old/new phenomenon occurs, then participants encode and retrieve the previously presented stimuli unintentionally/implicitly (Boehm et al., 2006).

Therefore, ERP recordings between 300 and 800 ms which includes mid-frontal old/new effects (300 ms to 500 ms) and parietal old/new effects (500 ms to 800 ms) were evaluated (Cruse & Wilding, 2009; Wilding & Ranganath, 2011). It has been suggested that ERP studies which are recorded from the human brain can provide an efficient time course of neural events using recognition memory tests between 300 and 800 ms after stimulus onset (Cruse & Wilding, 2009; Wilding & Ranganath, 2011). The hypothesis to be tested is that participants will recollect old names faster and more correctly than new names and at the same time greater electrophysiological activities will occur in the range of 500-800ms over parietal sites for old names compared with new names.

## 2. Materials and Methods

### 2.1. Participants

Thirty-two undergraduate students (15 male, 5 left-handed, 3 non-British, mean age 21 years, age range 18 to 41 years) from the Psychology Department of Bangor University were recruited. The experiments were approved by the Psychology Ethics Committee of Bangor University. All the non-British students have been living in the UK for at least three years and familiar with British culture. Also, none of the students were dyslexic. All of the participants were given course credits, as well as £15 or library credits. Before participation each participant gave written informed consent.

### 2.2. Stimuli and Procedure

The study consisted of four phases. The first phase was an eye calibration task including an arrow showing different directions. The eye calibration test consisted of five sections. The participants must look at the direction of the arrow. Following that they must look at the screen and blink.

The second phase consisted of a name recognition task, e.g. the testing phase (Figure 1). The task included names of celebrities who are very well-known by public (i.e. George Bush, Bradd Pitt, Angelina Julie) ranging

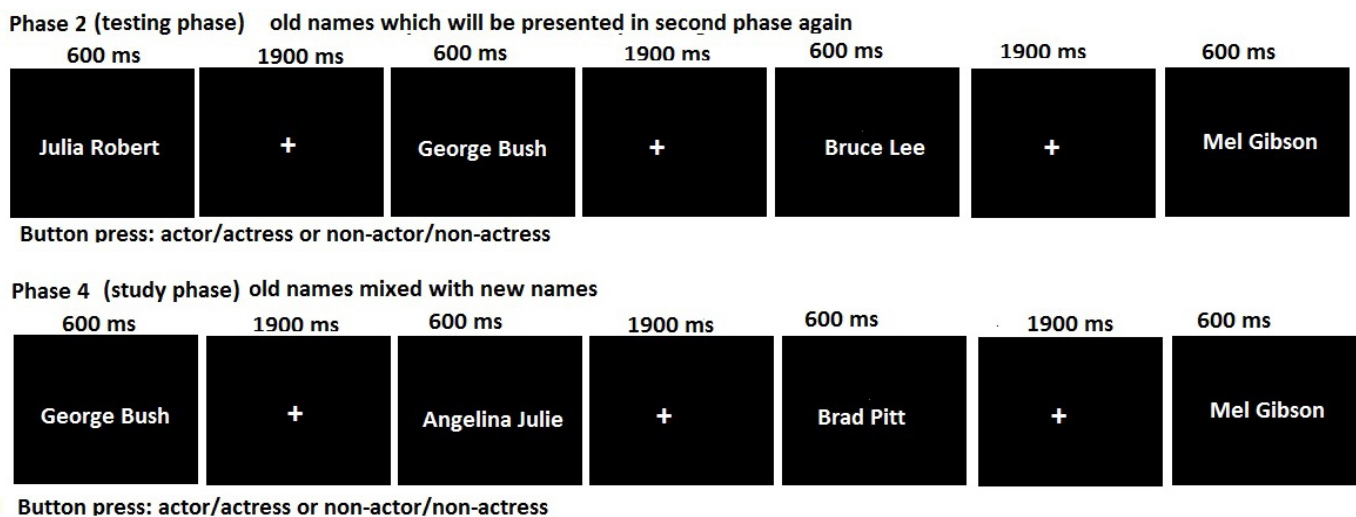
as possible. In the study phase, each name was followed by a 0.5 cm × 0.5 cm white fixation cross for 1900 ms.

The third phase was an object recognition task which consisted of upright and up-down objects and was used as distractor. In this phase, objects were presented randomly for 600 ms in greyscale against a white background; images measured 2 cm to 9 cm vertically and 1.8 cm to 8.5 cm horizontally. Each object was followed by a 0.5 cm × 0.5 cm black fixation cross presented against a white background for 2400 ms. The fixation cross was followed by the next object presented for 600 ms. Participants were asked to press the letter J as quickly as possible if the object was presented correctly; otherwise, they were asked to press the letter F.

The fourth phase was identical as the second phase (the name recognition task) except that it included new names, e.g. this was the study phase (Figure 1). Old and new names were intermixed and presented pseudo randomly. The order of the tasks was counterbalanced either 1,2,3,4 or 2,1,3,4 across participants. Finally, on completion of all of the tasks, a participants were debriefed.

### 2.3. ERP Recordings

EEG activity was recorded from 64 electrodes, the positions of which were determined using the International 10-20 system. An elastic cap (Easy Cap; FMS, Munich,



**Figure 1:** shows the design of phase 2 and phase 4. In phase 2, testing phase, a set of names was presented which are called “old names” because it will be presented in the fourth phase again. In the fourth phase, the study phase, names of the second phase were mixed with a new set of names.

from 2 to 4 words. All of the names were randomly presented in white against a black background, measured 1 cm vertically and 3 to 11.5 cm horizontally for 600 ms. Names were presented centrally and the viewing distance was set to 50 cm. Participants were asked to press the letter J with their right hand as quickly as possible if they remember that the name belongs to an actor or actress; otherwise, they were asked to press the letter F as quickly

Germany) was used to place the electrodes in 10 to 20 positions (American Electroencephalographic Society, 1991).

FCz was used as an initial common reference and digitised to a frequency of 1000 Hz and Fpz served as the ground electrode. Electrodes were amplified, filtered using a band-pass from 0.1 Hz to 250 Hz and digitised to a sampling rate of 1000 Hz. Impedance at each electrode

was maintained at 5kQ. To eliminate high-frequency noise, data were filtered using a high cut-off filter from 0.1 Hz to 35 Hz and a medium slope of 48 dB/oct. Selection of artefact-free episodes for eye movement and blink calibration data from 20 trials each (left, right, up, down, blink) was done by visual inspection. ICA-based correction of eye movement and blinks from EEG data was employed. For terminology, the names presented in the testing phase were called 'old names' and they were intermixed with a new set of names in the study phase called 'new names'. For each condition (old names and new names) in the study phase EEGs were segmented into 1700 ms epochs starting at 200 ms prior to the stimulus onset. Epochs were baseline-corrected based on the mean activity during the -200 ms to 0 ms pre-stimulus period for each electrode site. All epochs were free of ocular artefacts and contained responses that were correct according to the behavioural analysis and subsequently were averaged into ERPs for each experimental condition and channel. Also, each condition was re-referenced to the average reference.

#### 2.4. Statistical Analysis

ERPs were extracted from frontal and parietal sites where according to previous literature old/new effects are associated with recollection and familiarity. Mean reaction times, error rates and ERP waves for the names in all tasks were calculated. For amplitude analyses, firstly behavioural phases of old/new (old names versus new names) were compared. This was followed by ERP recordings from related brain regions (frontal/parietal) which were compared separately (e.g. ERP recording in frontal regions compared for old and new names). The specific electrodes included in the analysis were AFZ, Fz, AF3, AF4, Fp1, Fp2, F3, F4, F6, for mid frontal sites and for parietal sites PZ, P3, P4, P1, P2, CP1, CP2, CP3, CP5, and CPZ. An analysis of paired t test was used for comparisons among conditions. The significance level was set to  $p = 0.05$ . Only significant results are reported.

### 3. Results

#### 3.1. Behavioural Results

The results show that on average participants have a higher accuracy rate in old names (mean = 85.44, SD = 7.19) than the new names (mean = 70.78, SD = 7.21),  $t(32) = 14.42$ ,  $p < 0.01$ , Table 1.

**Table 1:** Mean and Standard Deviations for error rates (accuracy) during processing of old names and new names

| Conditions | Mean ms | Std. Deviation | N  |
|------------|---------|----------------|----|
| Old names  | 85.44   | 7.19           | 32 |
| New names  | 70.78   | 7.21           | 32 |

Furthermore, participants were faster responding to old names (mean = 824.93, SD = 154.68) than to new names (mean = 930.17, SD = 180.87), as illustrated by the on average slower RTs in the new names compared to the old names,  $t(32) = 82.06$ ,  $p < 0.01$ , Table 2.

**Table 2:** Mean and Standard Deviations for response time during processing of old and new names

| Conditions | Mean ms | Std. Deviation | N  |
|------------|---------|----------------|----|
| Old names  | 824.93  | 154.68         | 32 |
| New names  | 930.17  | 180.87         | 32 |

These results show that old names were recollected faster, leading to more reliable and more accurate memories while new names invoked longer and less accurate response times. To explore whether these behavioural differences regarding retrieval of old and new names were associated with recollection or familiarity, ERP results were analysed.

#### 3.2. ERP Results

The trials associated with familiarity (i.e. mid-frontal effect, from 300 ms to 500 ms) and recollections (i.e. the parietal effect, from 500 ms to 800 ms) were examined separately. To determine whether recollection and familiarity responses differ, ERP recordings from old names were compared with new names using paired samples t-tests. Based on a literature review, for frontal effect between 300-500 ms following electrodes were selected; AFZ, Fz, AF3, AF4, Fp1, Fp2, F3, F4, and F6, from parietal effect between 500-800ms following electrodes were selected; PZ, P3, P4, P1, P2, CP1, CP2, CP3, CP5 and CPZ. Significant activations in these electrodes are suggested to indicate that memories come to mind in the specific sites either in the form of familiarity (300-500 ms) or recollection (500-800 ms) and that the absence of significance would indicate that memories do not come to mind (either in the form of familiarity or recollection) in the particular sites (Bruett & Leynes, 2015; Leding, 2015; MacKenzie & Donaldson, 2009; Park & Donaldson, 2016).

#### 3.3. Stimuli Onset from 300 ms to 500 ms

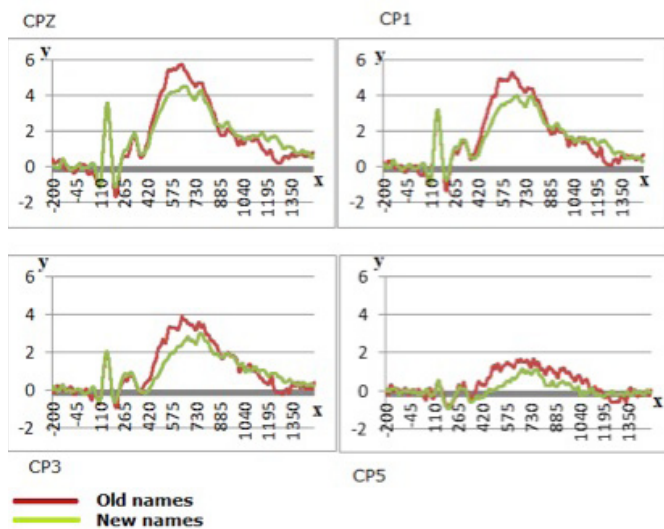
The results regarding the mid-frontal effect in the range of 300 ms and 500 ms for old names versus new names were non-significant in mid-frontal sites (all pairwise comparisons:  $t(32) < (\text{largest: } 1.79 / \text{lowest: } .02)$ , all  $p > (\text{largest: } .99 / \text{lowest } .49)$ ). The results indicate that no significant activities in the form of mid frontal effect (old new effect) in the range of 300-500 ms therefore, it might suggest that memories may not come to mind over mid-frontal sites that are associated with familiarity.

