



PASIFIKA
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Kava, traditionally influenced consumption volumes, and impacts on driver fitness

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Abstract

Introduction: Kava (*Piper methysticum*), a culturally significant Pacific Island beverage, produces soporific relaxant effects similar to Benzodiazepine. Traditional users typically consume this drink at volumes 20 times greater than pharmacologically recommended doses, with many then driving home. This study, funded by the New Zealand Health Research Council (19/002), assessed six key cognitive functions related to safe driving, following kava use.

Methods: Guided by the *faikava methodology*, male kava consumers ($n=20$) attended a six-hour kava session, each drinking 3.6 litres of kava. Drinkers were compared to a control group (males; $n=19$). At baseline (T1) all participants completed Brain Gauge testing - a somatosensory tool that measures cognitive functioning in six-areas. Re-testing was completed at three (T2) and six hours (T3). Statistical modelling comprised Wilcoxon and Mann-Whitney U (MW), and Bayesian (BF) analysis.

Results: Analysis indicated no statistically significant ($p<0.05$) difference to the focus, accuracy, time perception, plasticity or fatigue of the active participants when compared against control at T1, T2 or T3. Conversely, 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.

Conclusions: Kava at traditional consumption volumes is shown to significantly impact TOJ. TOJ is associated with Executive Function, particularly sequencing. This new understanding suggests kava, at traditionally consumed volumes, impacts upon cognitive functioning, and therefore may compromise driver safety. This presentation expands on these findings combined with a recent kava drink-driving awareness program.

Sponsorship: The study is funded by the New Zealand Health Research Council (19/002).

CITATION: Aporosa, A. S. (2022). *Kava, traditionally influenced consumption volumes, and impacts on driver fitness*. Paper presented at the Pasifika Medical Association Conference, Te Papa Museum, Wellington, Aotearoa New Zealand. Sept. 4-6.

Bio: 'Apo' Aporosa is maternally related to the village of Naduri in Macuata, Fiji. He has a Doctorate in Development Studies from Massey University, New Zealand. Aporosa has held two New Zealand Health Research Council: Pacific post-doctoral awards allowing him to investigate the impacts of traditionally influenced kava use on cognition and driver safety. Based at Te Huataki Waiora School of Health and Te Kura Whatu Oho Mauri School of Psychology at the University of Waikato, Aporosa also teaches, and supports the Pacific staff and student body as a member of the university's Pacific Strategic Group and Research Committee. Aporosa was recently awarded a 2022 Fulbright Scholarship to investigate the potential of traditionally influenced kava spaces to reducing PTSD symptomology among post-combat soldiers and first-responders.

(PPT 1 – aligns with PowerPoint slide in Endnote)¹

Introduction

This presentation explains new research investigating kava and cognition, with the results applied to driver safety. The study was funded by NZ Health Research Council. To give context to the study and its findings, I must first highlight several key misunderstandings about kava. I will move through this quickly, with full references in the slides which are available on request.

(PPT2)² Traditionally, kava is mixed by straining the crushed roots of the *Piper methysticum* plant in water to make a culturally important beverage.³

(PPT3)⁴ Pharmacology tells us that kava contains active properties called kavalactones which act in the body as a result of the mechanisms listed in the slide.⁵ Can I suggest the most important word in that explanation is the one in red, 'possibly'. While some publications make grandiose claims, (PPT4)⁶, the reality is, there is a great deal we do not know about kava psychopharmacology.⁷

Moreover, most of those claims about how kava works in the body and brain (PPT5)⁸ come from studies that used kava in tablet and pill form which contain extracted kavalactones ingested at small dose levels.⁹

Conversely, (PPT6)¹⁰ in typical traditionally influenced, or naturalistic kava use settings, it is not uncommon for drinkers to ingest more than 8,000mgs of kavalactones over 6 hours. (PPT7)¹¹ Regardless of the huge difference, findings from research that used pill-style kava are routinely applied to, and overlaid onto, naturalistic kava. Most importantly, until now, no research has been done which seeks to understand how naturalistic kava use interacts with cognition. This presentation focuses on naturalistic kava and not pill/tablet-style kava.

