A PHARMACEUTICAL COMPOSITION COMPRISING THE PHYTOCANNABINOIDS CANNABIDIVARIN (CBDV) AND CANNABIDIOL (CBD)

[0001] This invention relates to a pharmaceutical composition comprising or consisting essentially of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD).

[0002] The composition is particularly safe and efficacious for use in the treatment of neurological conditions, characterized by hyper-excitability of the central nervous system, convulsions or seizures such as occur in epilepsy.

[0003] Preferably the CBDV and the CBD are present with at least one non-cannabinoid component of cannabis such as one or more terpenes or a terpene fraction.

[0004] More particularly the composition further comprises one or more cannabichromene type compounds. Particularly cannabichromene propyl variant (CBCV) and / or cannabichromene (CBC).

[0005] More particularly still the composition is absent or substantially absent of other cannabinoids, including in particular tetrahydrocannabinol (THC) and tetrahydrocannabivarin (THCV), which would normally be present in significant amounts in cannabis chemotypes bred to contain a significant amount of CBDV and / or CBD.

BACKGROUND

[0006] Epilepsy is a chronic neurological disorder presenting a wide spectrum of diseases that affects approximately 50 million people worldwide (Sander, 2003). Advances in the understanding of the body's internal 'endocannabinoid' system has lead to the suggestion that cannabis-based medicines may have the potential to treat this disorder of hyperexcitability in the central nervous system (Mackie, 2006, Wingerchuk, 2004, Alger, 2006).

[0007] Cannabis has been ascribed both pro-convulsant (Brust et al., 1992) and anti-convulsant effects. Therefore, it remains to determine whether cannabinoids represent a yet to be unmasked therapeutic anticonvulsant or, conversely, a potential risk factor to recreational and medicinal users of cannabis (Ferdinand et al., 2005).

[0008] In 1975 Consroe et al. described the case of young man whose standard treatment (phenobarbital and phenytoin), didn't control his seizures. When he began to smoke cannabis socially he had no seizures. However when he took only cannabis the seizures returned. They concluded that 'marihuana may possess an anti-convulsant effect in human epilepsy'.

[0009] A study by Ng (1990) involved a larger population of 308 epileptic patients who had

been admitted to hospital after their first seizure. They were compared to a control population of 294 patients who had not had seizures, and it was found that using cannabis seemed to reduce the likelihood of having a seizure. However this study was criticized in an Institute of Medicine report (1999) which claimed it was 'weak', as 'the study did not include measures of health status prior to hospital admissions and differences in their health status might have influenced their drug use' rather than the other way round.

[0010] Three controlled trials have investigated the anti-epilepsy potential of cannabidiol. In each, cannabidiol was given in oral form to sufferers of generalised grand mal or focal seizures.

[0011] Cunha et al (1980) reported a study on 16 grand mal patients who were not doing well on conventional medication. They received their regular medication and either 200-300mg of cannabidiol or a placebo. Of the patients who received CBD, 3 showed complete improvement, 2 partial, 2 minor, while 1 remained unchanged. The only unwanted effect was mild sedation. Of the patients who received the placebo, 1 improved and 7 remained unchanged.

[0012] Ames (1986) reported a less successful study in which 12 epileptic patients were given 200-300mg of cannabidiol per day, in addition to standard antiepileptic drugs. There seemed to be no significant improvement in seizure frequency.

[0013] Trembly et al (1990) performed an open trial with a single patient who was given 900-1200mg of cannabidiol a day for 10 months. Seizure frequency was markedly reduced in this single patient.

[0014] In addition to the disclosures suggesting CBD may be beneficial there is a report (Davis & Romsey) of tetrahydrocannabinol (THC) being administered to 5 institutionalized children who were not responding to their standard treatment (phenobarbital and phenoytin). One became entirely free of seizures, one became almost completely free of seizures, and the other three did no worse than before.

[0015] In WO 2006/054057 it is suggested that the cannabinoid tetrahydrocannabivarin (THCV) may behave as anti-epileptic. However the main teaching in this document is the determination that THCV acts as a CB1 antagonist.

[0016] The application WO 2007/138322 shows CBD to be an inverse agonist at the CB1 and CB2 receptors and suggests this compound and structurally related compounds including CBDV, may have a therapeutic benefit in a wide range of conditions which involve these receptors. More specifically the data demonstrates that the cannabinoid CBD reduced bodyweight in rats.

[0017] However other work on cannabinoids has shown that despite THCV's structural similarity to THC the two compounds behave quite differently at the CB1 receptor and

consequently it does not follow that the propyl cannabinoid analogs will behave as their pentyl equivalents.

[0018] In addition a study in 2007 by Deshpande *et al.* established that the CB1 antagonist rimonabant was a pro-convulsant; this study demonstrated that antagonism of the CB1 receptor caused epileptic activity. The inference from this study is that cannabinoids which act as antagonists of the CB1 receptor may not be useful as anti-convulsants; indeed they may exacerbate such a condition.

[0019] The application WO 2007/083098 describes the use of cannabis plant extracts with neuroprotective properties. Cannabinoid extracts containing THC and CBD were shown to be more effective than their pure counterparts in this area of medicine.

[0020] The application WO 02/064109 describes a pharmaceutical formulation where the cannabinoids THC and CBD are used. The application goes on to state that the propyl analogs of these cannabinoids may also be used in the formulation. Since this application was written it has been shown that THCV behaves in a very different manner to THC and therefore the assumption that the propyl analogs of cannabinoids may behave in a similar manner to their pentyl counterparts is now not valid.

[0021] The application GB2471565 describes the use of THCV for the treatment of generalised seizures; it also describes the use of CBD in combination with THCV.

[0022] The application GB1005364.3 (unpublished) describes the use of CBDV for use in the treatment of epilepsy.

[0023] The condition of epilepsy is a very difficult to treat disease, there are more than forty recognisable types of epileptic syndrome partly due to seizure susceptibility varying from patient to patient (McCormick and Contreras, 2001, Lutz, 2004) and a challenge is finding drugs which are effective against these differing types.

[0024] Neuronal activity is a prerequisite for proper brain function. However, disturbing the excitatory - inhibitory equilibrium of neuronal activity may induce epileptic seizures. These epileptic seizures can be grouped into two basic categories:

a) partial, and
b) generalised seizures.

Partial seizures originate in specific brain regions and remain localised – most commonly the temporal lobes (containing the hippocampus), whereas generalised seizures appear in the entire forebrain as a secondary generalisation of a partial seizure (McCormick and Contreras, 2001, Lutz, 2004). This concept of partial and generalised seizure classification did not become common practice until the International League Against Epilepsy published a classification

scheme of epileptic seizures in 1969 (Merlis, 1970, Gastaut, 1970, Dreifuss et al., 1981).

[0025] The International League Against Epilepsy further classified partial seizures, separating them into simple and complex, depending on the presence or the impairment of a consciousness state (Dreifuss et al., 1981).

[0026] The League also categorized generalised seizures into numerous clinical seizure types, some examples of which are outlined below:

[0027] Absence seizures occur frequently, having a sudden onset and interruption of ongoing activities. Additionally, speech is slowed or impeded with seizures lasting only a few seconds (Dreifuss et al., 1981).

