

Improving road safety and health: Understanding kava's impact on driver fitness



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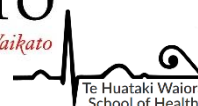
31 July 2021

Technical Report

(Prepared for the Health Research Council of New Zealand)



THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato



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TO CITE:

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.

Cover photo: Todd M. Henry, 2020.

Executive Summary

Kava (*Piper methysticum*) is a traditional and culturally significant Pacific Island beverage that produces soporific relaxant effects. Kava use is increasing in the Pacific islands, and among Pacific diasporic and non-Pacific people.

Users often consume the kava drink at much higher volumes than pharmacologically recommended doses (as much as 30 times greater is not unusual), with some users then driving home from kava use venues.

While there has been a great deal of research using tablets (or capsules) containing selected extracted kavalactones, very little is understood about the psychopharmacological effects of kava when consumed in its natural traditionally influenced form over many hours as is typical in the Pacific community.

Prompted by concerns over potential driver impairment as a result of kava use, this research involved testing the brain function of kava users over the course of a typical kava session (in terms of its duration and kava consumption volumes). The aim was to understand the effects that drinking kava had on driving safety.

Participants in the active group ($n=20$) attended a 6-hour kava session, each drinking 3.6 litres (6.33 pints) of kava. A non-kava consuming control group ($n=19$) was also included in the study. At baseline, all participants were assessed with the Brain Gauge, a somatosensory tool that measures strategic, tactical and operational aspects of brain function. Re-testing was conducted after 3 hours of kava consumption, and again at the conclusion of the test period following the sixth hour of kava drinking.

Analysis of the results compared changes in brain function, both between individuals and the two groups (active and control), before and after the kava drinking session. Statistical modeling was based on t -tests, Wilcoxon signed-rank test [W] and the Mann-Whitney U test (rank sum) [MW], and Bayesian analysis [BF].

The results showed that, for the active participants, the kava consumed had no statistically significant negative impact on their Focus, Accuracy, Timing Perception, Plasticity or Fatigue, when compared with the control group. When active participants (kava drinkers) were compared with other kava users' in their group, a slight positive increase in the kava users Focus and Fatigue was noted, which could infer increased driver alertness and improved driver safety.

However, the negative impact of the kava on the active participants' Temporal Order Judgement ("how well [the] brain is able to keep track of the order of events" which is linked to a participant's executive function) was (strongly) significant at the sixth hour: [$MW=0.0119$; $t=0.007301$; $BF=6.193058$].

This finding – as to the effect of kava on a person's Temporal Order Judgement (and hence executive function) – is new, and suggests kava at traditionally consumed volumes compromises driver safety, although the nature of this impairment is vastly different to alcohol, cannabis, and other euphoric and hallucinogenic substances.

Because executive function is also linked to Focus, Accuracy, Timing Perception, Plasticity and Fatigue, the finding was discussed with several psychopharmacologists, who were unable to provide an explanation for the anomaly, but noted that understanding of the effect of traditionally influenced kava consumption on cognition is still in its infancy.

This study makes a new and significant contribution to understanding kava's impacts, when consumed at traditional use volumes, on cognition, while also highlighting the huge knowledge gap that exists concerning kava psychopharmacology. The study has highlighted the need for more research to build understanding in this area, which would also assist road policing, particularly from an evidentiary perspective. The study also responded to national and international calls for research to fill the current gaps in understanding.

Additionally, the study investigated the use of a Pacific language-friendly brochure-based driver awareness campaign aimed at curbing potentially unsafe post-kava drink-driving. Although well received, the brochure appeared to have minimal immediate impact on participants' behavior. However, its value in prompting *talanoa* (discussion) on the subject was noted, as was the long-term nature of driver safety awareness campaigns.

The study was funded by the Health Research Council of New Zealand (19/002) and the University of Waikato. Cortical Metrics, the developers of the Brain Gauge, generously assisted the project through a substantial donation of hardware and software.

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1 Introduction

Kava drinking has been a central traditional practice of Pacific Island people for more than 2,000 years. As Pacific people have migrated, they have taken their kava-culture with them, which has, in turn, influenced kava use among non-Pacific people.

Many kava drinkers continue to reflect traditional patterns of use, including consuming kava at volumes that can be as high as 30 times the pharmacologically recommended daily dose. Increased kava use has also corresponded with increased reports by the police in several Pacific nations, New Zealand, Australia and the United States of suspected kava ‘intoxicated’ drivers.