#### 3.4. Stimuli Onset from 500 ms to 800 ms

The results regarding parietal effect in the range of 500 ms and 800 ms for old names versus new names showed significant activation over four electrodes in the parietal sites., ERP recordings shows significant activation over central parietal site for old names (mean = 4.97, SD = 3.30) versus new names in CPZ (mean = 4.20, SD = 2.94),  $t(32) = 4.44$ ,  $p < .05$ ]. The significant activations over left parietal sites were observed in CP1 (old names: (mean = 4.54, SD = 2.90), new names: (mean = 3.71, SD = 3.01)),  $t(32) = 10.17$ ,  $p < .01$ ]; CP3 (old names:



(mean = 4.25, SD = 2.68), new names: (mean = 3.20, SD = 2.80)),  $t(32) = 14.5, p < .01$ ], CP5 (old names: (mean = 2.00, SD = 1.13), new names: (mean = 1.45, SD = 1.17)),  $t(32) = 8.49, p < .01$ ]. The results indicate that participants recollect old names ( ) unintentionally as evident by significant electrophysiological activities in the left-lateralised central parietal sites. The activations seem to indicate late lateralised old/new effects (500 ms to 800 ms) which is associated with recollection, – Figure 2.



**Figure 2:** ERP waves for old names and new names over the parietal sites in CPZ, CP1, CP3 and CP5.

#### 4. Discussion

The behavioural findings demonstrated that the participants were faster and more accurate in processing of old names retrieval as compared to new names retrieval. These faster and more accurate behavioural performances were accompanied by higher electrophysiological activities in the range of 500 ms-800 ms mainly along parietal cortex which indicates parietal old/new effect i.e. recollection. In more detail, comparing retrieval in old names with new names showed higher electrophysiological activities between 500 -800 ms in the central parietal cortex mainly over the CPZ and CP1 and extending in the left parietal cortex over CP3 and CP5. On the other hand, the same comparison for old and new names did not reveal significant electrophysiological activities in mid-frontal cortices in the range of 300-500 ms which indicates no mid-frontal old/new effect (i.e. familiarity).

These anatomical areas in ERP studies have been repeatedly reported previously to be involved in the old/new effect in the mid-frontal electrodes (familiarity: 300-500 ms) and parietal effect (recollection: 500-800ms) (Boehm et al., 2006; Bruett & Leynes, 2015; Cruse & Wilding, 2009; Park & Donaldson, 2016; Wilding & Ranganath, 2011). It has been emphasised that these regions are involved in recognition memory which refers to information related to an episode coming to mind either with specific details or without the contextual details (Boehm et al., 2006; Bruett & Leynes, 2015; Cruse & Wilding, 2009;

Park & Donaldson, 2016; Wilding & Ranganath, 2011). In the current study, the observation that participants showed higher ERP activity for retrieval of old names than new names over parietal cortices in the range of 500-800 ms could indicate that participants recollected the old names which were presented previously. As it was mentioned in the introduction, in typical studies of old/new effects participants are required to decide explicitly whether the presented stimuli is old or new (Boehm et al., 2006; Jacoby, 1991; Tulving, 1985). However, in the current study this was not the case because similar stimuli were used in the testing and study phase and participants were given the same instructions for both phases. Therefore, it seems that in the study phase the participants recollected old names which were presented in the testing phase unintentionally/implicitly. In this context, the current results replicate previous studies that by showing late lateralised parietal old/new effect which is often maximal over left parietal cortices associated with recollection (MacKenzie & Donaldson, 2009; Paller, Voss, & Boehm 2007; 2008, Curran & Friedman, 2004), and also shows that memories may pop into mind in the form of recollection implicitly/ unintentionally.

In conclusion, the study showed faster response times and higher accuracy rates in retrieval of old names compared with new names in the implicit task performance and this behavioural evidence was associated with higher electrophysiological activation over left parietal cortices (i.e. left and central parietal cortices) in the range of 500-800 ms. While previous studies have shown recollection occurs in the same regions between 500-800 ms, the current study suggests recollection may occur implicitly as evident by showing the same pattern of old/new effect in relation to recollection. Thus, the results presented here should be considered as a platform for future studies to build upon. The continued investigation in terms of implicit recollection is fundamental to move towards a more consolidated conceptualization of cognitive impairments in high neurotics.

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# HOW THE DEVELOPMENT OF TONE AND POSTURE OCCURED IN NEW BORN

## YENİ DOĞANLARDA TONSAL GELİŞİM VE POSTÜRÜNÜN OLUŞUMU

Farjad Afzal<sup>1\*</sup>, Sidra Manzoor<sup>2</sup>, Asma Afzal<sup>3</sup>

**Abstract**

Our total body postural behavior results from an integration of all our body reflexes, and this integration occurred in central nervous system. New born baby do not have this integration and his/her all movements are automatic and crud level. Normal brain leads to normal development. And lesion in abnormal brain leads to abnormal development. Lesion in immature brain leads to abnormal tone development and abnormal postures. In cerebral palsy there is lesion in immature brain that leads to abnormal sensory-motor development. In cerebral palsy there is no integration of neonatal reflexes and delayed in motor development. Abnormal reflex movements produce abnormal synergies and abnormal posture. Primitive reflexes have very important role in development of child. These reflexes also have prime importance in assessment and evaluation. As there is brain lesion in these children, upper center do not have inhibitory effect on lower center, so there is an exaggerated reflex movements. There are different senserimotor approaches of treatment like Bobath, Brunnstrom's movement therapy, Rood's approach and proprioceptive neuromuscular facilitation. Theoretical basis of these treatments are neurodevelopmental modal, reflex theory, hierarchical theory and system approach. Reflex integration should be major component of treatment in children with cerebral palsy.

**Keywords:** cerebral palsy. development of tone, primitive reflexes, neonatal reflexes

**Özet**

*Vücut postural davranışımız bütün vücut reflekslerinin birleşiminden meydana gelir ve bu birleşme merkezi sinir sisteminde oluşur. Yeni doğan bebekler bu birleşmeye sahip değildir ve bütün hareketleri otomatik ve ilkel seviyededir. Normal beyin normal gelişimi sağlar. Anormal beyindeki lezyon ise anormal gelişime yol açar. Olgunlaşmamış beyindeki lezyon anormal tonal ve postural gelişime sebep olur. Beyin felcinde, anormal duyu-motor gelişime yol açan olgunlaşmamış beyin lezyonu vardır fakat neonatal refleks birleşmesi ve motor gelişimde gecikme yoktur. Anormal refleks hareketleri anormal sinerji ve postür oluşturur. İlkel reflekslerin çocuk gelişiminde çok önemli bir rolü vardır. Ayrıca, bu refleksler değerlendirme ve belirlemede birincil öneme sahiptir. Bu çocuklarda beyin lezyonu olduğu için üst merkezin alt merkez üzerinde engelleyici etkisi yoktur ve bu yüzden aşırı refleks hareketleri mevcuttur. Bobath, Brunnstrom'un hareket terapisi, Rood'un yaklaşım ve proprioseptif nöromüsküler kolaylaştırması gibi farklı duyumotor tedavi yaklaşımları vardır. Bu tedavilerin teorik temeli nöregelişimsel model, refleks teorisi, hiyerarşik teori ve sistem yaklaşımıdır. Refleks birleşimi beyin felci olan çocukların tedavisinde ana unsur olmalıdır.*

**Anahtar Kelimeler:** beyin felci, tonsal gelişim, ilkel refleksler, neonatal refleksler

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## 1. Introduction

Our total body postural behavior results from an integration of all our body reflexes, and this integration occurred in central nervous system (Loram, 2015). New born baby does not have this integration and his/her all movements are automatic and at crud level (Ахметзянова, 2014). New born baby borns with the influence of neonatal reflexes. These new natal reflexes play a vital role in the development of tone and posture (Keven and Akins, 2016). Head control, increase extensor tone, developing rotatory component and appearance of equilibrium reactions are basic components of motor development (Ivancevic et al., 2015). Skills in body are leaned by integration of neonatal reflexes. Neonatal reflexes are controlled by segmental level and that's why baby have no meaningful movements (Ozmun and Gallahue, 2016). As CNS takes the control and inhibition of these reflexes are gained, baby leaned skills. Acquisitions of these skills are a complex process in which neonatal reflexes play a prime role in development of tone in specific group of muscles (Sharma and Cockerill, 2014). increased tone in specific group of muscle causes to adopt a posture, and posture is the key behavior to learn skills.

Babies born with maximum flexor tone; there is flexion in arms and legs. With the development, this tone is counter balance by extensor tone and body achieve an erect posture that is preliminary in acquisitions of skills. Neonatal reflexes are automatic movements in the life of every child, most of neonatal reflexes disappeared at the age of 06 month. Initial six month in baby life is very important, if these reflexes persist, there is delay in the acquisitions of skills (Crain, 2015).

The rooting reflex and sucking reflex have prime importance in survival of child because baby sucking response will keep baby alive by breast feeding, but another very important role of rooting reflex is in the head and neck control (Neaum, 2015). As the baby peri-oral area is stimulated by touch there is rotation of neck. Every time when there is stimulation, there is rotation of neck, thus producing tone of neck muscles. Rotation of neck due to rooting reflex produces tonic neck reflexes like ATNR (asymmetrical tonic neck reflex) (Hölscher, 2014). ATNR produces tone in arms and shoulder and also its integration leads to midline control of baby. Similarly other neonatal reflexes like moro, gallant, landue, stepping, palmer grasp, tonic labyrinthine and supporting reactions all play role in development of tone and posture in baby initial six month. Most of these reflexes disappeared at the age of six month and get integrated in central nervous system. After neonatal reflexes integration, there is emergence of righting reaction in baby life. Righting reactions play very major role in development of rotatory component in development (Linhares, 2015). These reactions continue for 1 to 2 years of life and finally disappeared. Another very important reaction in development is equilibrium reactions. There reaction continues for whole life and baby leant new skills by this reaction.

There are different theories that explain the development in new born. According to neurodevelopmental modal,

motor control refers to two systems: open loop and close loop. Open loops are sequence of movements that are stored in central nervous system and produced isolated joint and limbs movements. Open loop system creates individual muscle movements and has voluntary control. Close loop refer to mass movements and postural movements and involuntary in nature and arise from pattern of coordination. Reflex theory also explains the motor control that reflexes at initial life turned into purposeful movements during later stage of development. Another theory is hierarchical, motor control is hierarchically arranged (Gallistel, 2013). Higher center in brain have inhibitory control on lower center. Another theory named system theory, according to system theory there is no absolute control of higher centers, movements and motor control also take place on lower levels also.