[0028] Tonic-clonic seizures, often known as "grand mal", are the most frequently encountered of the generalised seizures (Dreifuss et al., 1981). This generalised seizure type has two stages: tonic muscle contractions which then give way to a clonic stage of convulsive movements. The patient remains unconscious throughout the seizure and for a variable period of time afterwards.

[0029] Atonic seizures, known as "drop attacks", are the result of sudden loss of muscle tone to either a specific muscle, muscle group or all muscles in the body (Dreifuss et al., 1981).

[0030] The onset of epileptic seizures can be life threatening with sufferers also experiencing long-term health implications (Lutz, 2004). These implications may take many forms:

- mental health problems (e.g. prevention of normal glutamatergic synapse development in childhood);
- cognitive deficits (e.g. diminishing ability of neuronal circuits in the hippocampus to learn and store memories); and
- morphological changes (e.g. selective loss of neurons in the CA1 and CA3 regions of the hippocampus in patients presenting mesial temporal lobe epilepsy as a result of excitotoxicity) (Swann, 2004, Avoli et al., 2005)

[0031] It is noteworthy that epilepsy also greatly affects the lifestyle of the sufferer – potentially living in fear of consequential injury (e.g. head injury) resulting from a *grand mal* seizure or the inability to perform daily tasks or the inability to drive a car unless having had a lengthy seizure-free period (Fisher et al., 2000).

[0032] Despite the historic work on CBD in epilepsy in the 1980's/1990's, research in the field of anti-convulsants has focused on many other candidates many of which are now approved for use in the treatment of epilepsy. Such drugs include: acetozolamide, carbamazepine, clobazam, clonazepam, ethosuximide, eslicarbazepine acetate, gabapentin, lacosamide,

lamotriquine, levetiracetam, oxcarbazepine, phenobarbital, phenytoin, pregabalin, primidone, rufinamide, sodium valproate, tiagabine, topiramate, valproate, vigabatrin, and zonisamide.

[0033] The mode of action of some of these is understood and for others is unknown. Some modes of action are set out in Table 1 below: (Adapted from: Schachter SC. Treatment of seizures. In: Schachter SC, Schomer DL, eds. The comprehensive evaluation and treatment of epilepsy. San Diego, CA: Academic Press; 1997. p. 61-74)

[0034] Table 1.

Antiepileptic drug	**Mechanism of action**	**Sodium or calcium or GABA channel involvement**
Barbiturates: primidone (Mysoline), phenobarbital	Enhances GABAergic inhibition	GABA
Carbamazepine (Tegretol, Tegretol-XR, Carbatrol)	Inhibits voltage-dependent sodium channels	Sodium
Ethosuximide (Zarontin)	Modifies low-threshold or transient neuronal calcium currents	Calcium
Felbamate (Felbatol)	Unknown	
Gabapentin (Neurontin)	Unknown	
Lamotrigine (Lamictal)	Inhibits voltage-dependent sodium channels, resulting in decreased release of the excitatory neurotransmitters glutamate and aspartate	Sodium
Phenytoin (Dilantin, Phenytek)	Blocks sodium-dependent action potentials; reduces neuronal calcium uptake	Sodium/Calcium
Valproate (Depakote, Depakote ER, Depakene, valproic acid)	Reduces high-frequency neuronal firing and sodium-dependent action potentials; enhances GABA effects	Sodium/ GABA

[0035] However despite the introduction of some twenty different compounds for treatment of epilepsy over the last twenty years there remains a need for alternate drugs for several reasons:

i) 1-2% of the world's population suffer from epilepsy (http://www.ncbi.nlm.nih.gov/sites/ppmc/articles/PMC1808496/);

ii) Of these 30% are refractory to existing treatments; and

iii) There are also notable motor side effects in the existing therapies (http://en.wikipedia.org/wiki/Epilepsy).

[0036] For example valproate and ethosuximide both exhibit notable motor and other side effects (including sedation) when given to rats at doses greater than 200mg/kg, as does phenobarbital at doses greater than 250 mg/kg in rat models of epilepsy.

[0037] Three well-established and extensively used *in vivo* models of epilepsy are:

- pentylenetetrazole-induced (PTZ) model of generalised seizures (Obay et al., 2007, Rauca et al., 2004);
- pilocarpine-induced model of temporal lobe (i.e. hippocampus) seizures (Pereira et al., 2007); and
- penicillin-induced model of partial seizures (Bostanci and Bagirici, 2006).

These provide a range of seizure and epilepsy models, essential for therapeutic research in humans.

[0038] In the foregoing specification the following terms are used and are intended to have the following meanings / definitions:

[0039] "Cannabinoids" are a group of compounds including the endocannabinoids, the phytocannabinoids and those which are neither endocannabinoids or phytocannabinoids, hereafter "syntho-cannabinoids".

[0040] "Endocannabinoids" are endogenous cannabinoids, which are high affinity ligands of CB1 and CB2 receptors.

[0041] "Phytocannabinoids" are cannabinoids that originate in nature and can be found in the cannabis plant. The phytocannabinoids can be present in an extract including a botanical drug substance, isolated, or reproduced synthetically.

[0042] "Syntho-cannabinoids" are those compounds capable of interacting with the cannabinoid receptors (CB1 and / or CB2) but are not found endogenously or in the cannabis plant. Examples include WIN 55212 and rimonabant.

[0043] An "isolated phytocannabinoid" is one which has been extracted from the cannabis plant and purified to such an extent that all the additional components such as secondary and minor cannabinoids and the non-cannabinoid fraction have been removed.

[0044] A "synthetic cannabinoid" is one which has been produced by chemical synthesis this term includes modifying an isolated phytocannabinoid, by for example forming a pharmaceutically acceptable salt thereof.

[0045] A "botanical drug substance" or "BDS" is defined in the Guidance for Industry Botanical Drug Products Draft Guidance, August 2000, US Department of Health and Human Services, Food and Drug Administration Centre for Drug Evaluation and Research as: "A drug derived from one or more plants, algae, or microscopic fungi. It is prepared from botanical raw materials by one or more of the following processes: pulverisation, decoction, expression, aqueous extraction, ethanolic extraction or other similar processes." A botanical drug substance does not include a highly purified or chemically modified substance derived from natural sources. Thus, in the case of cannabis, BDS derived from cannabis plants do not include highly purified Pharmacopoeial grade cannabinoids.

[0046] In the present invention a BDS is considered to have two components: the phytocannabinoid-containing component and the non-phytocannabinoid containing component. Preferably the phytocannabinoid-containing component is the larger component comprising greater than 50% (w/w) of the total BDS and the non-phytocannabinoid containing component is the smaller component comprising less than 50% (w/w) of the total BDS.

[0047] The amount of phytocannabinoid-containing component in the BDS may be greater than 55%, through 60%, 65%, 70%, 75%, 80% to 85% or more of the total extract. The actual amount is likely to depend on the starting material used and the method of extraction used.

[0048] The "principle phytocannabinoid" in a BDS is the phytocannabinoid that is present in an amount that is higher than that of the other phytocannabinoids. Preferably the principle phytocannabinoid is present in an amount greater than 40% (w/w) of the total extract. More preferably the principle phytocannabinoid is present in an amount greater than 50% (w/w) of the total extract. More preferably still the principle phytocannabinoid is present in an amount greater than 60% (w/w) of the total extract.