This report documents a study that used a somato-sensory tool – the Brain Gauge – to assess the cognitive function of 20 active kava drinkers compared with 19 control participants (non-kava drinkers). Testing occurred during a typical kava session conducted in a naturalistic setting, with the aim of understanding the potential effects that drinking kava could have on driving safety.

The study was informed by two earlier investigations also aimed at understanding driver safety following naturalistic kava use. The historical aspects of kava use, together with kava psychopharmacology, the increased use of kava in new environments, road policing concerns and the two preceding studies will be explained before the present study and its findings are detailed.

2 Background

Kava (*Piper methysticum*) is the name of both the plant (a shrub) and the drink made from its roots and basal stump. Both the plant and the drink play an integral role in Pacific traditions and cultural practices (Aporosa, 2014a; 2014b; 2019b).

The kava drink is not an alcohol and, when consumed, does not cause marked euphoria or hallucination. Rather, it induces a relaxed feeling that facilitates clear-headed discussion (Aporosa, 2011; 2019a; Carlini, 2003). Put simply, kava's effects cannot be used as an excuse for criminal activity, emotional outbursts, raucousness or anti-social behavior (Aporosa, 2019a; D'Abbs, 1995). Kava is also considered a safe substance to ingest, lacking any major health concerns or addictive properties (Aporosa, 2019a; Bian et al., 2020).

Within kava, lipid-soluble kavalactones (Sarris, LaPorte, & Schweitzer, 2011) produce analgesic (Singh, 1992), antithrombotic, hypnotic, sedative (Cairney, Maruff, & Clough, 2002), anxiolytic (Pittler & Ernst, 2003; Singh & Singh, 2002) and muscle relaxant (Duffield & Jamieson, 1988) psychoactive effects. These effects are attributed to kava's action in the central nervous system, where it is understood to decrease neurotransmitter function (Carlini, 2003; Ligresti et al., 2012; Lim, 2016).

In 1989, Saletu and colleagues reported that a single 200mg tablet dose of *kavain* – one of the six key kavalactones found in kava – has an “elimination half-life of 9 hours” (p. 188). Based on this work, Aporosa (2008) calculated that it took slightly more than 90 hours for kava to be eliminated from the body (p. 46). Work to further understand kava’s elimination half-life has stalled since Aporosa’s work (National Standard, 2010). However, some commentators have suggested this half-life may be longer than 9 hours, particularly when kava is consumed at traditional high volumes and when all of the kavalactones – currently understood to number 20 (Bian et al., 2020) – are present.

Elsewhere, kava has been reported as a safe, non-addictive and viable alternative to benzodiazepam for the treatment of generalised anxiety disorder (Sarris et al., 2013). That safe status is reflected in kava’s regulation in New Zealand – falling under the *Food Standards Code 2015* (New Zealand Government, 2015) – which classifies kava as a ‘food’. Additionally, the World Health Organization’s 2016 kava risk assessment states, "On balance, the weight-of-evidence from both a long history of use of kava beverage and from the more recent research findings indicates that it is possible for kava beverage to be consumed with an acceptably low level of health risk" (Abbott, 2016, p. 26).

Kava’s psychotropic properties have also made it increasingly popular among non-Pacific people outside of the Pacific islands and within Pacific diasporic communities (Aporosa, 2015; Aporosa & Forde, 2017; Sumampow & Henry, 2021; Tecun, 2021), where, in some countries, kava is served in bar-like settings as an alternative to alcohol (Blackwood, 2019; Showman et al., 2015; Tecun, Reeves, & Wolfgramm, 2020; Wolinski, 2018). Although kava use among women is common in Fiji, this is not the case in all Pacific nations. However, as kava has moved into diasporic spaces, this has seen a dramatic increase in its use by Pacific women, with women drinking in both mixed gender and women only environments (Lolohea, 2021; Tecun et al., 2020).

2.1 Traditionally influenced kava consumption

For the purpose of this report, kava is defined as the drink resulting from mixing kava rhizome with water, and consumed in a naturalistic and traditionally influenced setting, alongside established cultural practices, as explained here. It does not include tablets or capsules containing selected extracted kavalactones, or pop-culture drinks containing flavoured or commercially produced and bottled kava.

Kava, when consumed in traditionally influenced settings is made by steeping dried and pounded kava rhizome in water in a *kumete* (a traditional wooden kava bowl). The resulting drink is then served to those present in *bilo* or *ipu* (cups made from half coconut shells) (see Figure 1).