Normal brain leads to normal development. And lesion in abnormal brain leads to abnormal development. Lesion in immature brain leads to abnormal tone development and abnormal postures. In cerebral palsy there is lesion in immature brain that leads to abnormal sensory-motor development. In cerebral palsy there is no integration of neonatal reflexes and delayed in motor development. Abnormal reflex movements produce abnormal synergies and abnormal posture. According to reflex theory, higher center have inhibitory effects on lower centers. In cerebral palsy this higher center control is not present and primitive reflexes persist in child life.

Primitive reflexes have very important role in development of child. These reflexes also have prime importance in assessment and evaluation. As there is brain lesion in these children, upper center do not have inhibitory effect on lower center, so there is an exaggerated reflex movements. Deep tendon reflexes show increased response on stimulation of tendon. Usually primitive reflexes disappeared at the age of six month, but in cerebral palsy these reflexes persist.

There are different senserimotor approaches of treatment like Bobath, Brunnstrom's movement therapy, Rood's approach and proprioceptive neuromuscular facilitation (Bhalerao et al., 2016). Theoretical basis of these treatments are neurodevelopmental modal, reflex theory, hierarchical theory and system approach (Bhalerao et al., 2016). Reflex integration should be major component of treatment in children with cerebral palsy.

## 2. Conclusion

Baby borns with maximum flexor tone; there is flexion in arms and legs. With the development, this tone is counter balance by extensor tone and body achieve an erect posture that is preliminary in acquisitions of skills. Neonatal reflexes are automatic movements in the life of every child, most of neonatal reflexes disappeared at the age of 06 month. Initial six month in baby life is very important, if these reflexes persist, there is delay in the acquisitions of skills.

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# PEDOPHILIA AND OTHER MONOSYMPOMATIC PSYCHOPATHOLOGIES

## PEDOFİLİ VE BAŞKA MONOSEMPTOMATİK PSİKOPATOLOJİLER

Levon Antikacıoğlu<sup>1</sup>, Nevzat Tarhan<sup>1</sup>

**Abstract**

In the present paper, we discussed the insufficiencies of two-dimensional (2D) confrontations and proposed the utility of three-dimensional (3D) and even four-dimensional (4D) confrontations, in researches specially of mono-symptomatic psychopathological cases like for instance in pedophilia.

**Keywords:** pedophilias, mono-symptomatic psychopathology, three and four-dimensional volumetric texture confrontations, time span.

**Özet**

*Bu yazıda, pedofili gibi monosemptomatik psikopatolojik belirti gösteren çalışmalarda 2 boyutlu karşılaştırmaların yetersizliklerini tartıştık ve onun yerine araştırmamızda, 3, hatta 4 boyutlu istatistiksel karşılaştırmaların kullanılmalarının gereğini ileri sürdük.*

*Anahtar Kelimeler:* pedofiller, monosemptomatik psikopatoloji, üç ve dört boyutlu hacimsel yapı karşılaştırmaları, zaman aralığı.

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## 1. Introduction

We are still definitely far from taking the pictures of our thoughts and imaginations. Even though probably we can make some proposals by which we can attempt to approach at least to some extent, to the exploration of clues, leading us closer to some diseases' diagnostic attempts.

Nevertheless, our below proposal, should be handled very carefully. Because laymen or, even some of our collaborative professionals, can perfectly misunderstand it and, take the words as definite truths, and fall into the same trap of polygraphs' results' interpretation.

## 2. Discussion

It is already well-known that, the blood flow and electrical activities of the neuronal connections, responsible of related given behaviors during activity, do increase.

Pedophilia is a problem concerning the adults who get sexually attracted by prepubescent kids. In healthy adults, absolutely, no sexual interest must be aroused toward infants. In short, pedophiles and controls, must be using different neuronal connections, either in perception or reaction, to children.

In the recent past, either by EEG or MRI and/or related equipment, have been done several researches trying to explore the abnormal neurophysiological activities in pedophiliacs. And in general lines, nearly all of them, found several deviated results, although in different forms and localities.

Below we tried to allude some principal researches made by EEG and/or MRI, preferably, on exclusively pedophiliacs, without including those subjects who were related to other abnormalities too.

In 1991 by qEEG, scholars detected different activities in those who had erotic arousal toward 6-12 aged subjects in comparison to normal. They had increased frontal delta, theta and alpha power with reduced interhemispheric – increased intra-interhemispheric coherence (Flor-Henry, P. at al 1991). Others in 2007, compared to homosexual and heterosexual control groups, observed that pedophiles exhibited decreased grey matter volume in the ventral striatum, orbitofrontal cortex and cerebellum (Schiffer, B. at al, 2007). In 2008 researchers found opposite amygdala activation between pedophiliacs and control groups in response to picture of children, by implementation of fMRI (Sartorius, A. at al, 2008). In 2011 in a reaction time task and fMRI experiment, it had been detected that pedophiliacs were reacting more boldly to sexual stimulations by images of pre-pubertal subjects (Poeppl, T. B. at al, 2011). In 2013, by fMRI, researchers found that pedophiles had altered activities, especially in frontal areas (Wiebking, C. at al, 2013). In 2013 in an fMRI pilot study researchers concluded that, "Slower reaction time and less accurate visual target discrimination in pedophilia, was accompanied by attenuated deactivation of brain areas, belonging to the default mode network" (Habermeyer, B. at al., 2013). In 2015 researchers published detailed study on pedophiles and emphasized that through sMRI, fMRI have found

remarkable differences (Tenbergen, G. at al, 2015). In 2015, by implementation of Diffusion Tensor Imaging (DTI) researchers found confirming results that pedophilia is characterized by neuroanatomical differences in white matter microstructure (Cantor, J. M., at al 2015) In 2015 researchers, by using functional magnetic resonance imaging (fMRI) found that Pedophiles showed diminished RSFC between the left amygdala and orbitofrontal as well as anterior prefrontal regions (Kärgel, C. at al, 2015).

As seen, EEG and MRI look being promising tools for the detection of some abnormal cerebral activities in pedophiliacs. By taking advantage of these tools, we propose that it could be quite useful to build up a database, to later use them as some type of marker, especially in mono symptomatic psychopathological cases, as for instance in the cases of pedophiles.

The idea seems attractive. But we need to accept that, (as for our today's knowledge), we cannot have big expectancies in identifying any underlying organic structure; very likely they are just activities tied to wrong conditioning.

Nevertheless, we can extract valuable data.

For the simple reason that, in cognitive psychology we know that any perception and reaction to it, even if they are consecutive to each other, are happening in almost an "instant". Everything happens at a lightning speed, nearly all-over the cerebrum. Than all these apparently fragmented and scattered perceptual clues, at the end, get synthesized and evaluated as a big entire picture, and we respond to them, again with the same speed. For instance, if while exploring the wilderness, we perceive an assaulting tiger, first we evaluate its size, weight, velocity, aggression, mobility, speed, distance, direction and several other factors. Than almost simultaneously, we evaluate all the parameters, and we decide where, toward which direction, how to escape, run or hide or climb on a tree, fire the gun or not, and many other alternatives. And we make our move. We know that all these processes are executed in different and special personal connectome connections in almost only milliseconds. At this point, whereas the phenomenon is occurring in our brain in fully 3 Dimensional (3D) manners we cannot pretend to identify all those activities with simply 2 Dimensional (2D) detections. That is impossible. So from now on, if we desire to arrive to more precise results, we do not have other change than using the EEG or MRI or other futuristic devices, in a way permitting us, confrontations in "volumetric spatial textures".

These assumptions /s which we made, are based on common knowledge, since long time disseminated in Neuropsychology and Cognitive Psychology researches, present here and there, in every related college texts books too. In this sense, what we assert, more than being new researches' outcomes, are based on old findings already known by whoever is familiar with Cognitive and Neuropsychology. We have just tried to "pinpoint" the "unseen" hidden before the eyes of everybody.

Henceforth it looks that the detections of symptoms and their confrontations with the control groups must be done, at least through some new software and statistical



tools that can give us the possibility of confronting the data in 3D.

Even better than that, although the differences can be at a Nano Scale, during the “apparent simultaneity” there can always be found some negligible but, extremely meaningful “time frame differences”, between the normal and controls. Thus it would be an indispensable idea to add the 4D, in other words the time factor too.

### 3. Conclusion

It seems that in several mono-symptomatic psychopathological cases as in the case of pedophilia, it is indispensable to orient ourselves to 3D volumetric, spatial textures’ confrontations. Because whatever is happening in our brain, during either normal or pathological perception, and reaction to it, is happening at a speed of lightening; quasi simultaneously. And all the perceptual processes first, are evaluated, deployed, scattered throughout all over the cerebrum’s differently specialized connectomal connections, then are synthesized to get the entire picture, in order to react to it. To understand what is happening in the pathological brain, we need to identify this brain’s 3Dimensional activity, because the bi-dimensional evaluations do not seem to be satisfactory in grasping the phenomena.

To be more precise, it could be enough neither the 3D. Indispensably we need to involve also the 4th, namely the time dimension. For the simple reason that, even if we accept that perceptions-evaluations-reactions, do happen in an “instant”, in reality with sophisticated equipment and software, we can perfectly detect that what seemingly looks as an “instant”, in reality is a “time span”. And often, even very negligible frames-ranges-spans’ differences, between subjects and controls, can be of vital importance.

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# ALTERATION OF NEUROBEHAVIOURAL ACTIVITIES BY CARBAMAZEPINE, PHENYTOIN AND THEIR COMBINATION IN WISTAR RATS: A MINI REVIEW

## WİSTAR SIÇANLARINDA KARBAMAZEPİN, FENİTOİN VE BU İKİSİNİN KARIŞIMINA BAĞLI OLARAK NÖRODAVRANIŞSAL AKTİVİTELERİN DEĞİŞİMİ: KISA BİR DEĞERLENDİRME

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**Abstract**

Antiepileptic drugs (AEDs) have been used for decades in the treatment of seizures in both humans and animals. There are different varieties of AEDs to choose from, the choice of an AED is determined by the seizure type, effectiveness of the drug in controlling seizure, cost and the side effects of the drug used. Epilepsy therapy could be monotherapy, that is, the use of an appropriate AED or polytherapy in which case, two or more AEDs are combined particularly in the case of refractory epilepsy. The side effects of AEDs are diverse and affect virtually all the systems of the body. This review is aimed at studying the side effects associated with the administration of carbamazepine, phenytoin and their combination on cognition and neurobehavioural generally, particularly in Wistar rats. Generally, the side effects of AEDs observed are not so detrimental because the discontinuation of the drugs usually cause a reverse of the effects observed. For this review, available informations on the effects of antiepileptic drugs on neurobehavioural activities were accessed from electronic databases.