[0049] The amount of the principle phytocannabinoid in the BDS is preferably greater than 50% of the phytocannabinoid-containing fraction, more preferably still greater than 55% of the phytocannabinoid-containing fraction, and more preferably still greater than 60% through 65%, 70%, 75%, 80%, 85%, 90% and 95% of the phytocannabinoid-containing fraction.

[0050] The "secondary phytocannabinoid/s" in a BDS is the phytocannabinoid/s that is / are present in significant proportions. Preferably the secondary phytocannabinoid is present in an amount greater than 5% (w/w) of the total extract, more preferably greater than 10% (w/w) of the total extract, more preferably still greater than 15% (w/w) of the total extract. Some BDS's will have two or more secondary phytocannabinoids that are present in significant amounts. However not all BDS's will have a secondary phytocannabinoid.

[0051] The "minor phytocannabinoid/s" in a BDS can be described as the remainder of all the phytocannabinoid components once the principle and secondary phytocannabinoids are

accounted for. Preferably the minor phytocannabinoids are present in total in an amount of less than 5% (w/w) of the total extract, and most preferably the minor phytocannabinoid is present in an amount less than 2% (w/w) of the total extract.

[0052] The term "absent" or "substantially absent" refers to less than 1%, preferably less than 0.5%, more preferably still less than 0.3%, most preferably less than 0.1% (w/w) of total extract.

[0053] The term "consisting essentially of" is limited to the phytocannabinoids which are specified, it does not exclude non-cannabinoid components that may also be present.

[0054] Typically the non-phytocannabinoid containing component of the BDS comprises terpenes, sterols, triglycerides, alkanes, squalenes, tocopherols and carotenoids.

[0055] These compounds may play an important role in the pharmacology of the BDS either alone or in combination with the phytocannabinoid.

[0056] The "terpene fraction" may be of significance and can be broken down by the type of terpene: monoterpene or sesquiterpene. These terpene components can be further defined in a similar manner to the cannabinoids.

[0057] The amount of non-phytocannabinoid containing component in the BDS may be less than 45%, through 40%, 35%, 30%, 25%, 20% to 15% or less of the total extract. The actual amount is likely to depend on the starting material used and the method of extraction used.

[0058] The "principle monoterpene/s" in a BDS is the monoterpene that is present in an amount that is higher than that of the other monoterpenes. Preferably the principle monoterpene/s is present in an amount greater than 20% (w/w) of the total terpene content. More preferably the principle monoterpene is present in an amount greater than 30% (w/w) of the total terpene content, more preferably still greater than 40% (w/w) of the total terpene content, and more preferably still greater than 50% (w/w) of the total terpene content. The principle monoterpene is preferably a myrcene or pinene. In some cases there may be two principle monoterpenes. Where this is the case the principle monoterpenes are preferably a pinene and / or a myrcene.

[0059] The "principle sesquiterpene" in a BDS is the sesquiterpene that is present in an amount that is higher than all the other sesquiterpenes. Preferably the principle sesquiterpene is present in an amount greater than 20% (w/w) of the total terpene content, more preferably still greater than 30% (w/w) of the total terpene content. The principle sesquiterpene is preferably a caryophyllene and / or a humulene.

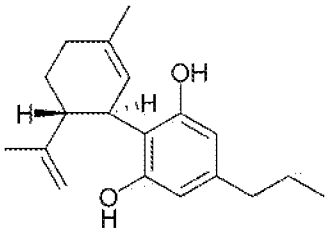
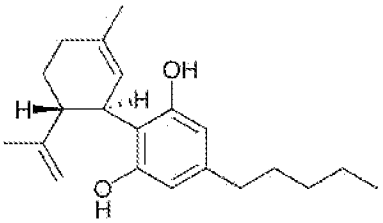
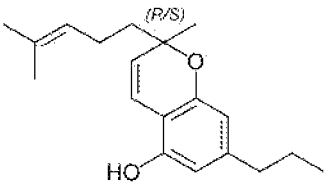
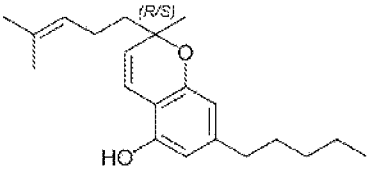
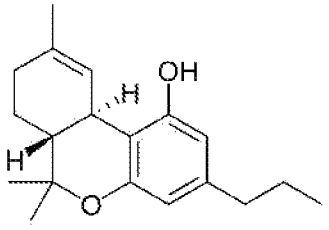
[0060] The sesquiterpene components may have a "secondary sesquiterpene". The secondary sesquiterpene is preferably a pinene, which is preferably present at an amount greater than 5% (w/w) of the total terpene content, more preferably the secondary

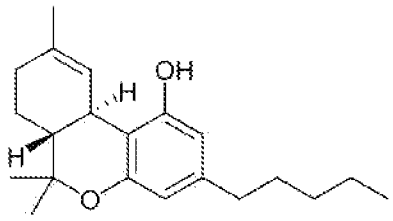
sesquiterpene is present at an amount greater than 10% (w/w) of the total terpene content.

[0061] The secondary sesquiterpene is preferably a humulene which is preferably present at an amount greater than 5% (w/w) of the total terpene content, more preferably the secondary sesquiterpene is present at an amount greater than 10% (w/w) of the total terpene content.

[0062] Alternatively botanical extracts may be prepared by introducing isolated phytocannabinoids or their synthetic equivalent into a non-cannabinoid plant fraction as can be obtained from a zero cannabinoid plant or one or more non-cannabinoid components found in the cannabis plant such as terpenes.

[0063] The structures of the phytocannabinoids CBDV, CBD, CBCV, CBC, THCV and THC are as shown below:

CBDV	Cannabidivarin	
CBD	Cannabidiol	
CBCV	Cannabichromene propyl variant	
CBC	Cannabichromene	
THCV	Tetrahydrocannabivarin	

THC	Tetrahydrocannabinol	

[0064] Phytocannabinoids can be found as either the neutral (decarboxylated form) or the carboxylic acid form depending on the method used to extract the cannabinoids. For example it is known that heating the carboxylic acid form will cause most of the carboxylic acid form to decarboxylate into the neutral form.

[0065] Where a synthetic phytocannabinoid is used the term is intended to include compounds, metabolites or derivatives thereof, and pharmaceutically acceptable salts of such compounds.

[0066] The term “pharmaceutically acceptable salts” refers to salts or esters prepared from pharmaceutically acceptable non-toxic bases or acids, including inorganic bases or acids and organic bases or acids, as would be well known to persons skilled in the art. Many suitable inorganic and organic bases are known in the art.

[0067] Phytocannabinoids can occur as either the pentyl (5 carbon atoms) or propyl (3 carbon atoms) variant. Initially it was thought that the propyl and pentyl variants would have similar properties, however recent research suggests this is not true. For example the phytocannabinoid THC is known to be a CB1 receptor agonist whereas the propyl variant THCV has been discovered to be a CB1 receptor antagonist meaning that it has almost opposite effects. This is confirmed by Pertwee (2000) in Cannabinoid receptor ligands: clinical and neuropharmacological considerations relevant to future drug discovery and development,

[0068] It is an object of the present invention to identify compositions which are safe and efficacious for use in the treatment of neurological conditions, characterized by hyper-excitability of the central nervous system, convulsions or seizures such as occur in epilepsy.