Kava and driving: (PPT8)¹² It is estimated 70% of kava drinkers in Aotearoa New Zealand (ANZ) and Australia drive following high naturalistic kava use.¹³

(PPT9)¹⁴ A Fijian based ethnographic study reported a “four-fold increase in the odds of crash involvement” following consumption of kava at traditional use volumes.¹⁵

(PPT10)¹⁶ The New Zealand Institute of Environmental Science and Research (ESR) report increased detection of kavalactones in the blood of motor vehicle accident victims.¹⁷

(PPT11)¹⁸ Aotearoa NZ and Pacific Island Police suspect that some unsafe driving is linked to kava use at high consumption volumes, with kava also suspected as an unaccounted factor in road deaths and injury.¹⁹

Currently there are no roadside tests to detect kava or measure kavalactone concentrations in users making the monitoring of kava drink-driving difficult.

Responding to a call by NZESR and Police for research on driver safety following traditional kava use, (PPT12)²⁰ a preliminary study which used an industry standard measure of drug driving was used to assess 20 kava users at a 6 hour long naturalistic kava use session against control.²¹

In short, (PPT13)²² that industry standard measure revealed no statistically significant differences to either reaction time or divided attention, suggesting that following 6 hours of kava drinking, users were safe to drive. However, from an observational perspective, the kava drinkers showed subtle slowed movement and slight slurring of speech.²³

The incongruence between the test results and observations were considered with a group of psychopharmacologists. While limited kava understanding was acknowledged, this did lead to the identification of a new psychometric measure, (PPT14)²⁴ The *Brain Gauge (BG)*, which was subsequently assessed for utility in a feasibility study.²⁵ This led to a full scale, active versus control study, the focus of the remaining presentation.

(PPT15)²⁶ The *BG* is a somato-sensory psychometric test measure. Through touch sensation and the central nervous system, the *BG* measures slight changes to six strategic, tactical and operational cognitive faculties including fine-motor-skills and fatigue to assess neurological functioning.²⁷

(PPT16)²⁸ The methods and measures:

The study was guided by the *Faikava Methodology* and the *Pacific Post-development Methodological Framework* which was specifically designed to ensure the ethical and equitable use of Western standardised and normed psychometric measures with Pacific peoples.²⁹

(PPT17)³⁰ Power calculations identified participant numbers to ensure statistical significance. All participants were male, regardless that female kava use is common, who attended a 6-hour kava-use session, with the ‘active’ participants each drinking 3.6 liters of kava over 6 hours.

(PPT18)³¹ *Brain Gauge* testing was done at baseline (before any kava was consumed), and again at 3 hours and 6 hours following kava use, with the results statistically analysed to compare the scores of the drinkers against the non-drinkers.

Full method and measure details are explained in a recent publication³² should you want more details

Key results

(PPT19)³³ Again, highly condensed as this is all published: data analysis showed no negative impact to the Focus, Accuracy, Time Perception, Plasticity or Fatigue of the ‘active’ participants when compared against ‘control’. This suggests kava, even at high consumption volumes, does not affect 5 key cognitive faculties necessary to safe driving.

(PPT20)³⁴ Of interest was that following 3 hours of kava drinking, the ‘active’ participants showed a statistically significant level of improved to their Focus, suggesting that after 3 hours of kava drinking, kava sharpens Focus which is important to safe driving.

(PPT21)³⁵ The most significant finding was the data analysis that showed a very strong negative impact to Temporal Order Judgement. The *Brain Gauge* descriptors defines *TOJ* as being linked to sequencing, or how the brain orders events.

(PPT22)³⁶ This suggests kava, when consumed at high volumes, has a marked negative effect on *TOJ*, sequencing and event ordering. This could have a negative impact on driving, although simple cause and effect assumptions must be resisted when coupled with the slight improvement to Focus and no impacts to Accuracy, Time Perception, Plasticity or Fatigue. Questions have also been raised about the role of sleep deprivation linked to lengthy and late attendance at kava environments as research shows a lack of sleep interferes with Executive Function, with *TOJ* being a faculty of Executive Function.

(PPT23)³⁷ This is new knowledge, focused specifically on naturalistic kava as opposed to tablet-styled kava.