**Keywords:** carbamazepine, phenytoin, learning, short-term memory, locomotion, rearing.

**Özet**

*Antiepileptik ilaçlar (AED), hem insan hem de hayvanlardaki hastalık nöbetlerinin tedavisinde on yıllar boyunca kullanılmaktadır. Antiepileptik ilaçların farklı türleri mevcuttur ve bu tür ilaçları seçerken geçirilen nöbet çeşidi, ilacın krizi kontrol altına alma hususundaki etkililiği ile kullanılan ilacın masrafı ve yan etkileri dikkate alınır. Epilepsi terapisi, uygun bir antiepileptik ilaç kullanımıyla yürütülen monoterapi şeklinde ya da özellikle dirençli epilepsi vakalarında başvuru ve iki veya daha fazla antiepileptik ilacın karışımıyla gerçekleştirilen politerapi yöntemiyle uygulanabilir. Antiepileptik ilaçların yan etkileri çeşitlilik arz etmekte olup neredeyse tüm vücut sistemlerini etkiler. Bu değerlendirme, karbamazepin, fenitoin ve bu iki ilacın birleşiminin özellikle Wistar sıçanlarının bilişsel ve nörodavranışsal faaliyetleri üzerindeki yan etkilerini incelemeyi hedeflemektedir. Genel olarak antiepileptik ilaçlarla ilgili ortaya çıkan yan etkiler, ilacın kesilmesine bağlı olarak gözlemlenen ters etki sebebiyle zannedildiği kadar zararlı değildir. Bu değerlendirmede, antiepileptik ilaçların nörodavranışsal aktiviteler üzerindeki etkileriyle ilgili mevcut bilgilere elektronik veri tabanlarından erişilmiştir.*

**Anahtar Kelimeler:** karbamazepin, fenitoin, öğrenme, kısa süreli hafıza, hareket kabiliyeti, yetiştirme.

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## 1. Introduction

The prevalence and phenomenology of naturally-occurring canine epilepsy are similar to those of humans, and it has been observed that head trauma in dogs is associated with a significant risk of developing epilepsy (Steinntze et al., 2013). Behaviour and cognition in patients with epilepsy may be affected by multiple factors including aetiology of the seizure, seizure type, frequency, duration, and severity; cerebral lesions acquired before seizure onset; age at seizure onset; intraictal and interictal physiological dysfunction due to the seizures; structural cerebral damage due to repetitive or prolonged seizures; hereditary factors; psychosocial factors; sequelae of epilepsy surgery; and untoward effects of antiepileptic drugs (AEDs) (Loring and Meador, 2001). Subtle impairment of cognitive function and behaviour occur with modest or therapeutic levels of phenytoin (PHE), valproic acid (VPA), phenobarbitone (PB) and carbamazepine (CBZ) (Balakrishnan et al., 1998). (Meador et al., 1991) reported that rather than being overtly manifest, subtle changes in cognitive and psychomotor functions do occur commonly with long-term antiepileptic drug (AED) therapy, especially phenytoin. Although the behavioural and cognitive effects of AEDs are less than the total of other factors of epilepsy, AEDs are of special concern because they are the major therapeutic modality for seizures and studying the cognitive effects of an AED should first be carried out in normal non-epileptic subjects. More importantly, a drug should theoretically be tested in well defined epilepsy syndromes with 'as homogeneous as possible' patient populations. An anti-epileptic drug theoretically can induce different cognitive effects in different epilepsy syndromes (Lagae, 2006). For instance, it is known that frontal epilepsy in a child is more prone to attention problems (Auclair et al 2005). The most common AED cognitive effects include psychomotor slowing, reduced vigilance, and impairments in memory (Loring and Meador, 2001). Phenobarbital (PB) and benzodiazepines (BZDs) possess the most marked adverse cognitive effects; major older AEDs, carbamazepine (CBZ), phenytoin (PHT), and valproate (VPA) have similar cognitive effects while the newer AEDs Gabapentine (GBP), lamotrigine (LTG), Tiagabine (TGB) and vigabatrin (VGB) produce fewer cognitive effects. Of the new AEDs, topiramate (TPM) appears to have the greatest cognitive side effect (Loring and Meador, 2001).

## 2. Therapy

Antiepileptic drugs (AEDs) are designed to reduce neuronal irritability and are the first choice for the treatment of new-onset epilepsy. In addition to their effects on abnormal brain activity, AEDs also decrease normal neuronal excitability, which may adversely affect cognitive function. But, the cognitive side effects of AED monotherapy are generally not pronounced when anticonvulsant blood levels are within the standard therapeutic range (Dodrill and Trompin, 1991). Cognitive side effects may be partially offset in patients with frequent seizures simply by virtue of their therapeutic effects on seizure control. The risk of significant cognitive side effects increases with higher drug dosages and with

polypharmacy (Loring and Meador, 2001). The choice of an AED for any individual should take into cognisance information about seizure control, adverse effects and cost (Gamble et al, 2009).

## 3. Antiepileptic drugs

Both phenytoin (PHE) and carbamazepine (CBZ) are widely used potent AEDs (Tripathy et al., 2000). Phenytoin sodium (PHE) is an anticonvulsant used to control grand mal and psychomotor seizures. It can cause various neurological disorders, when given for a long time. It produces chromosomal anomalies and increased incidence of malignant melanoma (Vijay et al., 2009). PHE blocks voltage-sensitive sodium ion channels; therefore, inhibiting neuronal firing in the brain (Rykacezewka-Czermanska, 2007). Newer AEDs that may have fewer side-effects are now available, but PHE continues to occupy an important role in the pharmacological treatment of epilepsy. This is particularly so for patients on long-standing PHE regimens that may require months to years of modification of the drug regimens and doses to achieve optimal control of their disease (Chen et al., 2001).

Carbamazepine is an iminostilbene, a dibenzepine derivative that is chemically and pharmacologically related to tricyclic antidepressant agents (Bazil & Pedley, 2003). CBZ is a highly used conventional AED, which has efficacy in attenuating picrotoxin-induced convulsion (Ali et al., 2003). CBZ is the usual drug of choice for patients with newly- diagnosed partial onset seizure (Shaikh et al., 2011). Side-effects of CBZ include: drowsiness, accommodation disorders among others (Jallon, 2007).

## 4. Rational polypharmacy of antiepileptic drugs

Epilepsy treatment has evolved from institutionalised polytherapy to dogmatic monotherapy and then to rational polypharmacy (Kramer, 1997). Polytherapy in epilepsy is a preferred regimen in patients with intractable seizures (Loscher & Ebert, 1996). The rationale for combining some AEDs is usually based upon the presumptions concerning two aspects of efficacious treatment; the first aspect is directly related to the anticonvulsant activity of the combination drugs, while the second one takes into consideration the side-effect profile of the co-administered drugs (Czuczwer et al., 2001) & (Le Couteur & Child, 1998). It has been established that polytherapy gives an improved control of epilepsy (Sun et al., 2002). Rational polypharmacy of AEDs is one of the treatment strategies for refractory epilepsy (Cascino, 1990).

## 5. Role of Rational Polypharmacy in the Treatment of Refractory Epilepsy

Refractory epilepsy or intractable seizures occur when epileptic symptoms are not responding to treatment. Seizures are well controlled with a single anticonvulsant in most epileptic patients. However, about 20% of patients with primary generalised epilepsy and 35% of patients with focal epilepsy have medically intractable

seizures (Reuten & Berkovich, 1995); (Jinsook et al., 2007). Some medical approaches undertaken in the management of intractable epilepsy include the use of drugs with complementary mechanisms of action, stimulation of various components of the nervous system, biochemical manipulations, focal intracerebral drug perfusion and gene therapy (Jallon, 2007). Some of the drug combinations employed in rational antiepileptic polypharmacy include; Levetiracetam and carbamazepine (Luszczki, 2004), carbamazepine and valproate (Sun et al., 2002), lamotrigine and valproate, lamotrigine and carbamazepine, lamotrigine and diphenylhydantoin (Luszczki, 2004), carbamazepine and phenytoin (Lai et al., 1992), carbamazepine and phenytoin (Perruca & Richens, 1980), carbamazepine, phenytoin, phenobarbital and valproic acid (Bhosale et al., 2014).

## 6. Side-effects of Antiepileptic drugs

The incidence of adverse effects is an important issue when prescribing antiepileptic drugs (AEDs), as some of the most effective medications for seizures are associated with a considerable degree of toxicity. Studies indicate that drug tolerance by individuals is a significant limiting factor in the treatment of seizure and drug retention rates are often determined by side-effect profiles (Bootsman et al., 2009); (Chung et al 2007). Older AEDs may still be prescribed, owing to advantages that include lower cost, wide availability and long-term usage with known effects, but often exhibit greater toxicity than newer drugs (Eddy et al., 2011). Newly developed agents tend to differ in terms of mechanisms of action and pharmacokinetic properties, and are often better tolerated than older drugs. However, all AEDs have the potential to exert detrimental effects on cognitive function; a thorough appreciation of the negative cognitive effects linked to a variety of AEDs makes a crucial contribution to therapeutic successes (Meldrum, 2002). As a means of evaluating the side-effect profile of AEDs in combination, all available combinations should be tested on animals. It is widely accepted that in animal models, some neurotoxic effects produced by AEDs in combinations can easily be determined, which may be sufficient enough for further clinical use in patients (Loscher & Notting, 1991). To properly assess the neurotoxic profile of AEDs in combinations, several behavioural tests can be conducted which include; rota rod performance, chimney tests and locomotor activity in rodents (Saraswathy et al., 2015).

## 7. Effect of administration of carbamazepine and/or phenytoin on locomotor and rearing activities in Wistar rats

Phenytoin has been shown to significantly reduce the spontaneous motor activity, indicating the central nervous system depressant effect of the drug (Coenen et al., 1995). Phenytoin has induced muscle weakness and motor incoordination in rats indicated in impaired rota rod performance of the rats, (Aliyu et al., 2016) reported that when comparing the administration of phenytoin and carbamazepine for some motor tests in rats, the performance of rats taking carbamazepine is faster.

(Nawakowska, 2011) reported decreased locomotor and rearing activities in rats administered CBZ, PHE and their combination. Decreased locomotor activity following CBZ administration was also observed in mice (Luszczki, 2004) and rats (Gillham et al., 1988). Similarly, (Luszczki, 2004) reported that combining two sodium-channel blockers may result in a considerable reduction in locomotion of the animals tested; which apparently, induced the potentiation, rather than the summation of hypo-locomotor effects produced by the combined AEDs.