Figure 1: *Mixing kava in a kumete (kava bowl) in Auckland, New Zealand (photographer: Todd M. Henry, 2019).*

Drinkers typically sit cross-legged on mats on the floor, observe cultural etiquette including a serving order based on hierarchy, partake in *cobo* (clapping) before drinking and after, and engage in *talanoa* or culturally guided discussion underpinned by Pacific respect-based values (Aporosa, 2014a) (see Figure 2).



Figure 2: *Kava drinking by participants with mixed ethnicity in a private home (Māori owners) in Waikato, New Zealand (photographer: Author, 2009).*

Aporosa and Tomlinson (2014) report that traditionally influenced Fijian kava drinking sessions (in Fiji) last, on average, for over 6 hours. During this time, consumers will typically ingest 3.6 litres (6.33 pints) of aqueous kava. Depending on the age of the kava plant at the time of harvest (lactone levels increase with age) and the concentration of the kava when mixed into the beverage, consumers often ingest more than 8,000mg of kavalactones per sitting, which represents 30 times the pharmacologically recommended daily dose.

2.2 Kava use and driver safety

The increased use of kava outside of the Pacific islands and kava's documented psychoactive properties have raised questions about its impact on cognitive functions, particularly in relation to driver safety.

The New Zealand Police, for example, report stopping increased numbers of drivers who appear mildly intoxicated, although breath-screening tests return negative results, with officers suspecting kava impairment (Morgan, 2014; 2017; Tokalau, 2020; Welsh, 2017). Australian police also report a suspected link between kava use and an increased likelihood of serious motor vehicle accidents (Fu et al., 2019). Researchers in Iowa in the United States report “kava impairment was demonstrated through four cases of self-reported kava use ... [suggesting kava use] may hinder one’s ability to operate a vehicle safely” (Berry, Gilbert, & Grodnitzky, 2019, p. 1948).

In addition, the New Zealand Institute of Environmental Science and Research (New Zealand’s Crown research institute) reports increased detection of kavalactones in the blood of deceased motor vehicle accident victims (Poulsen et al., 2012). However, the institute acknowledges there are large knowledge gaps concerning the interpretation of kavalactones in the blood. For instance, at this stage, it is not possible to determine whether kavalactones detected in the blood of victims result from kava consumed in the previous hour, or previous 24 hours or even 36 hours (Poulsen & McCarthy, 2020).

With kava not metabolising on the breath in a similar manner to alcohol, and therefore not allowing breath screening, and with blood testing of suspected kava drink-drivers being ineffectual for evidential purposes, the monitoring and policing of kava-impaired drivers is extremely difficult.

This difficulty is illustrated in a recent news item by journalist Torika Tokalau (2020). Tokalau reported that shortly after 2am on 14 October 14, 2018, New Zealand Police stopped a driver whose actions led them to believe he was under the influence of alcohol or drugs. The 52-year-old male driver admitted to consuming “about five or six small bowls [*bilo* or *ipu*]” of kava and also taking an “unknown prescription medicine” for leg and back issues. After passing a breath-screening test, he was ordered to undergo a roadside coordination test to determine his sobriety. He was subsequently arrested and charged with “driving while incapable”, due to a perceived unsteadiness on his feet. The case took 14 months to process through the court system, with the driver eventually found not guilty due to “reasonable doubt”; as it could not be determined whether the unsteadiness was the result of kava, the prescription medicine, a combination of both, or the leg and back issues.

While this report is not suggesting kava consumption by the driver was the cause of his unsteadiness, the title of Tokalau’s article – “*Auckland man under the influence of kava gets off drug-driving charge*” – appears to insinuate this, with the clear inference that he was ‘under the influence’ and yet ‘got off’ the drug-driving charge.

This current lack of a suitable evidentiary standard measure, against which to assess driver competency following kava use, not only impedes road policing efficiency and road safety, but also judicial process and the protection of innocents where applicable. Further, this lack of a suitable measure is evidenced in the fact that, to date, there has only been one successful kava-use-related driving prosecution in New Zealand (DCNZ, 2000; Tokalau, 2020), and a small number overseas (Swenson, 1996; Jolly, 2009).