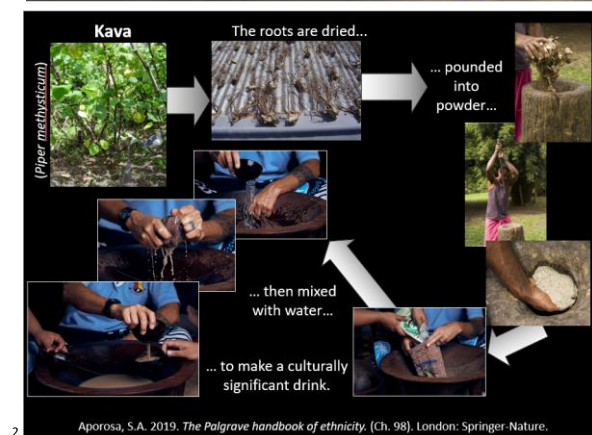
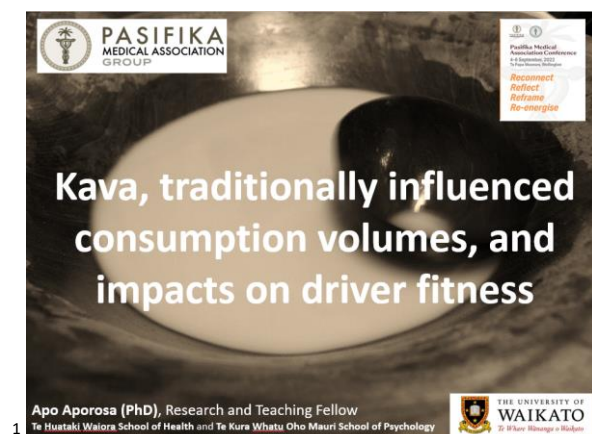
(PPT24)³⁸ What this research has also done is corroborate ethnographic studies that have reported for almost 100 years, that kava’s effects are subtle, very different to, and less impactful, when compared with alcohol and cannabis. This research also suggests the common term used to capture kava’s effects – *kava intoxication* – is both misleading and incorrect.³⁹

(PPT25)⁴⁰ Until we have a better understanding of kava drug half-life and metabolism, work I am currently doing with ESR, moving the current research forward has limitations which are explained in the publication.

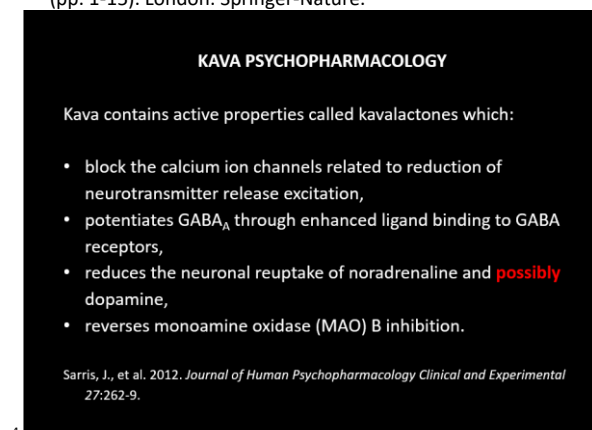
(PPT26)⁴¹ The research has been published as a technical report,⁴² journal article,⁴³ as a user-friendly summary,⁴⁴ in translated - Bislama,⁴⁵ Fijian,⁴⁶ Tongan⁴⁷ and Samoan⁴⁸ – brochure-form (English version⁴⁹), and shortly as a book presenting additional kava cognition research.⁵⁰

Finally, I want to sincerely thank the NZ Health Research Council for their support toward this research and my development as a Pacific health researcher.

Endnote Slides and References



³ Aporosa, S.A. (2019). Kava and ethno-cultural identity in Oceania. In S. Ratuva (Ed.), *The Palgrave handbook of ethnicity*. Chapter 134-1. (pp. 1-15). London: Springer-Nature.



- ⁵ Sarris, J., Scholey, A., Schweitzer, I., Bousman, C. A., LaPorte, E., Ng, C., . . . Stough, C. (2012). The acute effects of kava and oxazepam on anxiety, mood, neurocognition; and genetic correlates: A randomized, placebocontrolled, double-blind study. *Journal of Human Psychopharmacology Clinical and Experimental*, 27(3), 262-269.

KAVA PSYCHOPHARMACOLOGY

Bwarenaba and colleagues warn that kavalactone “modes of action are not fully understood” (p.1), with even less known about “the neurophysiological mechanisms associated with kavalactone metabolism” (p.5).