## 8. Effects of carbamazepine and/or phenytoin on learning and memory

The complex relationship between fits, cognitive impairment, psycho-social difficulties and underlying cerebral pathology has been the subject of several investigations. There has been a growing body of evidence that a fifth factor, the presence of AEDs in the brain, contributes independently to disruption of intellectual functioning (Bourgeois, 2004). Several non-independent factors and each to a variable extent contribute to the possible cognitive problems in epilepsy but are very difficult to study separately (Bourgeois et al 1983). Probably the most important determinants are the epileptic process itself and the underlying brain dysfunction/pathology with symptomatic epilepsy having a worse outcome than idiopathic epilepsy (Vandelinden & Lagae, 2004). The unique contributions of the epilepsy-related factors, such as the age of onset (Tromp et al., 2003), type of seizures and epilepsy syndrome, frequency of seizures and epileptic abnormalities on the EEG are more difficult to disentangle (Aldenkamp et al., 1993). It is the combination of the underlying brain dysfunction with an epileptic syndrome at a certain age that explains the cognitive profile (Lagae, 2006). It is clear that all the older drugs can induce psychomotor slowing to a variable extent which is a basic cognitive instrument (Farwell et al., 1990). Psychomotor slowing is generally measured in reaction time studies and anti-epileptic drugs typically induce a 100–200 ms (milliseconds) increase of reaction time. This reaction time increase can be very critical in some natural situations and especially during learning situation (Riva et al., 1996) and (Forsyth et al., 1991). That AEDs also suppress epilepsy through their effect on the hippocampus may be responsible for the cognitive deficit observed, since the same part of the brain plays an important role in memory. This, therefore, makes the hippocampus and its connections, which play important roles in epileptogenesis, memory and learning, (Mathews et al., 2011); (Fitzgerald et al., 2013), to be central to the beneficial and unwanted (adverse) effects of AEDs. The administration of CBZ and/or PHE impairing learning ability has been demonstrated in some studies (Rajesh et al., 1991); (Bourgeois, 2004). (Ogunrin et al., 2005), (Shannon & Love, 2005) and (Pulliainen & Jokoliainen, 2005) who reported impairments which are more pronounced following CBZ than with PHE administrations but (Aliyu et al., 2016) had a reversed observation with rats in their studies. Greater learning impairment was observed when the drugs were combined indicating a more cognitive deficit (Zhan, 1998); (Aliyu et al., 2016).



Memory impairment following AED administration, including CBZ and PHE, with greater deterioration in memory following CBZ than those repeatedly-dosed with PHE (Shannon & Love, 2004), has been observed. (Wamil & McLean, 1993), reported that PHE significantly decreased the retention latency in the passive avoidance test, similar to what was recorded in this study. In addition, (Thakur et al., 2011) showed that chronic PHE treatment caused memory impairment and that neuronal damage to the hippocampus, cortex, cerebellum and midbrain by PHE may be responsible for the impairment. Different studies have shown that both phenytoin and carbamazepine seem to have negative effects on cognitive performance, particularly on tasks with significant motor and speed components; practice effects were noted and may account for much of the improvement when patients stopped taking the drugs (Pulliainen & Jokoliainen, 1994). Phenytoin has been implicated in the decline in concentration, memory, visuomotor functions and mental speed (Andrews et al., 1986); (Gillham et al., 1988); (Aman et al., 1994). These effects may be dose-related (Bourgeois, 2004), (Aldenkamp et al., 1994) reported that there is no relationship in the cognitive-motor performance. But (Duncan et al., 1990) reported a slowed performance on information processing tasks with phenytoin in comparison with carbamazepine, but no differences for memory or selective attention. Some investigators reported more detrimental effects on memory by phenytoin than carbamazepine (Pulliainen & Jokoliainen, 1994); (Andrews et al., 1986). A double-blind placebo-controlled study indicated that attention and motor performance may improve after withdrawal (Duncan et al., 1990), and similar improvements in concentration and psychomotor performance were noted in another controlled study (May et al., 1992). (Pulliainen & Jokoliainen, 1994) concluded that the long-term effects of phenytoin on cognition are relatively few and restricted mainly to some visually guided motor functions. A number of cognitive and psychomotor effects have been linked to carbamazepine (Gillham et al., 1988). A randomized, double-blind, placebo-controlled study involving 150 epilepsy patients on AED monotherapy (mainly carbamazepine or valproate) found that drug discontinuation significantly improved performance in tests that required complex cognitive processing under time pressure, but not in more simple tasks of attention and reaction time (Henssen et al., 2006). A later study reported similar findings, with improved performance in a verbal fluency task, a Stroop task, a language task and a reaction time task after discontinuation of carbamazepine (Hessen et al., 2009). In relation to other AEDs, it has been suggested that carbamazepine has a cognitive profile that is worse than levetiracetam (Lee et al., 2011) and lamotrigine (Gillham et al., 1988) but better than phenytoin (Pulliainen & jokoliainen, 1994); (Andrews et al., 1986). However, (Coenen et al., 1995) reported that the cognitive profiles of valproate and carbamazepine were similar except for some aspects of attention and memory, in which individuals taking valproate scored better. These effects appear mild when compared with those of phenytoin and phenobarbital. A study of patients with partial epilepsy showed no impairments in selective

attention and memory compared with the control, although slower information processing speed was seen with monotherapy (Gillham et al., 2000). Despite none decline in coordination, memory, concentration or mental flexibility, a lack of practice on tasks appeared to suggest subtle changes in cognitive function (Engelberts et al., 2002). It was reported that carbamazepine did not have significant negative effects on memory and attention tasks, although performance improved slightly after withdrawal in children with partial epilepsy (Prevey et al., 1996). Beneficial effects reported on memory include improved immediate memory and late recall (Bittencourt et al., 1993) and better retrieval from episodic and semantic memory in adults and adolescents (Seidel & Michelle, 1999). Controlled-release medication may be most beneficial in memory and visual information processing (Kalvia et al., 1995). Despite these encouraging findings, some investigators suggested that carbamazepine is more likely to lead to cognitive deterioration than improvement (Aldenkamp et al., 1987). Factors that may be related to a greater incidence of cognitive effects include higher dose (Hemsteadter & Witt 2010) longer duration of intake (Shehata et al. 2009) and polytherapy (Bourgeois, 2004). Apart from its effects on epileptic patients, AEDs have been shown to impair learning, even in healthy subjects (O'Dougherty et al., 1987).

## 9. Conclusion

The risk of AEDs' cognitive side effects is increased with polypharmacy and at higher dosages and higher AED blood levels (Loring % Meador, 2001). The administration of carbamazepine and/or phenytoin caused cognitive impairment and alterations in neurobehaviour. This in essence indicates that learning and memory of individuals taking these drugs could be affected particularly with long term use. It is therefore important that the aforementioned parameters should be monitored so as to alleviate the expected side-effects. Additional studies are needed to compare the relative effects of all the new antiepileptic drugs to each other and to the older ones.

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# ASSESSING PROPRIOCEPTION

## PROPRİYOSEPSİYONU DEĞERLENDİRME

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**Abstract**

Proprioception is the sense of the relative position of parts of the body and strength of effort being employed in movement. Proprioception is essential for well-adapted sensorimotor control. Although proprioceptive deficits are known to be a common after several neurological and orthopedic conditions such as stroke, Parkinson's disease, peripheral sensory neuropathies, or injuries to ligaments, joint capsules, and muscles, there is no objective, accurate, and reliable method available in clinical settings to assess proprioceptive function. In this chapter specific techniques developed to assess proprioception will be briefly discussed.

**Keywords:** assessment, equipment, joint position sense, proprioception.

**Özet**

*Propriyosepsiyon, vücudun parçalarının göreceli konumunun ve hareket sırasında işe yönelik harcanan efor direncinin hissi anlamına gelmektedir. İyi bir sensorimotor kontrol için propriyosepsiyon gereklidir. İnme, Parkinson hastalığı, periferik duyu nöropatileri gibi ya da ligamentler, eklem kapsülleri ve kaslarda yaralanmalar gibi çeşitli nörolojik ve ortopedik koşullardan sonra propriyoseptif bozulmaların yaygın olduğu bilirse de, klinik pratikte propriyoseptif fonksiyonların ölçümünde objektif, doğru ve güvenilir bir yöntem bulunmamaktadır. Bu bölümde, propriyosepsiyonun değerlendirilmesi için geliştirilen spesifik teknikler kısaca tartışılacaktır.*

**Anahtar Kelimeler:** değerlendirme, ekipman, eklem pozisyon duygusu, propriyosepsiyon.

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## 1. Introduction

Proprioception is the sense of the relative position of parts of the body and strength of effort being employed in movement. Proprioception is essential for well-adapted sensorimotor control (Suetterlin & Sayer, 2014). Several assessment methods and techniques have been developed to test proprioception accurately (Clark, Röijezon, & Treleven, 2015).

For an intact proprioception, receptors in striated muscles and Golgi tendon organs must function properly. Although proprioception perceived as a role of the peripheral nervous system, it is becoming more evident that there processing of proprioception is a function of the central nervous system (Niessen, Veeger, & Janssen, 2009). It is the central nervous system integrating information coming from proprioceptors and also from the vestibular system into an overall sense of body awareness. An intact proprioception is vital for the neural control of locomotion. Conversely, an impaired proprioception negatively affects the control of spatial movements (Proske et al., 2012).

Proprioception has conscious and unconscious components. The unconscious component, controlled partially by the cerebellum, is seen soon after the infant gains neck movement control. It can be assessed by tilting body on one side and observing the eyes leveled to a horizontal line by tilting the head to opposite side (Bhanpuri, Okamura, & Bastian, 2013).

## 2. Assessing Proprioception

Although proprioceptive deficits are known to be a common after several neurological and orthopedic conditions such as stroke, Parkinson's disease, peripheral sensory neuropathies, or injuries to ligaments, joint capsules, and muscles (Bosco & Poppele, 2001), there is no objective, accurate, and reliable method available in clinical settings to assess proprioceptive function (Hillier, Immink, & Thewlis, 2015). In clinical practice many clinicians prefer to test proprioceptive acuity by detecting a patient's capability to discriminate the upwards or downwards position of a finger or toe. However, assessing proprioception accurately in the laboratory is much more complex work. Many assessment techniques utilize custom-built devices or costly computerized equipment although the use of them is not feasible in the clinical settings. Clinicians have tried to develop new evaluation methods for the spine and extremities, but a further advancement of clinical tests are needed (Gandevia, 2014).

Recently, researchers use various instruments such as goniometers, inclinometers or pressure sensors to develop an accurate and easy-to-use method to assess proprioception in a clinical context (Hillier et al., 2015).

### 2.1. Specific tests

There are several means by which physiotherapists can assess proprioception, depending on the body part being evaluated.

### 2.2. Thumb Finding Test

It is also called dynamic position sense test. The tester places one upper limb of the subject. Positioning might be in an active or passive manner. Then the subject is asked to touch the placed thumb with their contralateral thumb and forefinger while eyes are shut. A successful test requires specific cognitive abilities such as intact inter-hemispheric communication. It is an essential and easy-to-perform test, as no equipment is needed (Smith, Akhtar, & Garraway, 1983).

### 2.3. Finger-Nose Test

It is a basic test similar to thumb finding test. One or both limbs are actively or passively placed by the tester, and the subject asked to touch their nose with their forefinger while eyes are shut. It is a basic, bedside assessment test as it does not require any equipment. Both Thumb Finding Test and the Finger-Nose Test requires the proprioceptive sense and localization of the body segments in space (Taylor & McCloskey, 1988).

### 2.4. Distal Proprioception Test

It is one of the basic tests to assess proprioception of the distal joints. The examiner grasps the sides of the great toe and performs up/down movements while eyes of the subject are open. Then the subject repeats the same movement while the eyes are closed. The examiner scores for correct perception of movement and direction. Although it is a simple bedside test, inter-examiner variability in the magnitude of moving digits and low sensitivity in detecting proprioceptive deficit is a problematic area (Richardson, 2002).

### 2.5. Dual Joint Position Test

It is a closely related version of distal proprioception test, which requires simultaneous movement of two fingers with combinations of both up, both down, or one up/one down. The test requires the touch of the examiner to the subject's digit, which is a confounder for proprioception (Beckmann, Çiftçi, & Ertekin, 2013).