The prevalence of people driving while under the influence of drugs or alcohol is a significant health and safety issue in New Zealand, with an estimated annual 'social cost' of \$564 million (Ministry of Transport, 2017, p. 4). In one recent New Zealand study, 20 per cent of drivers reported taking drugs known to interfere with driver safety within 3 hours of driving (Starkey et al., 2016). In Australia, research focused specifically on Tongan kava drinkers, reported that it was common for 70 per cent of participants to drive home from kava drinking sessions (Maneze et al., 2008); travel that can include long-distance and inter-city driving (Aporosa, 2018b). By applying this estimate to the reported 20,000 people in New Zealand who drink kava on an average Friday or Saturday night (Aporosa, 2015), this would suggest there could be as many as 14,000 kava users controlling motor vehicles over this time. In addition, injury due to road traffic accidents is the leading cause of hospitalisation for Pacific men and women in New Zealand (Slack et al., 2009). Hospitalisation due to drug use is also higher among Pacific people than the general population, and increases significantly with age (Slack et al., 2009).

Rosekind and colleagues (2020) point out the need for more research aimed at understanding the effects that drug substances, notably substances other than alcohol and cannabis, have on driver safety. They also acknowledge that these studies can be complicated, requiring new and innovative approaches, particularly "in today's world of poly drug-impaired drivers" (p. E1).

It should be noted that although kava is regulated as a 'food' in New Zealand, kava is nevertheless a 'drug'. The World Health Organization (2021) explains that any substance, "when taken in or administered into one's system, [which] affect[s] mental processes, e.g. perception, consciousness, cognition or mood and emotions" is a drug. This includes nicotine, coffee, energy drinks such as Red Bull, and kava. As the World Health Organization goes on to explain, this can be confusing, as the term 'drug' is often incorrectly associated with "dependence-producing ... 'drug use', 'substance use' or 'substance abuse'." Therefore, had the 52-year-old male driver in Torika Tokalau's (2020) article been convicted in court, he would have been guilty of *drug-driving*.

2.3 Kava use and cognitive function

LaPorte and colleagues (2011) present the first comprehensive literature review on kava's effect on cognitive function. While this is valuable, overall the findings show inconsistency and

subjectivity across the studies surveyed. This was best illustrated in a 2017 update of the review, which included only one new study since 2011.

Sarris and McIntyre (2017) report that of 12 clinical trials that assessed the effects of kava on 'mental function', four reported "improved accuracy and performance on visual attention and working memory", five showed "kava to have little or no negative effect on cognitive processes", while another "reported kava to impair reaction time" (p. 16).

It is important to note that these studies involved participants who had consumed a modified version of kava, taken in tablet (or capsule) form. Administered at a pharmaceutically recommended "daily dose of 60–250mg kavalactones" (Bian et al., 2020, p. 13), these tablets contain selected extracted kavalactones, which Bian and colleagues (2020) refer to as "designer kava preparations" (p. 23). Such preparations are vastly different to kava consumed in naturalistic traditionally influenced settings. This contrast between modified pill-style kava and naturalistic kava has led some researchers to question whether the former can rightly be called or considered to be actual kava (Aporosa, 2019a). Moreover, it is common for findings deriving from research that used modified pill-style kava to be applied to, and overlaid on, naturalistic kava use psychopharmacology, incorrectly assuming affect correlation.

Bwarenaba et al. (2017) report that kavalactone "modes of action are not fully understood" (p. 1) and even less is understood about "the neurophysiological mechanisms associated with kavalactone metabolism" (p. 5). When this finding is considered alongside the fact that most research into kava's effects on cognitive function have used modified kava in tablet or capsule form, plus the dearth of equivalent research based on naturalistic kava use, these gaps in understanding become even more pronounced.

There is a real need for experimental data that investigates the cognitive effects of kava consumed in naturalistic settings at traditional volumes (Abbott, 2016, p.viii; Bian et al., 2020, p. 23). Such data will be valuable for understanding kava's effect on driver safety, which in turn could provide insights into the over-representation of Pacific people in motor vehicle accidents.

2.4 Initial research into the cognitive impacts of kava when consumed at traditional volumes

The first study that aimed to understand kava's impacts on cognition, and in turn driver safety, both during and following its consumption at traditional volumes, started in 2017 and was funded by a Health Research Council of New Zealand Pacific post-doctoral award (ref. 16/462).

This study, referred to as Experiment 1, used two visual-sensory psychometric measures drawn from the Vienna Test System: Traffic test battery. These were the WAF¹A Alertness and WAFG Divided Attention measures (Strum, 2011a; 2011b). The measures are industry standard assessments of driver safety and have been used extensively to assess the impacts of drugs and alcohol on driving.

The results of Experiment 1 failed to identify statistically significant differences in cognitive function between a control (non-kava drinking, $n=20$) and active (kava drinking, $n=20$) group following kava consumption (Aporosa, 2018a). However, the study investigators observed that most of the active participants exhibited a slowed motor response and a slight slurring of speech, which started around the mid-point of testing, or after 3 hours of kava consumption (Aporosa, 2017b).