⁶ Bwarenaba, B. K., et al. 2017. *Journal of Experimental Neuroscience* 11, 1-7.

- ⁷ Bwarenaba, B. K., Juliana, P., Kellie, S., Mengarelli, M. S., & Eric, A. N. (2017). A behavioral survey of the effects of kavalactones on *Caenorhabditis elegans* neuromuscular transmission. *Journal of Experimental Neuroscience*, 11, 1-7.

KAVA PSYCHOPHARMACOLOGY

“Most of these studies used a standardized WS 1490 Kava extract formulation, which is composed of 70% kavalactones.”

Kava pills/tablets: pharmacologically recommended dose of no more than 300 milligrams of kavalactones per day.

Belcaro, G. (2016). *Pharma-standard supplements: Clinical Use*. London: Imperial College Press. (p.52).



- ⁸
- ⁹ Belcaro, G. (2016). *Pharma-standard supplements: Clinical Use*. London: Imperial College Press.

TRADITIONAL / NATURALISTIC KAVA USE SETTINGS

- unlike kava-pills (which typically contain 6 extracted kavalactones), naturalistic kava contains 20+ kavalactones¹
- research shows the ‘typical’ naturalistic kava-use session is 6 hours long in which drinkers ingest over 8,000mg kavalactones (30 times the pharmacological daily recommendation).²

¹ Bian et al. 2020. *Nutrients* 12(10), 3044.

² Aporosa, S.A. 2017. *Journal of Psychopharmacology* 31(8), A84.



¹⁰

TRADITIONAL / NATURALISTIC KAVA USE SETTINGS




is **NOT** this!

Nevertheless, findings from research that used pill-style kava are routinely applied to, and overlaid onto, naturalistic kava.



¹¹

KAVA AND DRIVING



- estimated 70% of kava users drive following kava drinking¹

¹ Maneze, D., et al. 2008. *A&NZ Journal Of Public Health*, 32(4), 314-316.

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¹³ Maneze, D., Speizer, A., Dalton, N., & Dennis, S. (2008). A descriptive study of kava use among Tongan men in Macarthur, Sydney South West. *Australian & New Zealand Journal Of Public Health*, 32(4), 314-316.

KAVA AND DRIVING




- estimated 70% of kava users drive following kava drinking¹
- "four-fold increase in the odds of crash involvement"²

¹ Maneze, et al. 2008. *A&NZ Journal Of Public Health*, 32(4), 314-316.
² Wainiqolo, et al. 2015. *A&NZ Journal of Public Health*, 39(5), 495-499.

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¹⁵ Wainiqolo, I., Kool, B., Nosa, V., & Ameratunga, S. (2015). Is driving under the influence of kava associated with motor vehicle crashes? A systematic review of the epidemiological literature. *Australian and New Zealand Journal of Public Health*, 39(5), 495-499.

KAVA AND DRIVING




- estimated 70% of kava users drive following kava drinking¹
- "four-fold increase in the odds of crash involvement"²
- NZESR report kava in the blood of m/v accident victims³

¹ Maneze, et al. 2008. *A&NZ Journal Of Public Health*, 32(4), 314-316.
² Wainiqolo, et al. 2015. *A&NZ Journal of Public Health*, 39(5), 495-499.
³ Poulsen, et al. 2012. *Forensic Science International*, 223(1-3), 364-370.

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¹⁷ Poulsen, H., Moar, R., & Troncoso, C. (2012). The incidence of alcohol and other drugs in drivers killed in New Zealand road crashes 2004-2009. *Forensic Science International*, 223(1-3), 364-370.

KAVA AND DRIVING

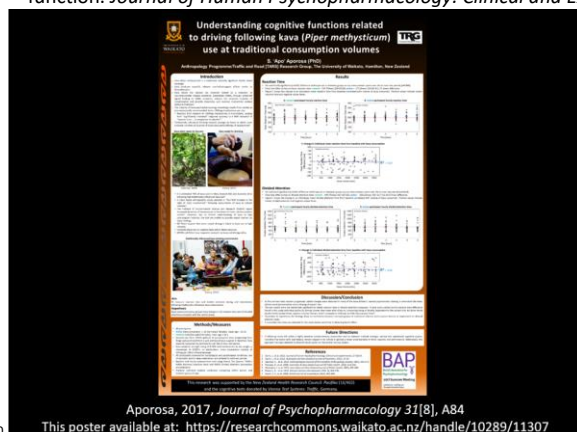


- estimated 70% of kava users drive following kava drinking¹
- "four-fold increase in the odds of crash involvement"²
- NZESR report kava in the blood of m/v accident victims³
- NZ and Pacific Police suspect kava linked to unsafe driving⁴