[0069] Indeed, a major drawback with existing standard anti-epileptic drugs (SAEDs) is that 30% are refractory to existing treatments and there are also notable motor side effects in the existing therapies. Thus it is desirable to use compounds or combinations which reduce or are absent of such side effects.

BRIEF SUMMARY OF THE DISCLOSURE

[0070] In accordance with a first aspect of the present invention there is provided a composition comprising or consisting essentially of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD).

[0071] Preferably the composition further comprising one or more excipients.

[0072] Preferably the composition further comprises at least one non-cannabinoid component of cannabis. More preferably the at least one non-cannabinoid component of cannabis is or comprises a terpene.

[0073] With reference to terpenes it should be noted that terpenes can be classified further into monoterpenes or sesquiterpenes. Common monoterpenes found in cannabis include myrcene and pinene and common sesquiterpenes found in cannabis include caryophyllenes and humulene.

[0074] Preferably the composition comprises or consists essentially of CBDV, CBD and one or more cannabichromene type compounds. More preferably the one or more cannabichromene type compounds is cannabichromene propyl variant (CBCV) and / or cannabichromene (CBC).

[0075] Preferably the composition is absent or substantially absent of any other cannabinoids. More preferably the composition is absent or substantially absent of the cannabinoids tetrahydrocannabivarin (THCV) and / or tetrahydrocannabinol (THC).

[0076] In particular the composition should comprise less than 0.3% (w/w) THC.

[0077] Preferably the composition comprises or consists essentially of the cannabinoids CBDV and CBD in a ratio of from 7:1 to 1:2 (CBDV:CBD). More preferably the CBDV and CBD are present in a ratio of from 5:1 to 1:1 (CBDV:CBD). More preferably still the CBDV and CBD are present in a ratio of 4.5:1 to 2:1 (CBDV:CBD).

[0078] Preferably the composition is packaged for delivery in a unit dosage form. More preferably the unit dosage form comprises from 500 to 2000 mg CBDV and from 100 to 600 mg CBD.

[0079] A “unit dose” is herein defined as a maximum dose of medication that can be taken at any one time or within a specified dosage period such as for example, 4 hours.

[0080] In a further embodiment of the present invention the composition further comprises a standard anti-epileptic drug (SAED).

[0081] A standard anti-epileptic drug is a medicament with anti-convulsant activity that is or has been used in the treatment of epilepsy.

[0082] In accordance with a second aspect of the present invention there is provided an extract or BDS comprising the phytocannabinoids CBDV and CBD but substantially absent of the cannabinoids THCV and THC.

[0083] The cannabinoids THCV and THC may not desirable components of a composition for use in the treatment of epilepsy for several reasons. In the case of THCV the fact that this phytocannabinoid is a known CB1 receptor antagonist gives rise to questions over the appropriateness of THCV for use in the treatment of epilepsy, particularly when one considers the evidence provided by Deshpande *et al*. that CB1 antagonists may be pro-convulsant and may give rise to suicidal tendencies. In the case of THC it is not clearly known whether THC is a pro- or anti-convulsant, however it is widely acknowledged that some of the side effects caused by THC, such as psychosis and anxiety, are particularly undesirable.

[0084] Preferably the extract or BDS further comprises one or more non-cannabinoid component(s).

[0085] In accordance with a third aspect of the present invention there is provided a combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD) for use in the treatment of neurological conditions, characterised by hyper-excitability of the central nervous system, convulsions or seizures.

[0086] Preferably the combination of the the neurological condition is epilepsy. More preferably the type of epilepsy to be treated is generalised seizure.

[0087] Preferably the combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD) further comprises a standard anti-epileptic drug (SAED).

[0088] Preferably the combination of the phytocannabinoids CBDV and CBD are absent or substantially absent of any other cannabinoids. More preferably the composition is absent or substantially absent of the cannabinoids tetrahydrocannabivarin (THCV) and / or tetrahydrocannabinol (THC).

[0089] In accordance with a fourth aspect of the present invention there is provided the use of a combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD) in the manufacture of a medicament for use in the treatment of neurological conditions, characterised by hyper-excitability of the central nervous system, convulsions or seizures.

[0090] Preferably the medicament is absent or substantially absent of any other cannabinoids. More preferably the composition is absent or substantially absent of the cannabinoids tetrahydrocannabivarin (THCV) and / or tetrahydrocannabinol (THC).

[0091] In accordance with a fifth aspect of the present invention there is provided a method for the treatment of neurological conditions, characterised by hyper-excitability of the central

nervous system, convulsions or seizures, which comprises administering to a subject in need thereof a therapeutically effective amount of a combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD).

[0092] Preferably the therapeutically effective amount of a combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD) is absent or substantially absent of any other cannabinoids. More preferably the composition is absent or substantially absent of the cannabinoids tetrahydrocannabivarin (THCV) and / or tetrahydrocannabinol (THC).

BRIEF DESCRIPTION OF THE DRAWINGS

[0093] Embodiments of the invention are further described hereinafter with reference to the accompanying drawings, in which

[0094] Figure 1 shows the maximum seizure severity of the CBDV (-/-) BDS in the PTZ model of epilepsy;

[0095] Figure 2 shows the percentage mortality of the CBDV (-/-) BDS in the PTZ model of epilepsy;

[0096] Figure 3 shows the percentage of animals that were seizure free in the CBDV (-/-) BDS in the PTZ model of epilepsy;

[0097] Figure 4 shows the latency to seizure onset in the CBDV (-/-) BDS in the PTZ model of epilepsy; and

[0098] Figure 5 shows the percentage of animals that experienced tonic-clonic seizures in the CBDV (-/-) BDS in the PTZ model of epilepsy.

[0099] The CBDV (-/-) BDS is used to designate a CBDV BDS from which THCV and THC have been selectively removed.

DETAILED DESCRIPTION

[00100] Example 1 below describes the use of a CBDV botanical drug substance (BDS) from which the cannabinoids THCV and THC have been selectively removed, hereinafter CBDV (-/-) BDS. The PTZ model of generalized seizures in epilepsy was used to determine the anti-convulsant activity of the test article.

Example 1

Use of a composition comprising CBDV and CBD in the PTZ model of generalised seizures

Methodology:

Animals:

[00101] Male Wistar rats (P24-29; 75-110g) were used to assess the combined effect of a composition comprising the phytocannabinoids CBDV and CBD in the PTZ model of generalised seizures. Animals were habituated to the test environment, cages, injection protocol and handling prior to experimentation. Animals were housed in a room at 21°C on a 12 hour light: dark cycle (lights on 0900) in 50% humidity, with free access to food and water.

[00102] The human dose equivalent (HED) can be estimated using the following formula:

$$\text{HED} = \text{Animal dose (mg/kg)} \textit{ multiplied by } \frac{\text{Animal } K_m}{\text{Human } K_m}$$

The K_m for a rat is 6 and the K_m for a human is 37.

Thus, for a human of approx 60Kg a 200mg/Kg dose in rat would equate to a human daily dose of about 2000mg.