### 2.6. Field Sobriety Test

It is mostly used by police officers to check for alcohol intoxication (Burns, 2003). In this test, the subject is asked to touch his or her nose with eyes closed. Error up to 2 cm is accepted as normal proprioceptive function.

### 2.7. Lumbar Proprioception Equipment

This technique is described by Taimela et al (Taimela, Kankaanpää, & Luoto, 1999). It assesses the proprioception of trunk. A motor-driven machine fixes the thorax of the subject and rotates lower body throughout lumbar spines of L4 and L5. The subject asked to indicate regaining of original neutral position either actively or when passive motion reaches neutral position. Although the test is acceptable for research population, the use in



the clinical population may not be feasible as it utilizes the sophisticated equipment

### **2.8. Spinal Motion Apparatus**

This procedure developed by Pankhurst and Burnett (Pankhurst & Burnett, 1994), for assessing the proprioception of lower back. It is composed of a motor-operated device that produces passive motion of lumbar spine in 3 planes while the trunk stayed fixed. The subject detects motion and identifies the neutral position or the direction of movement. It assesses movement in three planes as an advantage; however the use in a clinical population may not be feasible as it utilizes the complex equipment.

### **2.9. Active Movement Extent Discrimination Device**

Developed by Hobbs to assess lumbar proprioception (Hobbs, Adams, Shirley, & Hillier, 2010). It depends on discriminating the position differences in 11-19° of lumbar flexion. It consists of free standing with stopper at five preset distances. In the test the subject had to discriminate preset trained flexion positions while standing. The test's disadvantage is that the subject's head is also moving through the test so the vestibular system might be adding to the proprioceptive sense.

### **2.10. Neck Proprioception Testing Device**

It is a technique developed by Lee et al. for assessing cervical proprioception (Lee, Nicholson, Adams, & Bae, 2005). It depends on discriminating positional differences in cervical rotation of 25-41 degrees and cervical retraction of 1 to 1.8 cm. It is a cervical version of Active Movement Extent Apparatus. The subject asked to identify the preset active rotation and retraction positions while sitting. The test's disadvantage is that the subject's head is also moving through the test so the vestibular system might be adding to the proprioceptive sense.

### **2.11. Manipulandum**

This device is developed by Bevan et al. [18], and Cordo et al. [19] (Bevan, Cordo, Carlton, & Carlton, 1994; Cordo, Carlton, Bevan, Carlton, & Kerr, 1994). It assesses the proprioception of elbow by passive recognition of joint angle or estimation of distance. The test requires the forearm and upper arm of the subject banded to a motorized mechanism that generates a passive change in the joint angle. The subject asked to indicate the time their elbow reaches one of the pre-trained joint angles or distance. Manipulandum can also be used in the upper arm by discriminating 2 tilting pathways and two bowed pathways.

### **2.12. Kinarm**

Developed by Bhanpuri et al. to assess proprioception of elbow (Bhanpuri, Okamura, & Bastian, 2012). It depends on subject's apprehension of movement and then the

perception of the magnitude of motion of the elbow. It uses a robot system on which the forearm and upper arm of the subject strapped. Subjects state if they sense a shift or not and indicate the magnitude of the second movement is greater or less than first.

### **2.13. Shuttle Miniclinic Constant Resistance Device**

It is developed by Lin et al. to assess the proprioception of hip and knee (Lin, Lien, Wang, & Tsauo, 2006). A continuous resistance mechanism affixed to sole to yield increase or decrease in hip and knee joint angles. The subject asked to push on a device to extend limb from beginning position of 60° hip flex and 90° knee flex to a pre trained position while being in prone position.

### **2.14. Movement Detection Apparatus**

It is described by Matre et al. (Matre & Knardahl, 2003). It depends on detecting the threshold for movement and direction precision of the joint. The test uses a motor-operated rotating platform with an axle arranged with the ankle of the subject. Subject asked to state the-the detection and direction of the motion while his or her foot pivoted in dorsi- or plantar flexion direction.

### **2.14. Cervicocephalic Kinesthesia**

Kristjansson et al. described the test. It has fast track sensors. In different studies, various uses of the test described such as relocation of the head to the natural position after active turn to left and right or active relocation to 30° turn from the natural head position. Passive trunk rotation of 30° or figure of eight motion can also be used before subjects repositioning head to a natural position (Kristjansson, Dall'Alba, & Jull, 2001).

### **2.15.. Thoracolumbar Proprioception Test**

It is described by Gill and Callaghan (Gill & Callaghan, 1998). It depends on the active reproduction of thoracolumbar movement. A lumbar motion monitor measures the error between pelvis and trunk harness. The subject reproduces the position in flexion, rotation, lateral flexion planes after the baseline active test position.

### **2.16. Arm Position Matching Task**

Described by (Dukelow et al., 2010). It requires active reproduction of spatial coordinates by the contralateral arm after passive positioning of an arm.

### **2.17. Joint Position Sense**

Joint position sense is commonly tested using either active or passive copy of joint positioning. It can be used in cervical or lumbar spine, knee, upper limb, lower limb joints. While assessing the proprioception in the cervical spine, examiners generally use a laser pointer attached to a headband. In the test subject is asked to relocate to the neutral starting position with the eyes closed after



performing an active head movement. The discrepancy between the initial active and relocation positions measured in millimeters, and the error in joint position computed in degrees (Chen & Treleaven, 2013). Active joint position sense testing is possible to be restrained by pain. The test also demands sufficient motor control of the subject. Passive joint control tests do not require motor control of the subject. However, both active and passive joint position sense tests need the kinesthetic memory of pre-established position.

### 2.18. Limb Position Copying and Reproducing Tests

Described by Kaplan (Kaplan, Nixon, Reitz, Rindfleisch, & Tucker, 1985). This test can be used for assessing the proprioception of various joints such as knee or elbow. The test requires active reproduction of ipsi- and contralateral positions of the limb. Goniometer measures the error between reproduction and the target.

### 2.19. Cumulative Somatosensory Impairment Index

Described by Deshpande et al (Deshpande, Metter, & Ferrucci, 2010), the test was used in diabetic peripheral arterial disease or stroke patients to assess the proprioception of lower extremity. In the test procedure, reference ankle is positioned by the examiner as neutral or with a degree of 10-20 and subject matches position.

## 3. Conclusion

Proprioception is a sense that is essential for healthy interaction with the environment. Loss of proprioception leads to a significant functional impairment. Although proprioception is an important clinical entity, the technique for accurate clinical assessment of proprioception is a debate. Many of the clinical tests require an intact working memory and interhemispheric connection. Various techniques utilize complex technical equipment, so the use in a clinical population may not be feasible as it. Further research is required to develop more objective, accurate, and reliable methods to assess proprioception in clinical settings.

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# HEMISPHERE DOMINANCE IN BIPOLAR DISORDER

## BİPOLAR BOZUKLUKTA HEMİSFER DOMİNANSI

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**Abstract**

Bipolar Disorder is characterized with unusual shifting of mood, from mania to depression and is an extremely risky and very serious mood disorder. The person's behavior may damage both his/her social function and harm the people in his/her environment. Although bipolar disorder recurs during the person's life and thus can manifest at any age, its onset is often observed during early twenties. The difference in prevalence between males and females has not been clearly determined. Although genetics play a role, the disorders cannot be explained by inheritance alone. The disorders has also been explained by disruptions of neurotransmitter balance, in plane words the disruption in the transmission of signals.

Bipolar disorder is a brain disorder and impairs functioning of the brain. Rationalized decision making and improper reasoning can be seen. Therefore, attention impairments with cognitive content are also on the agenda of bipolarity. Neural basis of bipolar disorder is not clearly known but it is suggested that the right frontoparietal cortex is particularly affected. In bipolar disorder, the concept of right hemisphere dysfunction is not new, it has been originally presented by Flor-Henry (1969, 1979). In this review we aimed to review research exploring hand/foot dominance in the light of this hypothesis. We first aimed to, find studies that measured hand dominance in bipolar disorder to find out whether there were any organizational differences in the brain of people with bipolar disorder. From several articles accessed via Pubmed database Five articles in met the inclusion criteria and were thus included to the review. In general, right hemisphere dominance in bipolar disorder was evident in these studies. However it is also acknowledged that further studies are needed to evaluate whether hand lateralization is related to biological or functional hemispheric asymmetry parameters in patients with bipolar disorder. It is thought that neuroimaging studies on bipolar disorder patients with dominant left hand, foot and eye will shed light on many points for elucidating the organizational alterations in mental disorders such as bipolarity.

**Keywords:** bipolar and hand dominance, bipolar and right hemisphere, bipolar and left-handedness, affective disorder connectivity left handedness, affective disorder and dominance hand.

**Özet**

*Bipolar Bozukluk iki ayrı uçta diye açıklanan; coşkun tepesinde ve mutsuzluğun dibinde yaşanan, son derecede riskli ve çok ciddi bir duygu durum hastalığıdır. Kişinin sosyal çevredeki itibarına olduğu gibi ve çevresine de zarar verici davranışları olabilir. Bipolar bozukluk kişinin yaşamı süresince aralıklarla kendini gösteren, her yaşta görülebilen bir rahatsızlık olmasına rağmen, sıklıkla 20 li yaşların başlarında başladığı en çok gözlenenidir. Kadın erkek farkı net olarak saptanmamıştır. Sadece kalıtımla açıklanamaz. Nörotransmitterlerin dengesinin bozulması; açıkçası sinyallerin iletilmesindeki aksaklıktan da bu durum oluşabilir.*

*Bipolar bozukluk bir beyin rahatsızlığı olup beynin işlevsel fonksiyonlarında bozulma görülür. Rasyonel şekilde karar verme ve muhakeme etmede uygunsuzluklar görülebilir. Dolayısıyla kognitif içerikli dikkate yönelik bozulmalar da bipolaritenin gündemindedir. Bipolar bozukluğun nöral temeli henüz net olarak bilinmiyor ancak sağ fronto parietal korteksin özellikle etkilendiği ileri sürülmektedir. Bipolar bozuklukta sağ hemisfer disfonksiyonu kavramı yeni değildir, başlangıçta Flor-Henry (1969, 1979) tarafından sunulmuştur. Bu bağlamda bilimsel açıdan bipolarite ile sağın dominant olması sol el, sol göz, sol ayakta baskınlığa dair bir araştırma, çalışma olup olmadığı, bir ilişki olup olmadığı incelenmek istendi. İncelemenin başında sağ hemisfere göre sol*

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*hemisferin yaratıcılığa etkisi ile başlayarak; el tercihi ve el tercihini belirleyen etkenler araştırıldı ve yaratıcılık testi ile desteklenen çalışma bulunmadığı için el tercihlerine psikiyatrik rahatsızlıkla birlikte bakmaya karar verildi. Sonunda bipolarite ve sağ hemisfer baskınlığına ait araştırmalara bakmak için özellikle sol el tercihine dikkat edildi. Bipolarların beyinde organizasyonel açıdan fark var mıya bakıldı bunun için de dominant el araştırıldı. Pubmedden araştırarak 5 makalenin dâhil olma kriterine uyduğu fark edildi ve bu 5 çalışma alındı.*

*Araştırmalarda sol göz baskınlığının olması da sağ hemisfer baskınlığını düşündürdüğünden, genel anlamda sağ hemisfer baskınlığının olduğu dikkati çekti. Diğer çalışmalarda da Bipolar bozukluğu olan hastalarda sağlak olup olmamanın biyolojik veya fonksiyonel hemisferik asimetri parametreleriyle ilişkili olup olmadığını değerlendirilmek için daha fazla araştırmaya ihtiyaç olmakla birlikte, sol el baskınlığının dikkati konusunun daha fazla araştırılması gerektiğini düşündürmektedir. Özellikle solaklığın el, ayak ve göz olarak baskın olduğu kişilere ait araştırmaların bipolarite gibi bazı ruhsal rahatsızlıklarda araştırılmasının birçok noktaya ışık tutacağı düşünülmektedir.*

**Anahtar Kelimeler:** bipolar ve el baskınlığı, bipolar ve sağ hemisfer, bipolar ve solaklık, afektif bozuklukla ilişkili solaklık, afektif bozukluk ve baskın el.