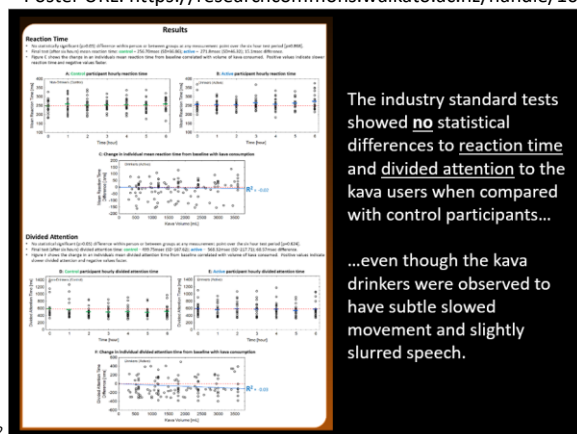
¹ Maneze, et al. 2008. *A&NZ Journal Of Public Health*, 32(4), 314-316.
² Wainiqolo, et al. 2015. *A&NZ Journal of Public Health*, 39(5), 495-499.
³ Poulsen, et al. 2012. *Forensic Science International*, 223(1-3), 364-370.
⁴ Aporosa, et al. 2020. *Journal of Human Psychopharmacology* 35(2), e2725.

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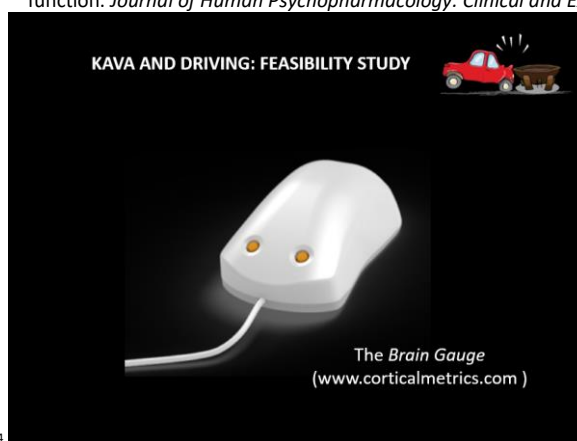
- ¹⁹ Aporosa, S. A., Atkins, M., & Brunton, R. (2020). Kava drinking in traditional settings: Towards understanding effects on cognitive function. *Journal of Human Psychopharmacology: Clinical and Experimental*, 35(2), e2725.



- ²¹ Aporosa, S. (2017). Understanding cognitive functions related to driving following kava (Piper methysticum) use at traditional consumption volumes. *Journal of Psychopharmacology*, 31(8), (Supplement) A84.
Poster URL: <https://researchcommons.waikato.ac.nz/handle/10289/11307>




- ²³ Aporosa, S. A., Atkins, M., & Brunton, R. (2020). Kava drinking in traditional settings: Towards understanding effects on cognitive function. *Journal of Human Psychopharmacology: Clinical and Experimental*, 35(2), e2725. doi:10.1002/hup.2725


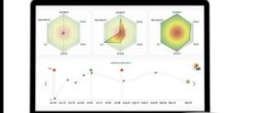


- ²⁵ Aporosa, S. A., Atkins, M., & Leov, J. (2021). Decolonising quantitative methods within a Pacific research space to explore cognitive effects following kava use. *Pacific Dynamics: Journal of Interdisciplinary Research*, 5(1), 74-92. doi:10.26021/10642

THE BRAIN GAUGE



- a somato-sensory psychometric testing measure
- measures slight changes to six cognitive faculties: *Focus, Accuracy, Time Perception, Plasticity, Fatigue and Temporal Order Judgement (TOJ)*
- assesses neurological functioning





(www.corticalmetrics.com)

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27 www.corticalmetrics.com

KAVA AND DRIVING: METHODOLOGY




- Guided by the *Pacific Post-development Methodological Framework (PP-dMF)* and *Faikava Methodology*
 - The *PP-dMF*, driven by Pacific respect-based values, was specifically designed to ensure the ethical and equitable use of Western standardised and normed psychometric measures with Pacific peoples
 - The *Faikava Methodology* has been used in eight HRC funded research projects since 2016