Composition

[00103] A composition was prepared using a CBDV botanical drug substance (BDS) that had been further prepared by centrifugal partition chromatography to remove the cannabinoids THCV and THC, such that the cannabinoids consisted essentially of CBDV and CBD, and lesser amounts of CBCV and CBC. This BDS is termed CBDV (-/-) BDS for the purpose of this application.

Experimental setup:

[00104] Five 6L Perspex tanks with lids were placed on a single bench with dividers between them. Closed-circuit television (CCTV) cameras were mounted onto the dividers to observe rat behaviour. Sony Topica CCD cameras (Bluecherry, USA) were linked via BNC cables to a low-noise PC via Brooktree digital capture cards (Bluecherry, USA). Zoneminder (http://www.zoneminder.com) software was used to monitor rats, start and end recordings and manage video files. In-house Linux scripts were used to encode video files into a suitable format for further offline analysis using The Observer (Noldus Technologies).

PTZ model:

[00105] A range of doses of PTZ (50-100mg/kg body weight) were used to determine the best

dose for induction of seizures. As a result, a dose of 85mg/kg injected intra-peritoneally (IP; stock solution 50mg/ml in 0.9% saline) were used to screen the CBDV (-/-) BDS test article.

Experimental Protocols:

[00106] On the day of testing, the CBDV (-/-) BDS was administered via intra-peritoneal (i.p.) injection at doses of 50, 100, 200, 275 and 346 mg/kg alongside animals that were injected with a matched volume of the cannabinoid vehicle (2:1:17 ethanol : Cremophor : saline), which served as the negative control group, (giving defined doses of CBDV and CBD as set out in Table 1.1 below). Animals were then observed for 1 hour, after which time they received an IP injection of 85mg/kg PTZ. Negative vehicle controls were performed in parallel with cannabinoid-dosed subjects. After receiving a dose of PTZ, animals were observed and videoed to determine the severity of seizure and latency to several seizure behaviour types (see *in vivo* analysis, below). Animals were filmed for half an hour after last sign of seizure, and then returned to their cage.

Dose groups:

[00107] Table 1.1 below demonstrates the respective content of the cannabinoids CBDV and CBD in the different dose groups of the CBDV (-/-) BDS.

Table 1.1:

Dose group (amount of test article)	CBDV content (mg/kg)	CBD content (mg/kg)	Ratio (CBDV:CBD)
Vehicle	0	0	-
50 mg/kg	29	7	4.14 : 1
100 mg/kg	58	14	4.14 : 1
200 mg/kg	116	27	4.29 : 1
275 mg/kg	159	38	4.18 : 1
346 mg/kg	200	47	4.25 : 1

***In vivo* analysis:**

[00108] Animals were observed during experimental procedures, but all analysis was performed offline on recorded video files using The Observer behavioural analysis software (Noldus, Netherlands). A seizure severity scoring system was used to determine the levels of

seizure experienced by subjects (Pohl & Mares, 1987). All signs of seizure were detailed for all animals.

Table 1.2 Seizure severity scoring scale, adapted from Pohl & Mares, 1987.

Seizure score	Behavioural expression	Righting reflex
0	No changes to behaviour	Preserved
0.5	Abnormal behaviour (sniffing, excessive washing, orientation)	Preserved
1	Isolated myoclonic jerks	Preserved
2	Atypical clonic seizure	Preserved
3	Fully developed bilateral forelimb clonus	Preserved
3.5	Forelimb clonus with tonic component and body twist	Preserved
4	Tonic-clonic seizure with suppressed tonic phase	Lost
5	Fully developed tonic-clonic seizure	Lost
6	Death	

Latency from injection of PTZ to specific indicators of seizure development:

[00109] The latency (in seconds) from injection of PTZ to first myoclonic jerk (FMJ; score of 1), and to the animal attaining "forelimb clonus with tonic component and body twist" (score of 3.5) were recorded. FMJ is an indicator of the onset of seizure activity, whilst >90% of animals developed scores of 3.5, and so is a good marker of the development of more severe seizures. Data are presented as the mean ± S.E.M. within an experimental group.

Maximum seizure severity:

[00110] This is given as the median value for each experimental group based on the scoring scale below.

Percentage mortality:

[00111] The percentage of animals within an experimental group that died as a result of PTZ-induced seizures. Note that the majority of animals that developed tonic-clonic seizures (scores of 4 and 5) died as a result, and that a score of 6 (death) automatically denotes that the animal also experienced tonic-clonic seizures.

Seizure duration:

[00112] The time (in seconds) from the first sign of seizure (typically FMJ) to either the last sign of seizure or, in the case of subjects that died, the time of death – separated into animals that survived and those that did not. This is given as the mean ± S.E.M. for each experimental

group.

Statistics:

[00113] For measures of latency and severity, one way analysis of variance (ANOVA) was performed on all the groups together in order to detect overall effects of the test article ($p \leq 0.05$ considered significant), and is denoted by a '*' in the figures.

[00114] Significant ANOVA results were followed by post hoc tests to test differences between vehicle and drug groups (Tukey's test, $p \leq 0.05$ considered significant), and is denoted by a '*' in the figures.

Results:

[00115] Figure 1 illustrates the maximum seizure severity, a significant effect of the CBDV (-/-) BDS on the maximum seizure severity was observed at a dose of 275mg/kg CBDV (-/-) BDS.

[00116] Figure 2 illustrates the percentage mortality of the animals dosed with the CBDV (-/-) BDS. As can be observed the animals given the, 200 and 275 mg/kg CBDV (-/-) BDS had a strongly statistical significance and the animals given the highest dose (346 mg/kg CBDV (-/-) BDS had a less statistical significance but still resulted in a decrease in the percentage mortality.

[00117] Figure 3 illustrates that although no significant effect of the CBDV (-/-) BDS was observed on the percentage of animals that were seizure free, the 275 mg/kg dose resulted in 20% of the animals becoming seizure free.

[00118] Figure 4 illustrates the latency to seizure onset was statistically increased in all of the high dose groups (200, 275 and 346 mg/kg) of the CBDV (-/-) BDS.

[00119] Figure 5 illustrates the percentage of animals that experienced the severe tonic-clonic seizures decreased in the higher dose groups (200, 275 and 346 mg/kg) of the CBDV (-/-) BDS; however the decrease was not statistically significant.

Conclusion:

[00120] From the above data it would appear that the CBDV (-/-) BDS composition will reduce seizure severity and mortality and increase latency to onset of seizures, making it a desirable composition for use in the treatment of epilepsy.

[00121] The omission of the cannabinoids THCV and THC from a BDS further obviates concerns associated with CB1 antagonism and psychosis.

Example 2

Analysis of CBDV (-/-) BDS

[00122] The CBDV (-/-) BDS which was used in Example 1 above can be obtained using centrifugal partition chromatography (CPC) of a CBDV (+/+) BDS.

