



Understanding kava's impact on driver fitness

THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato



S. 'Apo' Aporosa (PhD)
(sucu i Niutiladi, vasi ni koro i Naduri, Macuata, Fiji)
The University of Waikato, New Zealand

Introduction

It is believed the traditional Pacific drink kava contributes to unsafe driving¹. A recent study utilising an industry standard measure of drug driving failed to register effects to selected cognitive functions¹. The following reports on a subsequent study using a new method.

Kava

- Kava (*Piper methysticum*) contains active properties - kavalactones.
- Kavalactone levels vary dependent upon the maturity of the plant and cultivar type¹.
- Kavalactones :
 - research has identified 20 kavalactones²,
 - block the calcium ion channels related to reduction of neurotransmitter release excitation,
 - potentiates GABA_A through enhanced ligand binding to GABA receptors,
 - reduces the neuronal reuptake of noradrenaline and possibly dopamine,
 - reverses monoamine oxidase (MAO) B inhibition³.
- Kava produces soporific relaxant non-hallucinogenic effects similar to Benzodiazepine⁴.

Kava plant and harvesting kava at three years of age



(Source: Yadhu Singh, 2004)

(Source: Author, 2009)

Kava psychopharmacology

- The majority of kava psychopharmacology knowledge results from studies utilising a pharmaceutically recommended tablet-dose <300mgs kavalactones per day.
- Tablet-dose kava typically contains only six (of the 20) selected and extracted kavalactones⁴.
- Reaction time research at <300mgs kavalactones is inconsistent, ranging from "significantly increased" response accuracy to a 40% reduction in "reaction time ... in comparison to placebo"⁵.
- Recent research reported that kavalactone "modes of action are not fully understood", even less is understood regarding "the neurophysiological mechanisms associated with kavalactone metabolism"⁶.

The 2016 WHO⁷ kava risk assessment report lists 28 "data gaps" and requested "further data" regarding kava ethnobotany, psychotropy, psychopharmacology and mechanisms of action related to "human health effects".

Traditional kava use and driving

Traditional, or naturalistic, kava is mixed by steeping or straining the crushed roots of the plant in water to make a culturally important beverage used in almost every ceremony from birth to death⁴.

Kava being prepared for consumption



(Source: Todd M. Henry, 2019)

Naturalistic kava drinking sessions average six hours during which users consume 3.6 litres (6.33 pints) of beverage kava and in excess of 5,000mgs of kavalactones⁸.

It is estimated 70% of kava users in Aotearoa New Zealand and Australia drive following high naturalistic kava use⁹.

- A Fijian based ethnographic study reported a "four-fold increase in the odds of crash involvement" following consumption of kava at culturally influenced volumes¹⁰.
- The New Zealand Institute of Environmental Science and Research (NZESR) reported increased detection of kavalactones in the blood of motor vehicle accident victims¹¹. However, due to limited understanding of kava at high consumption volumes, the NZESR are unable to provide expert opinion on these findings.
- Aotearoa New Zealand and Pacific Island Police suspect that some unsafe driving is linked to kava use at high consumption volumes with kava also proposed as an unaccounted factor in road deaths and injury of which Pacific peoples in Aotearoa New Zealand are over represented¹².
- Currently there are no roadside tests to detect kava or measure kavalactone concentrations in consumers.
- Little is known about the psychopharmacology of naturalistic kava¹³.
- It is common for research findings resulting from studies that utilized pill-style kava to be applied to, and used to explain, naturalistic kava use psychopharmacology. This is misleading.

In a 2017 study, an industry standard measure of drug driving was administered to kava users ('active', n=20) in a naturalistic setting ('control', n=20) to assess cognitive functions¹.

- No statistical differences to reaction time and divided attention between the active and control groups were found, despite observations of slowed movement and slurred speech by some of the kava drinkers.

100ml quantities of kava being served to participants during research data collection



(Source: Todd M. Henry, 2020)

The current study

The inconsistency between the results and observations (in the 2017 study¹) may be due to a lack of test sensitivity. This informed the identification of a novel assessment of neurological functioning – the *Brain Gauge* (BG).

Aim: To measure participant neurological functioning using the BG during, and immediately following, naturalistic kava consumption, and apply the results to driver functionality.

Methods/Measures

- Protocol guided by Aporosa's¹³ respect-based Pacific methodological framework and the *faikava methodology*¹³.
- 39 male participants (exclusive of 1 dropout).
- **Active:** n=20, experienced kava consumers, mean age = 34.75 years (SD = 8.59).
- **Control:** n=19, mean age = 35.57 years (SD = 8.58).
- Attended a 6 hour traditionally influenced naturalistic kava use session.
- Participants each drank 6 x 100ml (0.2 pints) serves per hour [= 3.6 litres (6.33 pints)] over 6 hours, equating to 3,680mg of kavalactones (based on HPLC analysis), chemotype of 462531.
- All participants screened for neurological and psychological conditions, use of anxiolytic and/or sleep medication, and adhered to washout periods.
- Baseline (T1) and testing at 3 (T2) and 6 (T3) hours using BG (www.corticalmetrics.com).
 - BG measures slight changes to six strategic, tactical and operational cognitive faculties including fine-motor-skills and fatigue to assess neurological functioning.
 - Each of the six domains are scored and compared against norms, which also informed a composite CM score.
- Statistical modelling based on t-tests (Wilcoxon and Mann-Whitney U [MW]), and Bayesian [BF] analysis.