Aporosa et al. 2021. Decolonising quantitative methods within a Pacific research space to explore cognitive effects following kava use. *Pacific Dynamics: Journal of Interdisciplinary Research* 5(1), 74-92. 10.26021/10642



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29 Aporosa, S. A., Atkins, M., & Leov, J. (2021). Decolonising quantitative methods within a Pacific research space to explore cognitive effects following kava use. *Pacific Dynamics: Journal of Interdisciplinary Research*, 5(1), 74-92. doi:10.26021/10642

KAVA AND DRIVING: METHODOLOGY




- Participants (informed by power calculations):
 - all male
 - 20 'active' (kava drinkers), 19 'control' (non-drinkers)
 - average age 34.12 years (SD = 9.61)
- attended a 6-hour traditionally influenced kava session:
 - 'active' participants drank 3.6 litres (6.33 pints) of kava
 - equating to 5,220mg of kavalactones (HPLC analysis)

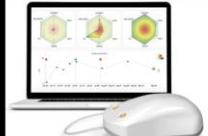




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KAVA AND DRIVING: METHODOLOGY




- *Brain Gauge* testing:
 - T1 - at baseline (prior to any kava consumption)
 - T2 - at 3-hours
 - T3 - and again at 6-hours (following the last bowl of kava)
- numerical data gathered during testing was exported and analysed using Student's *t*-test (Normal) and Bayesian inference techniques

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- ³² Aporosa, S. A., Ballard, H., Pandey, R., & McCarthy, M. J. (2022). The impact of traditional kava (Piper methysticum) use on cognition: Implications for driver fitness. *Journal of Ethnopharmacology*, 291(115080), 1-15. doi:10.1016/j.jep.2022.115080

KAVA AND DRIVING: RESULTS 

- Data analysis showed **no statistically significant negative** impact to the **Focus, Accuracy, Time Perception, Plasticity or Fatigue** of the 'active' (kava drinking participants) at any time over the 6-hour period when compared against 'control' (non-kava drinkers)

Between cohort data at T1, T2 and T3 with significantly statistical data underlined.

Test	Focus	Accuracy	Timing Perception	Plasticity	Fatigue
Control T1 v Active T1	0.1056	0.553	0.5471	0.4135	0.7914
Control T2 v Active T2	0.2257	0.2664	0.07599	0.3085	0.2560
Control T3 v Active T3	0.1243	0.6883	0.4068	0.3287	0.3074

≤0.05 (underlined) = statistically significant


KAVA AND DRIVING: RESULTS 

- Data analysis showed **no statistically significant negative** impact to the **Focus, Accuracy, Time Perception, Plasticity or Fatigue** of the 'active' (kava drinking participants) at any time over the 6-hour period when compared against 'control' (non-kava drinkers)
- The 'active' participants showed a small statistically significant level of **improved Focus** at **T2** or following 3 hours of kava drinking.

Within cohort data at T1, T2 and T3 with significantly statistical data underlined.

Test	Focus	Accuracy	Temporal Order Judgement	Timing Perception	Plasticity	Fatigue
Active T1 v Active T2	<u>0.2302</u>	0.4574	0.2867	0.0963	0.1872	0.5181
Active T2 v Active T3	0.2079	0.0783	0.2521	0.1242	0.2446	0.0945

≤0.05 (underlined) = statistically significant

KAVA AND DRIVING: RESULTS 

- Data analysis showed a **statistically significant negative impact** to the **Temporal Order Judgement (TOJ)** of the 'active' (kava drinking participants) following 6-hours of kava drinking when compared against 'control' (non-kava drinkers)
- TOJ (Brain Gauge)** is defined as being linked to **sequencing**, or how the brain orders events.




Between cohort data at T1, T2 and T3 with significantly statistical data underlined.