[00123] A CBDV (-/-) BDS has been produced and analysed as described in Table 2.1 below:

Table 2.1 CBDV (-/-) BDS amount in total and range

CBDV (-/-) BDS	Amount (% w/w)	Range (± 10%)	Range (± 25%)	Range (± 50%)
CBDVA	0.14	0.13 – 0.15	0.11 – 0.18	0.07 – 0.21
CBDV	**41.19**	**37.07 – 45.31**	**30.89 – 51.49**	**20.60 – 61.79**
CBDA	0.07	0.06 – 0.08	0.05 – 0.09	0.04 – 0.11
CBG	0.59	0.53 – 0.65	0.44 – 0.74	0.30 – 0.89
CBD	**17.70**	**15.93 – 19.47**	**13.28 – 22.13**	**8.85 – 26.55**
CBCV	4.35	3.92 – 4.79	3.26 – 5.44	2.18 – 6.53
CBDV (related substances)	2.20	1.98 – 2.42	1.65 – 2.75	1.10 – 3.30
CBC	0.93	0.84 – 1.02	0.70 – 1.16	0.47 – 1.40
Total Cannabinoids	**67.17**			
Total Non-cannabinoids	**32.83**			

[00124] The total phytocannabinoid containing fraction of CBDV (-/-) BDS comprises approximately 41% of the total BDS. According to variation this fraction may vary by ± 10% up to ± 50%.

Table 2.2 Cannabidivarin (-/-) BDS by percentage cannabinoid

CBDV (-/-) BDS	Amount (% of total cannabinoid)
CBDVA	0.23
CBDV	**61.30**
CBDA	0.11
CBG	0.96
CBD	**28.90**
CBCV	7.11

CBDV (related substances)	3.60
CBC	1.52

[00125] The amount of the principle phytocannabinoid in the CBDV (-/-) BDS as a percentage of the phytocannabinoid containing fraction is approximately 61%. According to variation this fraction may vary by ± 10% up to ± 50%.

[00126] In this Example it is intended that references be made to the principle or secondary components independently of the 'other' cannabinoids.

Comparative Example 3

CBDV (+/+) BDS analysis

[00127] The following example is included to provide details of the components of the CBDV (+/+) BDS. The CBDV (+/+) BDS was obtained by subcritical CO_2 extraction. It comprises, as well as CBDV, the cannabinoids CBD, THCV and THC in significant quantities (each greater than 1% by weight as a percentage of total cannabinoid content). THC has been ascribed a pro-convulsant and it can also have marked psychoactive effects in addition to other side effects such as anxiety which are not desired. THCV whilst showing anti-convulsant activity specific to generalized seizures in epilepsy is a CB1 antagonist and following evidence to suggest that the CB1 antagonist rimonabant may cause epilepsy and other undesired effects it may be desirable to remove these cannabinoids from a BDS whilst still retaining the non-cannabinoid component(s) which may contribute to the activity of the BDS.

[00128] A CBDV (+/+) BDS can be obtained from extraction of CBDV-rich plants. Such chemovars are bred specifically to produce a significant proportion of their cannabinoids as CBDV.

[00129] The CBDV chemotype results from the breeding of plants which carry both postulated B_D and A_{PR} genes.

[00130] The B_D gene instruct the plants to synthesize the cyclic part of the CBD molecule and the A_{PR} gene instructs the plant to synthesize this molecule with a propyl side chain, as opposed to the usual pentyl chain found in CBD.

[00131] A CBDV chemovar has been bred and the BDS analysed as described in Table 3.1 below:

Table 3.1 CBDV (+/+) BDS amount in total and range

CBDV (+/+) BDS	Amount (% w/w)	Range (± 10%)	Range (± 25%)	Range (± 50%)
CBDVA	0.14	0.13 – 0.15	0.11 – 0.18	0.07 – 0.21
CBDV	**41.19**	**37.07 – 45.31**	**30.89 – 51.49**	**20.60 – 61.79**
CBDA	0.07	0.06 – 0.08	0.05 – 0.09	0.04 – 0.11
CBG	0.59	0.53 – 0.65	0.44 – 0.74	0.30 – 0.89
CBD	17.70	15.93 – 19.47	13.28 – 22.13	8.85 – 26.55
THCV	3.06	2.75 – 6.12	2.30 – 3.83	1.53 – 4.59
CBCV	4.35	3.92 – 4.79	3.26 – 5.44	2.18 – 6.53
THC	0.88	0.79 – 0.97	0.66 – 1.10	0.44 – 1.32
CBDV (related substances)	2.20	1.98 – 2.42	1.65 – 2.75	1.10 – 3.30
CBC	0.93	0.84 – 1.02	0.70 – 1.16	0.47 – 1.40
Total Cannabinoids	**71.11**			
Total Non-cannabinoids	**28.89**			

[00132] The total phytocannabinoid containing fraction of CBDV (+/+) BDS comprises approximately 41% of the total BDS. According to variation this fraction may vary by ± 10% up to ± 50%.

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Table 3.2 CBDV (+/+) BDS by percentage cannabinoid

CBDV (+/+) BDS	Amount (% of total cannabinoid)
CBDVA	0.20
CBDV	**57.92**
CBDA	0.10
CBG	0.83
CBD	24.89
THCV	4.30
CBCV	6.12
THC	1.24
CBDV (related substances)	3.09
CBC	1.31

[00133] The amount of the principle phytocannabinoid in the CBDV (+/+) BDS as a percentage of the phytocannabinoid containing fraction is approximately 58%. According to variation this fraction may vary by ± 10% up to ± 50%.

[00134] In this Example it is intended that references be made to the principle or secondary components independently of the 'other' cannabinoids.

Comparative Example 4

Non-cannabinoid profile of a high phytocannabinoid containing plant

[00135] This comparative Example is included to demonstrate a typical terpene profile obtained from a cannabis plant that has been bred to produce a high quantity of cannabinoids.

[00136] The non-cannabinoid components of a phytocannabinoid BDS may play an important role in the BDS's pharmacology. As such the terpene profile is classified below. The following tables illustrate the terpene profile of a CBD chemovar which is representative of a high phytocannabinoid containing plant. Five plants were freshly harvested and extracted using steam distillation. The principle monoterpene and sesquiterpene are highlighted in bold.

Table 4.1 Monoterpene amount by percentage of total terpene fraction and ranges

Monoterpenes	**Amount (% of terpene fraction)**	**Range (± 10%)**	**Range (± 25%)**	**Range (± 50%)**
Pinene (alpha & beta)	10.56	9.50 – 11.62	7.92 – 13.20	5.28 – 15.84
Myrcene	**39.46**	**35.51 – 43.41**	**29.60 – 49.33**	**19.73 – 59.19**
Limonene	4.14	3.73 – 4.55	3.11 – 5.18	2.07 – 6.21
Beta-ocimene	4.04	3.64 – 4.44	3.03 – 5.05	2.02 – 6.06
Total	**58.20**			

[00137] The monoterpene containing fraction comprises approximately 52-64% (w/w) of the total terpene fraction.

Table 4.2 Monoterpene amount by percentage of monoterpenes

Monoterpenes	**Amount (% of monoterpene fraction)**

Pinene (alpha & beta)	18.14
Myrcene	**67.80**
Limonene	7.12
Beta-ocimene	6.94

[00138] The amount of the principle monoterpene myrcene in the monoterpene fraction as a percentage of the monoterpene fraction is approximately 61-75% (w/w). The monoterpene fraction also has a secondary monoterpene pinene which is present at approximately 16.3-20% (w/w) of the monoterpene fraction.