This anomaly – between the lack of a test-identified impairment in cognitive function and the observed deterioration – was discussed with several psychopharmacology experts. The experts postulated that the experiment’s failure to detect a significant difference in cognitive function was potentially due to the Vienna Test System measures using visual-sensory assessment, whereas kava’s dominant action is to decrease neurotransmitter function in the central nervous system (Aporosa, 2020; Aporosa, Atkins, & Brunton, 2020). They suggested an alternative assessment tool could be used; one capable of measuring subtle changes in cognition via the central nervous system.

This alternative testing system – named the Brain Gauge – was assessed in a feasibility study also funded by the Health Research Council of New Zealand Pacific post-doctoral award (ref. 16/462). That feasibility study is discussed in detail in a recently published paper in *Pacific Dynamics: Journal of Interdisciplinary Research* (Aporosa, Atkins & Leov, 2021), where it is argued that the methodology and methods used in the study “provide a robust procedure for examining the effects of kava on cognitive function in the context of a full study, while maintaining the naturalistic setting of a traditional kava session.” (p. 82)

Learning from the feasibility study was then used to inform a new application to the Health Research Council. This resulted in the 2019 New Zealand Health Research Council: Pacific Sir Thomas Davis Te Patu Kite Rangi Ariki Award (ref. 19/002) being awarded to the author, enabling the feasibility study to be replicated in a full research study. This report describes and explains that full study.

¹ WAF¹A and WAFG are test labels and not acronyms.

2.5 Study aims and hypothesis

The study described in this report aimed to measure aspects of participants' neurological functioning during, and immediately following, traditionally influenced kava consumption, and to apply those results to driver functionality.

The purpose was to build better understanding of kava-related cognition, driver safety and coordination issues. It is anticipated this information will improve road safety, reduce injury and hospitalisation rates, and the related economic and social costs, and have a positive impact on the health of Pacific people and other road users, both in New Zealand and internationally.

The hypothesis being tested was that the participants consuming kava in the active kava using group would show changes in their neurological functioning (namely speed, focus, fatigue, accuracy, sequencing, timing perception, plasticity and connectivity), when compared with the participants not consuming kava in the control group.

3 Methodology and methods

The study was based at the University of Waikato's Te Huataki Waiora School of Health and linked to the School of Psychology's *Traffic and Road Safety Research Group*. Ethics approval was granted by the Health and Disability Ethics Committee within the New Zealand Ministry of Health (reference number 19/NTB/44).

The study was guided by the post-development methodological framework and the *faikava methodology*.

The post-development methodological framework combines the Fijian *vanua* research framework with post-development theory, to guide the ethical and equitable use of Western-developed, -standardised and -normed psychometric measures among Pacific peoples (Aporosa, 2014a, p. 102; Aporosa et al., 2021). It is also argued that the framework has broader applicability for all ethnicities, as it is underpinned by ideals and values based on respect; ensuring participants are treated with dignity and respect at all times, and that the guests and their needs are treated as superior to those of the host (or research team).

The *faikava methodology* uses a naturalistic kava-use environment to collect both quantitative and qualitative research data. This approach to data collection has only recently been termed the *faikava methodology*, although these types of naturalistic settings have been used for research purposes for more than 20 years. The *faikava methodology* is endorsed by the Health Research

Council (HRC), which has funded nine research projects over the past seven years in which this data collection methodology has been used (Aporosa et al., 2021).

The status of the *faikava methodology* has been commented on elsewhere by the author.

The lengthy use of the *faikava methodology* in research, together with kava's recognition as a safe, non-addictive substance that facilitates quality *talanoa* (Aporosa, 2019a) and its endorsement by the HRC due to its inclusion in stringently assessed and subsequently funded projects, has led to a recognised and authenticated Pacific-based research data collection mechanism. (Aporosa et al., 2021, p. 83)

The naturalistic kava-use environment used in the methodology is explained further in section 3.6: Location of the kava session.

3.1 Determining participant numbers

Dr Ray Littler, a biostatistician at the University of Waikato, was consulted about the number of participants required for the results to achieve statistical significance. Dr Littler used power calculations (based on the overall cortical metric values obtained from the use of the Brain Gauge tool during the feasibility study) to determine the minimum number of participants required for the study to produce statistically significant results: $n=15$. However, it was considered that increasing the number of participants to $n=20$ would substantially increase the statistical significance to a 98 per cent probability level and allow for dropouts. These calculations are represented in Figure 3.