Test	Focus	Accuracy	Temporal Order Judgement	Timing Perception	Plasticity	Fatigue
Control T1 v Active T1	0.1056	0.553	0.7854	0.5471	0.4135	0.7914
Control T2 v Active T2	0.2257	0.2664	0.1427	0.07599	0.3085	0.2560
Control T3 v Active T3	0.1243	0.6883	<u>0.00793</u>	0.4068	0.3287	0.3074

≤0.05 (underlined) = statistically significant

KAVA AND DRIVING: DISCUSSION

- This suggests naturalistic kava has a marked negative effect on **TOJ = sequencing and event ordering**; this could negatively impact driver safety
- Simple cause and effect conclusions must be **resisted** due to a slight improvement to **Focus** and no negative impacts to **Accuracy, Time Perception, Plasticity or Fatigue**.
- Speculation: sleep deprivation influences **TOJ** linked to kava use

KAVA AND DRIVING: DISCUSSION

This



is NOT this!




This study has generated new knowledge about the cognitive effects of kava when consumed in naturalistic settings





KAVA AND DRIVING: DISCUSSION

- This study:
 - corroborates ethnographic evidence showing kava's effects are subtle, very different to, and vastly less impactful, when compared with alcohol and cannabis.
 - shown the common term used to capture kava's effects – *kava intoxication* – is both misleading and incorrect.

Aporosa, S. A., Ballard, H., Pandey, R., & McCarthy, M. J. (2022). The impact of traditional kava (*Piper methysticum*) use on cognition: Implications for driver fitness. *Journal of Ethnopharmacology*, 291(115080), 1-15. doi:10.1016/j.jep.2022.115080

Aporosa, S. A. (2022). Traditional kava use, cognition and driver fitness. *Journal of Psychopharmacology*(36, No. 8), A91-A92.


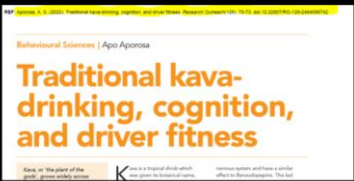
KAVA AND DRIVING: LIMITATIONS

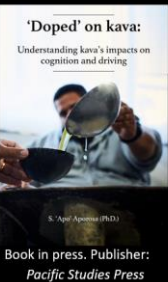
- To better understand the effects of naturalistic kava on cognition, we need to understanding kava drug half-life and metabolism
- That work is currently underway in a collaboration between the University of Waikato and the New Zealand Institute of Environmental Science and Research (ESR)





KAVA AND DRIVING: PUBLICATIONS



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- ⁴² Aporosa, S. A. (2021). Improving road safety and health: Understanding kava's impact on driver fitness. Technical report prepared for (and accepted by) Health Research Council of New Zealand, July 31. Retrieved from <https://hdl.handle.net/10289/14570>
- ⁴³ Aporosa, S. A., Ballard, H., Pandey, R., & McCarthy, M. J. (2022). The impact of traditional kava (*Piper methysticum*) use on cognition: Implications for driver fitness. *Journal of Ethnopharmacology*, 291(115080), 1-15. doi:10.1016/j.jep.2022.115080
- ⁴⁴ Aporosa, A. S., & Pathe, A. (2022). Traditional kava-drinking, cognition, and driver fitness. *Research Outreach*(129), 70-73. doi:10.32907/RO-129-2464096742 (permanent link: <https://cdn.researchoutreach.org/Flipbooks/RO129/index.html>)
- ⁴⁵ https://researchcommons.waikato.ac.nz/bitstream/handle/10289/14570/KavaDrinkDrive_brochures_BISLAMA.pdf?sequence=24&isAllowed=y
- ⁴⁶ https://researchcommons.waikato.ac.nz/bitstream/handle/10289/14570/KavaDrinkDrive_brochures_FIJIAN.pdf?sequence=22&isAllowed=y
- ⁴⁷ https://researchcommons.waikato.ac.nz/bitstream/handle/10289/14570/KavaDrinkDrive_brochures_TONGA.pdf?sequence=20&isAllowed=y
- ⁴⁸ https://researchcommons.waikato.ac.nz/bitstream/handle/10289/14570/KavaDrinkDrive_brochures_SAMOAN.pdf?sequence=21&isAllowed=y
- ⁴⁹ https://researchcommons.waikato.ac.nz/bitstream/handle/10289/14570/KavaDrinkDrive_brochures_ENGLISH.pdf?sequence=23&isAllowed=y
- ⁵⁰ Aporosa, S. A. (2022). 'Doped' on kava: Understanding kava's impacts on cognition and driving. Suva: Pacific Studies Press. (in press)