Table 4.3 Sesquiterpene amount by percentage of total terpene fraction and ranges

Sesquiterpenes	**Amount (% of terpene fraction)**	**Range (± 10%)**	**Range (± 25%)**	**Range (± 50%)**
Caryophyllenes (t & oxide)	**29.27**	**26.34 – 32.20**	**21.95 – 36.59**	**14.64 – 43.91**
Bergotamene	0.18	0.16 – 0.20	0.14 – 0.23	0.09 – 0.27
Humulene	7.97	7.17 – 8.77	5.98 – 9.96	3.99 – 11.96
Aromadendrene	0.33	0.30 – 0.36	0.25 – 0.41	0.17 – 0.50
Selinene	0.59	0.53 – 0.65	0.44 – 0.74	0.30 – 0.89
Anon	0.44	0.40 – 0.48	0.33 – 0.55	0.22 – 0.66
Farnesene (Z,E & alpha)	1.55	1.40 – 1.71	1.16 – 1.94	0.78 – 2.33
alpha Gurjunene	0.12	0.11 – 0.13	0.09 – 0.15	0.06 – 0.18
Bisabolene	0.39	0.35 – 0.43	0.29 – 0.49	0.20 – 0.59
Nerolidol	0.43	0.39 – 0.47	0.32 – 0.54	0.22 – 0.65
Diepicedrene-1-oxide	0.38	0.34 – 0.42	0.29 – 0.48	0.19 – 0.57
Alpha-Bisabolol	0.16	0.14 – 0.18	0.12 – 0.20	0.08 – 0.24
Total	**41.80**			

[00139] The sesquiterpene containing fraction comprises approximately 27-32% (w/w) of the total terpene fraction.

Table 4.4 Sesquiterpene amount by percentage of sesquiterpenes

Sesquiterpenes	**Amount (% of sesquiterpene fraction)**

Caryophyllenes (t & oxide)	**70.02**
Bergotamene	0.43
Humulene	19.07
Aromadendrene	0.79
Selinene	1.41
Anon	1.05
Farnesene (Z,E & alpha)	3.71
alpha Gurjunene	0.29
Bisabolene	0.93
Nerolidol	1.03
Diepicedrene-1-oxide	0.91
Alpha-Bisabolol	0.38

Comparative Example 5

Non-cannabinoid profile of a 'zero cannabinoid' plant

[00140] This comparative Example describes the terpene profile of a different cannabis plant to that described on Example 4 above and is reproduced here for comparative purposes.

[00141] Patent application number PCT/GB2008/001837 describes the production of a 'zero cannabinoid' plant. These plants were produced by selective breeding to produce a Cannabis sativa L plant that contained a generally qualitatively similar terpene profile as a Cannabis sativa L plant that produced cannabinoids yet it was devoid of any cannabinoids. These plants can be used to produce cannabinoid-free plant extracts which are useful control plants in experiments and clinical trials. A breakdown of the terpene profile produced in the plants can be found in the table below. The primary monoterpenes and sesquiterpene are highlighted in bold.

Table 5.1 Monoterpene amount by percentage of total terpene fraction and ranges

Monoterpenes	**Amount (% of terpene fraction)**	**Range (± 10%)**	**Range (± 25%)**	**Range (± 50%)**
Pinene (alpha & beta)	**29.34**	**26.41 – 32.27**	**22.01 – 36.68**	**14.67 – 44.01**
Myrcene	**29.26**	**26.33 – 32.19**	**21.95 – 36.58**	**14.63 – 43.89**
Limonene	5.32	4.79 – 5.85	3.99 – 6.65	2.66 – 7.98
Linalol	4.50	4.05 – 4.95	3.38 – 5.63	2.25 – 6.75

Verbenol (cis & trans)	3.45	3.11 – 3.80	2.59 – 4.31	1.73 – 5.18
Total	**71.87**			

[00142] The monoterpene containing fraction comprises approximately 65-79% (w/w) of the total terpene fraction.

Table 5.2 Monoterpene amount by percentage of monoterpenes

Monoterpenes	**Amount (% of monoterpene fraction)**
Pinene (alpha & beta)	**40.82**
Myrcene	**40.71**
Limonene	7.41
Linalol	6.26

Table 5.3 Sesquiterpene amount by percentage of total terpene fraction and ranges

Sesquiterpenes	**Amount (% of terpene fraction)**	**Range (± 10%)**	**Range (± 25%)**	**Range (± 50%)**
Caryophyllenes (t & oxide)	**10.89**	**9.80 – 11.98**	**8.17 – 13.61**	**5.45 – 16.34**
Bergotamene	2.51	2.26 – 2.76	1.88 – 3.14	1.26 – 3.77
Farnesene (Z,E & alpha)	3.43	3.09 – 3.77	2.57 – 4.29	1.72 – 5.15
Humulene (& epoxide II)	5.04	4.54 – 5.54	3.78 – 6.30	2.52 – 7.56
delta guaiene	2.40	2.16 – 2.64	1.80 – 3.00	1.20 – 3.60
Bisabolene	3.85	3.47 – 4.24	2.89 – 4.81	1.93 – 5.78
Total	**28.12**			

[00143] The sesquiterpene containing fraction comprises approximately 25-31% (w/w) of the total terpene fraction.

Table 5.4 Sesquiterpene amount by percentage of sesquiterpenes

Sesquiterpenes	**Amount (% of sesquiterpene fraction)**
Caryophyllenes (t & oxide)	**38.73**
Bergotamene	8.93

Farnesene (Z,E & alpha)	12.20
Humulene (& epoxide II)	17.92
delta guaiene	8.53
Bisabolene	13.69

[00144] The amount of the principle sesquiterpene caryophylene in the sesquiterpene fraction as a percentage of the sesquiterpene fraction is approximately 35-43% (w/w). The sesquiterpene fraction also has a secondary sesquiterpene humulene which is present at approximately 16-20% (w/w) of the sesquiterpene fraction.

Comparative Example 6

Use of CBDV (+/+) BDS in the PTZ model of generalised seizures

[00145] This comparative Example was previously presented in GB1005364.3 (unpublished) patent application and is included here for representative purposes.

[00146] Methodology as described in Example 1.

[00147] CBDV (+/+) BDS was administered at four doses that yielded a dose of CBDV of 50 and 100 mg/kg. Table 6.1 below details the data obtained.

Table 5.1

CBDV (+/+) BDS (mg/kg)	**Mortality (%)**
0	26.3
50	16.7
100	0

[00148] As can be seen the CBDV (+/+) BDS exhibited a trend to decrease seizure-related mortality.

References

ALGER, B. E. (2006) Not too excited? Thank your endocannabinoids. *Neuron,* 51, 393-5.

AMES FR. (1986) Anticonvulsant effect of cannabidiol. *South African Medical Journal* 69:14.

AVOLI, M., LOUVEL, J., PUMAIN, R. & KOHLING, R. (2005) Cellular and molecular mechanisms of epilepsy in the human brain. *Prog Neurobiol.*

BOSTANCI, M. O. & BAGIRICI, F. (2006) The effects of octanol on penicillin induced epileptiform activity in rats: an in vivo study. *Epilepsy Res,* 71, 188-94.

BRUST, J. C., NG, S. K., HAUSER, A. W. & SUSSER, M. (1992) Marijuana use and the risk of new onset seizures. *Trans Am Clin Climatol Assoc,* 103, 176-81.