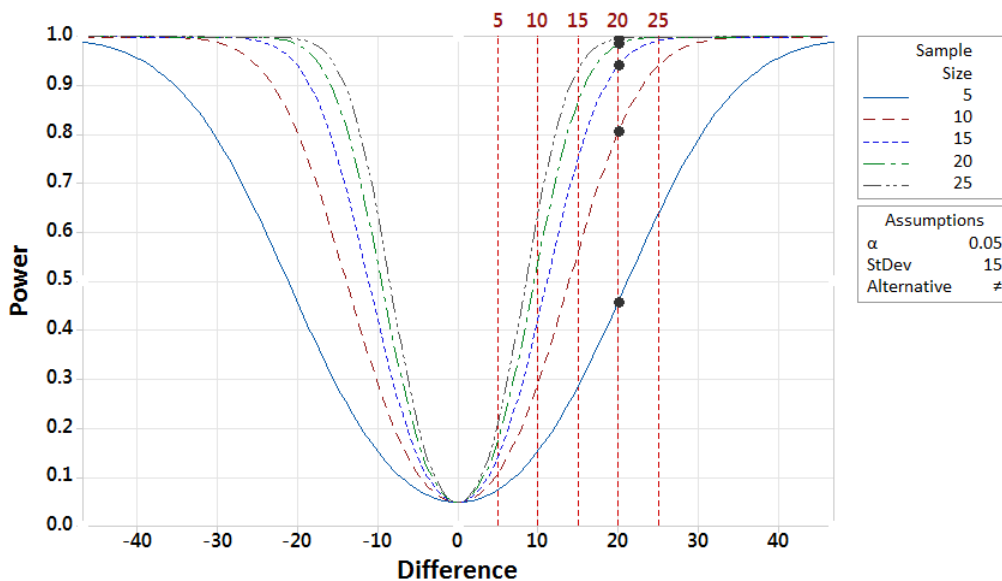


Figure 3: Power calculations (using Power Curve 2-sample t-test) used to determine minimum participant numbers required to ensure the statistical significance of the data (Dr Ray Littler, 24 May 2018).

3.2 Participant recruitment and eligibility

Initial recruitment was for male participants over 18 years of age who held a full (unrestricted) driver's license. Males were targeted, as historically they have been the dominant kava-consuming gender. Females are, however, increasingly drinking kava, which has led to the emergence of female-only groups attending *faikava* venues (Lolohea, 2021; Tecun et al., 2020). It is anticipated future testing will include both a female active and control cohort.

Through this recruitment, 26 kava-using participants were identified, all of whom were recruited from *faikava* venues in Hamilton and Auckland. In the study, this group is referred to as the 'active' group. In addition, 25 non-kava drinking participants were recruited by word of mouth and through online advertisements and noticeboards at the University of Waikato. This group is referred to as the 'control' group.

All recruits completed an eligibility screening form to ensure they were in good health, free of neurological or psychological conditions (for example, previous head injury, concussion or psychotic disorders), and were not taking any anxiolytic, antipsychotic or sleep medication. The form required recruits to answer a range of simple questions related to these matters by ticking either 'yes' or 'no'.

Recruits in the active group were also questioned about their kava use; allowing novice kava users to be identified and excluded, as the study required participants who regularly consumed kava at high volumes over multiple hours.

Eligibility screening for the control group asked whether the recruits had ever consumed kava, and if so, how recently. For those who indicated they had previously used kava, that use had mostly occurred as part of a cultural experience at the University of Waikato or while on holiday in Fiji.

The eligibility screening reduced the number of participants to $n=20$ in each group, complying with the 98 per cent statistical significance probability level identified from the power calculations.

Participants were given an information sheet explaining the research aims, procedures, expected time commitment, and the requirement not to consume any alcohol in the 24 hours before testing, and no coffee, energy drinks or Coca-Cola in the 6 hours before testing. Control participants were also reminded that they must not consume any kava at all in the period prior to testing. Active participants were requested not to consume any kava in the 4 days prior to testing. This 4-day washout period is based on current understandings of kava elimination half-life, as explained in the section 2: Background (Aporosa, 2008).

Just prior to the commencement of testing, one control participant was forced to withdraw due to an unexpected incident at home. Due to time limitations, he was unable to be replaced.

3.3 Participant demographics

The age and ethnic breakdown of the 39 participants who completed the testing is presented in Table 1.