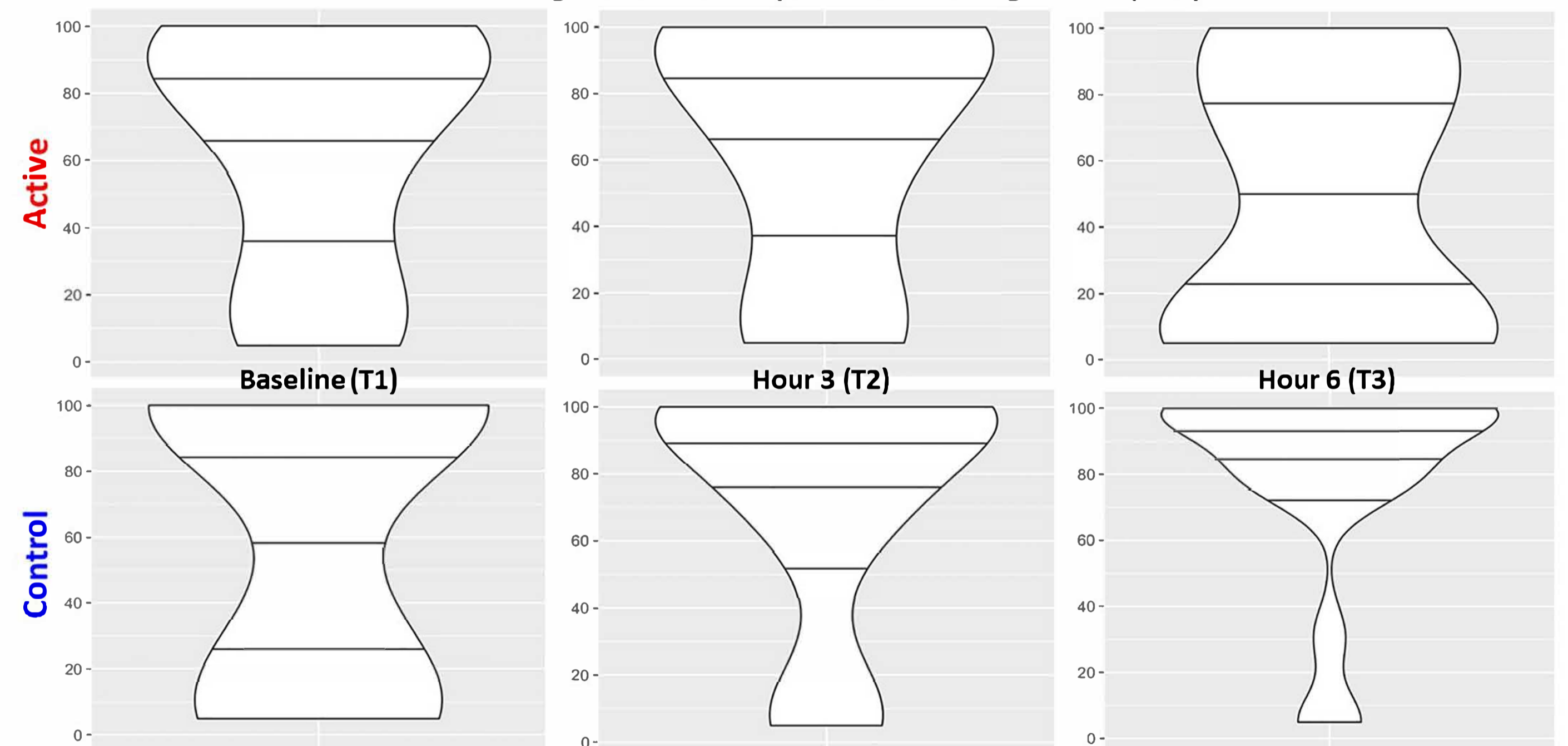
Brain Gauge

Results

- Data analysis showed no statistical significant (p<0.05) difference to five of the six cognitive faculties of the **active** participants when compared against **control** at any measurement point over the six hour testing period.
- Data analysis showed a significant level of impairment to the Temporal Order Judgement (TOJ) of the **active** participants at T3 ([MW=0.0119; t=0.007301; BF=6.193058]) when compared with both their **own** and **control** data at T2 and T1.

Testwise [t]	Focus	Accuracy	Temporal Order Judgement	Timing Perception	Plasticity	Fatigue
Control-T1 v Active-T1	0.1056	0.353	0.7854	0.3471	0.4133	0.7914
Control-T2 v Active-T2	0.2257	0.2664	0.5427	0.07599	0.3003	0.3568
Control-T3 v Active-T3	0.1243	0.6883	0.007301	0.4068	0.3207	0.3074

Brain Gauge results: Temporal Order Judgement (TOJ)



Discussion

Kava at traditional consumption volumes is not shown to impact focus, accuracy, time perception, plasticity or fatigue, although has a significant negative impact on TOJ. TOJ is associated with Executive Function "including decision making, behavioural control, and information processing" and sequencing¹⁴.

Limitations:

- The introduction of a placebo driven double blinded methodology. However, as Aporosa et al.^{1,13} explain, this is not possible due to kava's union with cultural values and respect preventing a kava substitute, placebo or deception, and the need for experienced kava drinkers capable of consuming large volumes of kava.
- Individual participant rates of kavalactone metabolism and dose relationship of kavalactones with cognitive impact; this is knowledge that is currently beyond kava psychopharmacology understanding.
- Further limitations are discussed in Aporosa, Atkins, & Leov, 2021¹³.

Conclusion

The findings of this study¹⁵ are both unique and new and suggests kava at traditionally consumed volumes compromises driver safety, impairment that manifests vastly different to alcohol, cannabis and hallucinogens⁴. While this study will go some way toward assisting Police and NZESR in understanding kava's effects on driver safety following high consumption, large knowledge gaps remain concerning kava's impacts on cognition. These gaps will remain until more is known about "the neurophysiological mechanisms associated with kavalactone metabolism"⁶. Brochures, translated into the dominant Pacific kava-using languages, have been produced to highlight the potential dangers of kava drink-driving.

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