CONSROE, P.F., WOOD, G.C. & BUCHSBAUM, H. (1975) Anticonvulsant Nature of Marihuana Smoking. *J.American Medical Association* 234 306-307

CUNHA, J. M., CARLINI, E. A., PEREIRA, A. E., RAMOS, O. L., PIMENTEL, C., GAGLIARDI, R., SANVITO, W. L., LANDER, N. & MECHOULAM, R. (1980) Chronic administration of cannabidiol to healthy volunteers and epileptic patients. *Pharmacology,* 21, 175-85.

DAVIS, M. I., RONESI, J. & LOVINGER, D. M. (2003) A Predominant Role for Inhibition of the Adenylate Cyclase/Protein Kinase A Pathway in ERK Activation by Cannabinoid Receptor 1 in N1E-115 Neuroblastoma Cells. *J.Biol. Chem.,* 278, 48973-48980.

DREIFUSS, F. E., BANCAUD, J., HENRIKSEN, O., RUBIO-DONNADIEU, F.PENRY, J. K. & SEINO, M. (1981) Proposal for revised clinical and electroencephalographic classification of epileptic seizures. *Epilepsia,* 22, 489-501.

FERDINAND, R. F., VAN DER ENDE, J., BONGERS, I., SELTEN, J. P., HUIZINK, A. & VERHULST, F. C. (2005) Cannabis--psychosis pathway independent of other types of psychopathology. *Schizophr Res,* 79, 289-95.

FISHER, R. S., VICKREY, B. G., GIBSON, P., HERMANN, B., PENOVICH, P., SCHERER, A. & WALKER, S. (2000) The impact of epilepsy from the patient's perspective I. Descriptions and subjective perceptions. *Epilepsy Res,* 41, 39-51.

GASTAUT, H. (1970) Clinical and Electroencephalographical Classification of Epileptic Seizures. *Epilepsia,* 11, 102-112.

LUTZ, B. (2004) On-demand activation of the endocannabinoid system in the control of neuronal excitability and epileptiform seizures. *Biochem Pharmacol,* 68, 1691-8.

MACKIE, K. (2006) Cannabinoid receptors as therapeutic targets. *Annu Rev Pharmacol Toxicol,* 46, 101-22.

MCCORMICK, D. A. & CONTRERAS, D. (2001) On the cellular and network bases of epileptic seizures. *Annu Rev Physiol,* 63, 815-46.

MERLIS, J. K. (1970) Proposal for an International Classification of the Epilepsies. *Epilepsia,* 11, 114-119.

NG *et al.* (1990) Illicit drug use and the risk of new-onset seizures, *American Journal of Epidemiology* 132: 47-57.

OBAY, B. D., TASDEMIR, E., TUMER, C., BILGIN, H. M. & SERMET, A. (2007) Antiepileptic effects of ghrelin on pentylenetetrazole-induced seizures in rats. *Peptides,* 28, 1214-9.

PEREIRA, M. B., FREITAS, R. L., ASSIS, M. A., SILVA, R. F., FONTELES, M. M., FREITAS, R. M. & TAKAHASHI, R. N. (2007) Study pharmacologic of the GABAergic and glutamatergic drugs on seizures and status epilepticus induced by pilocarpine in adult Wistar rats. *Neurosci Lett,* 419, 253-7.

PERTWEE R. G., (2000) Cannabinoid receptor ligands: clinical and neuropharmacological considerations, relevant to future drug discovery and development. *Exp. Opin. Invest. Drugs 9(7):*

RAUCA, C., WISWEDEL, I., ZERBE, R., KEILHOFF, G. & KRUG, M. (2004) The role of superoxide dismutase and alpha-tocopherol in the development of seizures and kindling induced by pentylenetetrazol - influence of the radical scavenger alpha-phenyl-N-tert-butyl nitrone. *Brain Res,* 1009, 203-12.

SANDER, J. W. (2003) The epidemiology of epilepsy revisited. *Curr Opin Neurol,* 16, 165-70.

SWANN, J. W. (2004) The effects of seizures on the connectivity and circuitry of the developing brain. *Ment Retard Dev Disabil Res Rev,* 10, 96-100.

TREMBLY B. SHERMAN M. (1990) Double-blind clinical study of cannabidiol as a secondary anticonvulsant. *Marijuana '90 International Conference on Cannabis and Cannabinoids*. Kolympari, Crete, July 8-11, 1990.

WINGERCHUK, D. (2004) Cannabis for medical purposes: cultivating science, weeding out the fiction. *Lancet,* 364, 315-6.

CLAIMS

1. A composition comprising or consisting essentially of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD).

2. A composition as claimed in claim 1, further comprising one or more excipients.

3. A composition as claimed in claim 1 or 2, which further comprises at least one non-cannabinoid component of cannabis.

4. A composition as claimed in claim 3, wherein the at least one non-cannabinoid component of cannabis is or comprises a terpene.

5. A composition as claimed in any of the preceding claims, wherein the phytocannabinoids comprise, or consist essentially of CBDV, CBD and one or more cannabichromene type compounds.

6. A composition as claimed in claim 5, wherein the one or more cannabichromene type compounds is cannabichromene propyl variant (CBCV) and / or cannabichromene (CBC).

7. A composition as claimed in any of the preceding claims, which is absent or substantially absent of any other cannabinoids.

8. A composition as claimed in claim 7, wherein the any other cannabinoids are tetrahydrocannabivarin (THCV) and / or tetrahydrocannabinol (THC).

9. A composition as claimed in any of the preceding claims, wherein the CBDV and CBD are present in a ratio of from 7:1 to 1:2 (CBDV:CBD).

10. A composition as claimed in claim 9, wherein the CBDV and CBD are present in a ratio of from 5:1 to 1:1 (CBDV:CBD).

11. A composition as claimed in claim 9 or claim 10, wherein the CBDV and CBD are present in a ratio of 4.5:1 to 2:1 (CBDV:CBD).

12. A composition as claimed in any of the preceding claims, wherein a unit dosage form comprises from 500 to 2000 mg CBDV.

13. A composition as claimed in any of the preceding claims, wherein a unit dosage form comprises from 100 to 600 mg CBD.

14. A composition as claimed in any of the preceding claims further comprising a standard anti-epileptic drug (SAED).

15. An extract or BDS comprising the phytocannabinoids CBDV and CBD but substantially absent of the cannabinoids THCV and THC.

16. An extract or BDs as claimed in claim 15, further comprising one or more non-cannabinoid component(s).

17. A combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD) for use in the treatment of neurological conditions, characterised by hyper-excitability of the central nervous system, convulsions or seizures.

18. A combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD) as claimed in claim 17, wherein the neurological condition is epilepsy.

19. A combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD) as claimed in claim 18, wherein the type of epilepsy to be treated is generalised seizure.

20. A combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD) as claimed in any of claims 17 to 19, further comprising a standard anti-epileptic drug (SAED).

21. The use of a combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD) in the manufacture of a medicament for use in the treatment of neurological conditions, characterised by hyper-excitability of the central nervous system, convulsions or seizures.

22. A method for the treatment of neurological conditions, characterised by hyper-excitability of the central nervous system, convulsions or seizures, which comprises administering to a subject in need thereof a therapeutically effective amount of a combination of the phytocannabinoids cannabidivarin (CBDV) and cannabidiol (CBD).