Participants were all males and included people of Pacific Island and other ethnicities, to reflect the increasing use of kava by non-Pacific people (Aporosa, 2015; Aporosa & Forde, 2019). The average age of the participants was 34.12 years (SD = 9.61); with the average age of those in the active group being 32.75 years (SD = 8.59) and in the control group 35.57 years (SD = 8.58).

Table 1: Age and ethnicity of active and control participants

	ACTIVE (kava using)		CONTROL (non-kava using)	
	AGE	ETHNICITY	AGE	ETHNICITY
1	34	Guatemalan	24	Tongan
2	34	Tongan	32	Vietnamese
3	31	Hawaiian	49	Māori
4	41	NZ European	49	Māori
5	27	NZ European	34	Vietnamese
6	30	Fijian	31	Fijian
7	51	Fijian	49	NZ European
8	48	Fijian	50	Māori
9	27	Tongan	21	Māori
10	29	Tongan	36	NZ European
11	31	Fijian	44	Māori
12	36	Fijian	30	Samoan
13	48	Fijian	49	Fijian
14	30	Fijian	24	Fijian
15	23	Tongan	25	NZ European
16	28	Tongan	31	Māori
17	22	Tongan	18	Māori
18	37	American	Withdrawn	
19	27	Samoan	39	Māori
20	22	Samoan	41	Māori

Fijians represented the greatest number of active participants in the study (eight), with two in the control group. Tongans were the next largest active participant group, with five, and one control participant. All of the eight Māori participants were in the control group. Although this number of Māori control participants was similar to Experiment 1, that earlier investigation also

had three active Māori participants (Aporosa et al., 2020). New Zealand European representation totaled five participants: three active and two control. Interestingly, the study also included one active participant of Guatemalan ancestry who has been drinking kava for many years and two Vietnamese control participants who accompanied an active participant.

3.4 Briefing and preparing participants for the test

The total participant group was split in two for the testing; with testing carried out on two separate occasions, and each occasion hosting 10 active and 10 control participants. This number allowed for appropriate management and observation of participants during the tests.

On both test-days, research assistants transported the participants from their homes to a large meeting room adjacent to a computer lab at the University of Waikato, which would serve as the *faikava* venue during the test.

Participants arrived at 6pm, allowing them time to be briefed on the study procedures, sign consent forms (including an explanation of their ethical rights as a research participant) and complete a short questionnaire. The questionnaire replicated some of the questions asked during the eligibility screening phase, to ensure participants had refrained from using kava for the designated period before the test, were still in good health, had not started taking new medicines, and had not consumed alcohol in the past 24 hours or caffeine, energy drinks or Coca-Cola in the past 6 hours.

Participants were advised that if they had any questions at any point they were free to ask and an open and transparent answer would be given; and that should they wish to withdraw from the study, they were free to do so, and a taxi would be ordered to take them home. With the exception of the control participant who needed to leave for family reasons, no other participants withdrew from the study.

After the consent forms were signed, participants attended a nearby lecture theater where they viewed a short video explaining the Brain Gauge test and were given a full explanation of the test procedures (as detailed in sections 3.7 to 3.9). Participants were advised that their kava intake, and any other liquid or food consumed during the test period, would be recorded by a research assistant, who would also note any unusual behavior among the participants, as the test proceeded. The participants were then given time to ask questions.

Following this, the participants were taken to the computer lab to complete the first psychometric test session, using the Brain Gauge, to provide baseline data. Once baseline testing

was complete, all participants returned to the *faikava* venue and were invited to sit on woven mats, where *isevusevu* was presented.

isevusevu is a Fijian-influenced cultural practice in which attendees are acknowledge and the purpose of the *isevusevu* explained. In this case, the participants were thanked for their time and participation (Aporosa, 2014a). All Pacific people have cultural practices similar to *isevusevu*, including Māori whose equivalent practice is known as pōwhiri and whakatau (Aporosa & Forde, 2019). By conducting *isevusevu* as part of the *faikava methodology*, this complies with and upholds Pacific cultural expectations and obligations, as guided by a post-development Pasifika methodological framework (Aporosa, 2014; Aporosa et al., 2021).

Over the following 6 hours, the participants drank kava (if they were members of the active group), engaged in *talanoa*, consumed chasers (see section 3.6) and occasionally left the room to use the toilet. The control participants did not consume kava at any point during the testing phase.

3.5 Preparing the kava

Dried powdered kava root and basal stump, originating in Fiji and sold under the Green Gold brand, was purchased from a reputable kava retailer in Hamilton, New Zealand. Green Gold kava powder is sold in sealed bags, as shown in Figure 4.