## 1. Giriş

Sağ ve sol hemisferin biri diğerinden farklıdır ve baskın tarafları bulunur. Sağ hemisferin sol tarafı, sol hemisferin de sağ tarafı yönettiği artık bilinmektedir. Sağ yarımkürede; şekil, boyut, renk, müzik, hayal, bütünü görme. Sol yarımkürede ise; mantık, sayılar, diziler, bağlantılar, detaylar dikkati çeker. Dolayısıyla her iki yarımkürede bir diğerinden farklı olup, farklı işlemsellik görülür. Sol hemisfer bilgiyi seri şekilde işlerken, sağ hemisfer ise bilgiyi paralel işler.

Sağ hemisfer daha çok bir sanatsal yanı sanki birleştirici gibi görülmekle birlikte, sol hemisfer de daha rasyonel düşünce içeriğinin oluştuğunu ve detaylarla ilgilendiğini göstermektedir. En ideali sağ ile solun birlikte sistemli çalışmasıdır ki detaydan bütüne gitmeyi, bütünün içinde detayı görmeyi yapabildiğimiz zaman ve işlevselliğimizin bozulmadığı zaman aslında en sağlıklı görünen bir süreç olduğunu düşündürmektedir. Sağ hemisferin baskınlığı daha yaratıcı olmayı sağlayan yönler ile yüklü olduğundan; sezgilerin güçlü olduğu, sanat tarafı daha ağır basan ve dolayısıyla yaratıcılık yönü kuvvetli olan bir kişiden söz edilebilme olasılığı yüksektir. Duygusal açıdan doluluk olduğunu düşünebiliriz.

Sol hemisfer baskınlığı ise daha rasyonel ve mantıklı taraf olduğundan analiz etme ve sentezleme yeteneğinin gücü ile birleştirici bağlayıcı bir yönün kuvvetli olduğu hakkında fikir yürütebiliriz ki. Bir çok araştırmada sağ ve sol hemisfer baskınlığı hakkında çıkarımlarda bulunulmuştur. Ayrıca doğum öncesinde de bebeğin gelişimini izleyen birçok araştırmacı olduğu bilinmektedir. Bu araştırmalarda gelişimin aynı zamanda olmadığı, sağ hemisfere göre sol hemisferin bir hafta geç geliştiği söylenmiştir (Galaburda ve ark., 1978; Öktem, 2006).

El tercihlerine bakıldığında sağ el baskınlığı, sol el baskınlığı, her iki elin de kullanılması; farklı beceriler için kullanılması ya da aynı şekilde her iki elin birlikte kullanımı (hem sol elle hem de sağ elle çok düzgün yazı yazma) gibi tercihlerden bahsedebiliriz. " Bazı kişiler beceri gerektiren manüel işlevlerin tümünü (yazma, saç tarama, top fırlatma, makas kullanma) sağ elleriyle yerine getirir. Diğer bazıları, sağ elle yazabilir ama top fırlatma ya da saç tarama gibi bazı beceri gerektiren hareketler için sol ellerini kullanırlar. Rutin zihinsel durum değerlendirilmesinde yazma dışındaki aktivitelerle ilgili soru sorulmadı-

ğından, bu bireyleri sağ eli olarak sınıflandırmak eğilimi vardır. Oysaki bu karma el tercihli bireyler, tümüyle sağ elini kullananlarla kıyaslandığında, kayda değer bir biçimde farklı bir hemisferik özelleşme tarzına sahip olabilirler. Bu tip bir bilgiye gerek duyulduğunda, el tercihinin net bir indeksini veren özelleşmiş soruşturular mevcuttur (Mesulam.M., Davranışsal ve Kognitif Nörolojinin İlkeleri, 2. Baskı, Yelkovan Yayıncılık, 2004, s:163)".

Psikiyatrik rahatsızlıklarda Lohr ve Caliguri (1997); şizofreninin sol hemisfer disfonksiyonu, bipolar bozukluğun ise sağ hemisfer disfonksiyonu olabileceğini söylemişler (Tuncel.R, Psicotik Belirtileri olan ve olmayan psikiyatri hastalarında el tercihi dağılımının incelenmesi, Yüksek lisans tezi, 2014). Hastalıklarda hemisfer asimetrisini destekleyen bulgular dendiğinde; mesela QEEG çekilirken genelde depresyonda sol hemisfer baskılanmıştır. Eğer sağ baskılanmışsa da bipolariteden söz edilmektedir. Manik semptomlar gösteren hastalarla yapılan çalışmalar da duygusal uyarılar karşısında artmış subkortikal limbik aktiviteye işaret edilmiştir. "EEG ve QEEG çalışmaları; Duygudurum bozukluğu olanların büyük bir kısmında anormal beyin elektrik aktivitesi olabileceğini bildirmektedir. EEG çalışmaları özellikle sağ hemisferde ufak keskin dalgalar ve paroksizmal aktiviteye sık olarak işaret eder. Yaygın kanı unipolar depresyon hastalarına sıklıkla artmış teta ve alfa baskınlığı, asimetri ve özellikle ön alanlarda hipokoherans olduğu yönündedir. Bipolar hastalar ise sıklıkla azalmış alfa ve artmış beta aktivitesi gösterirler ([http://www.psikiyatridequeeg.com/qeeg\\_kullanimi\\_hakkinda.html](http://www.psikiyatridequeeg.com/qeeg_kullanimi_hakkinda.html))"

Buradan yola çıkarak hemisfer dominansın da duygu durumuna katkıda bulunabileceği düşünülmüştür. Nitekim bu düşünce bir çok meşhur solak ve duygu durum bozukluğu yaşayan insanların hayatı incelendiğinde de desteklenmektedir. Örnek vermek gerekirse Beethoven, Mozart, Michelangelo, Leonardo Da Vinci, Picasso gibi sanatkarlar. Einstein, Napolyon, Fidel Castro, Büyük İskender gibi liderler ki zamanımızda da birçok solak kişiler var. Sanatkarlara baktığımızda Picasso çok evlenmiş, çok aşık olmuş, çok aldatmıştır. Beethovenin yarım kalan aşkları vardır, ay ışığı sonatı sevdiği insana yazılmıştı, duyguların baskınlığı belki de yaratıcılığı arttırıyordu, ya da yaratıcılık duyguların deli dolu gitmesini sağlıyordu. Tartışılır ve bir netlik bulunamaz, kişinin kendisi ile birlikte geçirilen zamanlar, anlar insana gerçeği gösterir. Yaratıcı vasıfları

olup, lider ve isimlerinden söz ettirmiş kişiler de diyebiliriz. Spekülasyon olmaması amaçlı netlikten bahsedilemez, ancak varolan ise insanı göz ardı edilemez diye düşünmeye sevk etmektedir.

Bütün bu bulgular ışığında olgu raporları solaklıkla duygudurum arasında bağ olduğunu düşündürmekle beraber, olgu öyküleri çok güvenilir bilgi vermez, bu nedenle biz bunu güvenilir olarak bir literatür derlemesi yaparak sorgulamak istedik.

## 2. Yöntem

Yapılan çalışmada bipolar bozukluk hand dominans diye literatür tarandı. "Bipolar and handedness" yazarak tarandığında 490, "Bipolar and left-handedness" olarak tarandığında 7, "Bipolar and hand dominance" da 27, "Affective disorder and dominance hand" de 34, "Affective disorder and left-handedness" de 12 ve "Affective disorder and connectivity left handedness" de 14 makale çıktı. Bunların abstraktları okundu sonunda full text olarak çalışmada dahil etme kriteri olarak bipolar bozukluk hastalarında el dominansına bir ölçekle (Edinburg) ya da başka bir soru kriterleriyle Waterloo el baskınlığı anketi (WHO) çalışmalar alındı. Sonuç olarak kriterlerimize uyan 5 tane çıktı.

## 3. Sonuçlar

Sonuçlar için Bipolar hasta kriterlerine tanı kriterleri ile

bakılmış ve yapılan çalışmalarda bipolar ailelerin çocukları ile, bipolar aileler ve aynı zamanda bazı mental rahatsızlıklar da dahil edilmiş olsa da bunlara kıyasla çıkan sonuçlar değerlendirildiğinde karşımıza genelde sağ hemisfer baskınlığının ortaya çıktığını gördük.

## 4. Tartışma

Girişte de bahsettiğimiz gibi, birçok ünlü bipolar var bunlarda solak. Acaba bu bize bipolarlarda solaklık çok mu gibi bir şey düşündürdü bu nedenle bunu tam olarak ortaya koymak için derlemede bulunduk. Karşılaştırma kriterini karşılayan az çalışma bulunmasına rağmen araştırmaya değer bir durumdur diye düşündük.

Tüm çalışmalar genelinde 1230 bipolar alınmıştı. Bunların içinde Bipolar aileler ve bipolar ailelerin çocukları da bulunmaktaydı. El baskınlığı dışında bir araştırmada WISC-R ve Rorschach testleri de yapılmıştı. WISC-R da performans IQ'dan daha yüksek sözel IQ modeli; Rorschach testinde de renk belirleyicilerinin hareket belirleyicilerine daha yüksek oranları olduğu tespit edilmiştir. Ayrıca bulgular sol el kullanımının genel olarak fazla olduğunu göstermektedir. Bipolar ailelerin çocuklarında psikopatolojilerin olduğu saptanmıştır. Sağ eli kullanmama ve bipolar bozukluk arasındaki ilişkiyi değerlendiren bugüne kadarki en büyük çalışmada (796 bipolar) bipolar bozuklukta sağlak olmama oranı % 15 bulundu ve bu da genel popülasyonda yaygın olarak görülen orandan yaklaşık%

| Yıl  | Yazarlar  | Başlık  | Tipi          | Amaç   | Örneklem  | Materyal   | Sonuçlar  |
|------|---|---|---------------|--|---|--|---|
| 1982 | Paolo Decina et al.                                     | Clinical and Psychological Assessment of Children of Bipolar Probands   | Araştırma     | Bipolar bozukluğun başlamasından önce bipolar ebeveynlerin çocukluk ve gençlik çağındaki çocuklarının incelenmesi                                      | 18 bipolar ebeveynin 7-14 yaş arasındaki 31 çocuğu  | (SADS)görüşmesi ile tespit edilen primer bipolar bozukluk için Araştırma Tanı Kriterleri; WISC-R+ Rorschach + el baskınlığı test esnasında gözlemlenmiştir ve motorik lateralizasyon kendinden raporlu anketle onaylanmıştır | sol el kullanımının fazlalığı   |
| 1993 | Brett A. Clementz, William G. Iacono, and Morton Beiser | Handedness in First-Episode Psychotic Patients and Their First-Degree Biological Relatives                    | Araştırma     | Şizofreni, psikotik özellikli majör depresyon ve bipolar psikoz hastalarında ve akrabalarında baskın eli değerlendirmek                                | 117 psikotik probands ve 111 birinci derece akrabalar(36 bipolar psikoz ve 33 onların birinci derece akrabaları) ve 119 psikiyatrik hastalığı olmayan süje ve 42 birinci derece akrabaları, | DSM-III, el baskınlığı ölçeği (Oldfield 1971),   | Şizofreni hastalarında solaklık diğer gruplardan daha fazlaydı  |
| 2006 | J. Savitz, L. Van Der Merwe, M. Solms, R. Ramesar,      | Lateralization of hand skill in bipolar affective disorder  | Araştırma     | BPB'de aşırı sol hemisfer hakimiyetinin duygusal regülasyonda eksikliklere yol açan sağ hemisfer fonksiyon bozukluğuyla ilgili olduğunu değerlendirmek | 47 BPB öyküsü olan aileden 350 birey  | DSM-IV Eksen I Bozukluklar için Yapılandırılmış Klinik Görüşme (SCID), Waterloo El baskınlığı Anketi (WHQ),  | BPB de sağ hemisfer disfonksiyonu var.  |
| 2008 | Cecylia Nowakowska et.al                                | Increased rate of Non-Right Handedness in patients with bipolar disorder                                      | Makale        | Bipolar bozukluğu olan süjelerde sağ el kullanmama oranı ve klinik ilişkileri değerlendirmek   | 796 patient with bipolar disorder type  | Scale 10-maddelik Edinburgh Handedness Inventory (Oldfield ölçeği)   | Bipolar hastalarda genel popülasyonda görülen yaklaşık %50 fazlası, % 15 oranında sağ el kullanmama               |
| 2015 | Naser Goodarzi et al.                                   | The Role of the Hemispheric Lateralization in Mental Disorders by Use of the Limb (Eye, Hand, Foot) Dominance | Pilot çalışma | Psikotik, bipolar ve depresif bozukluğu olan hastalarda üç uzuv (el, ayak ve göz) kullanımıyla hemisferik baskınlığı araştırmak                        | Psikotik, bipolar ve depresif bozukluğu olan 57 erkek ve 26 kadın hasta   | Edinburgh Inventory ölçeği, Chapman ayak tercih envanteri, nişan almak gibi kesinlik gerektiren eylemler için bir delikten bakma   | Kontrol grubuyla karşılaştırıldığında, psikotik, bipolar ve depresif bozukluğu olan hastalarda sol göz baskınlığı |



50 daha fazladır (Annett M ; Lansky LM). Bir çalışmada ise şizofreni hastalarında solaklığın daha fazla olduğu görülmektedir. Sol göz baskınlığının fazla olması da sağ hemisfer baskınlığını destekler niteliktedir. Bipolar bozukluğu olan hastalarda sağlıklı olup olmamanın biyolojik veya fonksiyonel hemisferik asimetri parametreleriyle ilişkili olup olmadığını değerlendirilmek için daha fazla araştırmaya ihtiyaç vardır.

Bu bulguları değerlendirdiğimizde bipolarlık açısından sol baskınlığın artmış olması ki sadece el değil, sol gözde baskınlığın artmış olması duygu durumdaki gel gitlerin beynin işlevsel fonksiyonunun bozulmasıyla birlikte bir düzensizlik olduğunu düşündürmektedir. Bipolar hasta aynı med cezir gibi yoğun gel gitler yaşayabilir ve kendinin farkında olmayabilir. Kendinin farkında olduğunda ise yaptıklarına kendisi de gülebilmektedir. Aynı bir duygusal değişimi son derece hızlı yaşayan bir sanatçı gibi, liderler arasında da bu tarz tutumlar ve davranışlar görülmektedir. Nörotransmitterlerde bir dengesizlik söz konusudur. Kişi kendini dengede tutmaya çalışırken, çevrenin de dengesini bozabilir ve kimi zaman paylaşılmış bir enerji artışı ve hiperaktif bir tutum ile birlikte, kişilerde kontrolün kaybolması nedeniyle yaşanan çöküş, kimi zaman da tam dipte bir durum kendini gösterebilir. Bu tutumlar genellikle duygusal kırgınlıklar ve kabul edememe duygusunun verdiği bir sonuç olabilir! Bipolar bozuklukta beyin doğru zannettiğini yapar ve düşünmeden dürtüsel olarak hareket eder. Kritere uyanları araştırma esnasında aslında yapılacak birçok araştırma olabileceği tespit edildi. Kısıtlılıklar vardı. Örneğin sağ elini kullanan ancak sol ayağıyla futbol oynayan ya da sol eliyle dişini fırçalayan yani yazı yazma dışında birçok aktiviteyi sol eliyle yapanlar ile ilgili karşılaştırmalar yapılabilir. Özellikle bizim kültürümüzde solak çocukların sağ ellerini kullanmaları için aileler tarafından zorlama vardır. Sol eli kullanmanın günah olduğunu düşünenler de bulunmaktadır. Bu gibi kişiler çevresel ve kültürel nedenlerle sonradan sağlıklı olduklarında, psikiyatrik bozukluklara yatkın olabilirler mi düşüncesi üzerine bir araştırma bulamadık.

Tüm bu çalışmalar ışığı altında solaklık ile bipolarite arasında sağ hemisfer baskınlığını gösteren çalışmalar belli oranda olmasına rağmen tartışma götürmez bir sonuç elde edemedik. Ancak bu durum yaptığımız kriterlerin el baskınlığını ölçmesi üzerine olduğundan çok yeterli değildi ve yapılan çalışmaların azlığı ve eksikliği ile de ilgili idi. Bu nedenle Bipolar hastalarda özellikle tam solak ve sağ el ile yazıp diğer aktiviteler için sol uzuvların kullanıldığı kişiler ile karşılaştırmalı ve çeşitli araştırmalar yapılmasının önemli olduğu düşünülmektedir. Bu durum literatürde bir eksiği dolduracaktır kanaatindeyiz.

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## COGNITIVE REMEDIATION THERAPY TOOLBOX DEVELOPMENT FOR TURKISH POPULATION

### TÜRK ÖRNEKLEMİ İÇİN HAZIRLANAN BİR BİLGİSAYARLI BİLİŞSEL ONARIM TERAPİ PROGRAMI

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Dear Editor,

Cognitive remediation therapy (CRT) dates back to 1970s (Meichenbaum and Cameron 1973) and since then it is used for the rehabilitation of the cognitive disfunctioning of several clinical conditions such as schizophrenia (Kluwe-Schiavon et al., 2013; Anaya et al., 2012), mood disorders (Bowie et al., 2013) eating disorders (Tchanturia and Lock, 2011), brain tumor related cognitive deficits (Sacks-Zimmerman et al., 2015) and attention deficits (Wender et al., 2001).

Wykes defines CRT as "A number of different methods of teaching "thinking" skills." CRT is a type of therapy that focuses on the so called 'cold' aspects of cognition such as attention, memory and decision making rather than the 'warm' aspects like emotions (Wykes and van der Gaag, 2001). The main aim of the therapy is to teach the patient a couple of problem solving strategies which can be adapted to daily life situations and makes it easier for the patient to cope with daily life problems. For a long while the materials used for the therapy were pencil and paper, and recently computer based remediation therapy started taking the stage especially because the motivation for the therapy is a main factor for benefitting it (Saperstein and Medalia, 2016) and computer based exercises seem to be more interesting for the patient than paper based ones.

A main factor of benefitting any kind of therapy is its relevance to the culture that it is applied to. For that reason, in our project named "Beynini Çalıştır Kendini Yenile", which started almost a year ago and is supported by Istanbul Development Agency, after reviewing the literature for the CRT applications abroad, especially the

computer-based versions, we developed a CRT toolbox suitable for local culture.

Reha-bil exercises were developed focusing on some main cognitive functions such as attention, memory, decision making, visiospatial abilities and their sub categories: sustained attention, selective attention, short-term memory, working memory, planning, alternating attention, impulse inhibition. For each sub-category, our team had brain storming sessions for finding an original computer-game idea with which the use of that specific cognitive function will be needed and several strategies about the effective use of that function can be discussed. Another major indicator of the game creation process was it is relevance of daily life situations. We created probably scenarios for the exercises such as selecting the rotten fruits from several others, preparing the order of the customer in a fast-food restaurant. By this way we came up with 20 original exercises, all with 5 levels of difficulty and can easily be related to daily-life conditions. The exercises were designed in 3D using Unity 3D game engine. After developing the exercises, we came up with a 16 session CRT program.

Scaffolding, massed practice, errorless learning, positive reinforcement are the main techniques that are used in CRT application and we embedded all these techniques in our exercises.

Scaffolding means starting the exercises at the level appropriate for the participant and adding the bricks of cognitive functions one by one by increasing the level and complexity of the exercise. Therefore, each exercise in Reha-bil program has 5 levels that differ in terms of

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difficulty and complexity. In addition, while most of our exercises focus on different aspects of cognition, a few of them focuses on more than one aspect (so to say, attention, memory and decision making at the same time) so that at the last sessions of the therapy we can help the patient to integrate the steps of the stair. Massed practice helps the patient to digest the strategies learned for solving problems. For that, each level has at least 5 trials or a minimum of 2 minutes of application.

In our everyday life, we tend to learn from our mistakes. However, in CRT, the main aim is to teach the patient the strategies without making errors, so the correct responses are learned implicitly. For errorless learning to take place, we designed the exercises to minimize the risk of error. At the beginning of each exercise, we have slides which explain the exercise in detail and the patient goes over all the slides with the help of the therapist. At the end of the slides, the patient is asked to recall and tell the therapist what the exercise is about, to be sure the exercise was understood well. In addition, our exercises were designed in a way that the therapist can interfere in the exercise where s/he sees a possibility of error making. S/he can pause the exercise, discuss it with the patient, help the patient find an appropriate strategy for the exercise and makes the patient continue when s/he is sure that the possibility of making an error is minimized. Also, because these program will be shared online with people to use it on their own (without a therapist), in each exercise after a reasonable number of errors, the user is asked if s/he wants to see the instruction slides again before continuing. Positive reinforcement is also a main factor in implicit learning as is generously used in CRT application. The computer program also has auditory and visual stimuli for positive reinforcement such as applause sound and check mark.

To sum up, Reha-bil CRT toolbox is a ready-to-use computer based, 3D exercise program that is relevant for Turkish population and was designed sensitive to the application of main techniques used in CRT therapy: scaffolding, massed practice, errorless learning, positive reinforcement.

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