Figure 4: Green Gold kava powder, used to mix the kava beverage used during testing

A sufficient quantity of kava was sourced for both test-day sessions to aid standardisation. Kava powder, retained for the second testing session, was compressed into heavy-duty plastic bags and stored in an airtight container in a dry dark cupboard at approximately 18°C, to maintain its freshness (AECOM-Kalang, 2017).

Approximately 1 hour before each test session, the author mixed 36 litres (9.51 gallons) of kava for consumption during the test. The author has over 20 years' kava-use experience, and the mixing procedure used a standard recipe to produce a kava beverage with a similar concentration to that usually consumed in *faikava* environments in New Zealand. The recipe used was also chosen for its ease of duplication.

The prepared kava was served to the participants in the active group from a *kumete*, in *bilo/ipu* (cups made from coconut shells), at 100ml (equivalent to 0.2 pints) portions (see Figure 5 and Figure 6). Portions were served at the rate of six serves per hour, throughout the 6-hour test session; meaning that each active participant consumed 3.6 litres of kava during the session.



Figure 5: Kava being poured into the kumete for serving to study participants. (Photographer: Todd M. Henry, 2019)



Figure 6: Kava being served, in bilo/ipu from a kumete, during the test session (Photographer: Todd M. Henry, 2019)

3.6 Location and set up of the kava session

The room where the kava was consumed during the study was set up to reflect a *faikava* space, or a typical kava session venue. To replicate that naturalistic environment, woven mats were placed on the floor, which the participants sat on cross-legged while consuming the kava (see Figure 7).

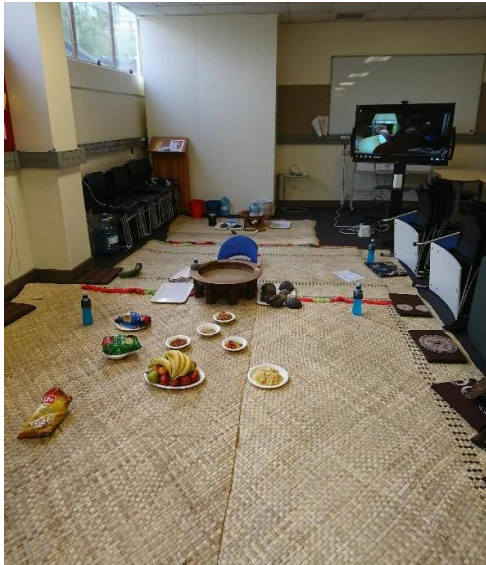


Figure 7: *The faikava environment used during the study (Photographer: Author, 2019)*

The author ensured that all cultural kava consumption protocols were adhered to throughout the session (Aporosa, 2014a). This adherence to protocol, together with the naturalistic setting, encapsulated the *faikava methodology*, as used in previous kava cognition studies.

All of the participants were invited to partake of snack foods, at their leisure, during the test period. These foods were typical kava ‘chasers’, or food items consumed during a regular kava session, and included salted potato chips and peanuts, apples, pears, bananas and sweets (see Figure 7). The sweets provided were sugar-free to limit any potential cognitive stimulant effect; this was done purely as a precautionary measure, contrary to research that argues “that the idea of a positive CHO–mood relationship is unsubstantiated” (Mantantzis et al., 2019).

The drinks offered (in addition to kava) were water and sports rehydration drinks, as participants had been asked to avoid any Coco-Cola, energy drinks or caffeine. Participants were free to move about the venue and leave it to use the toilet throughout the testing session, although members of the active group were advised to be in the room at kava serving times, and all participants were required to be available for testing in the computer lab.

Although the study adhered to some strict conditions, flexibility around the consumption of chasers, along with the freedom to move about were allowed, so as to create a naturalistic kava consumption setting and to comply with the structure of the *faikava methodology* (Aporosa et al., 2021).

3.7 Psychometric tests used in the cognitive assessment

The cognitive assessment of participants during the study was conducted using the Brain Gauge testing tool (www.corticalmetrics.com). Brain Gauge is an innovative tool that measures slight

changes in strategic, tactical and operational cognitive faculties, including fine motor skills and fatigue, to assess neurological functioning (King et al., 2018).

Shaped like a typical computer mouse, the Brain Gauge device has two probes (each 5mm in diameter) on which the participant rests the index and middle finger of their non-dominant hand. The participant also controls a standard computer mouse using the dominant hand. This standard computer mouse is used to register responses delivered by the Brain Gauge probes. The Brain Gauge tool is paired with a Brain Gauge application, which delivers the test battery via a computer screen. This set-up is shown in Figure 8.

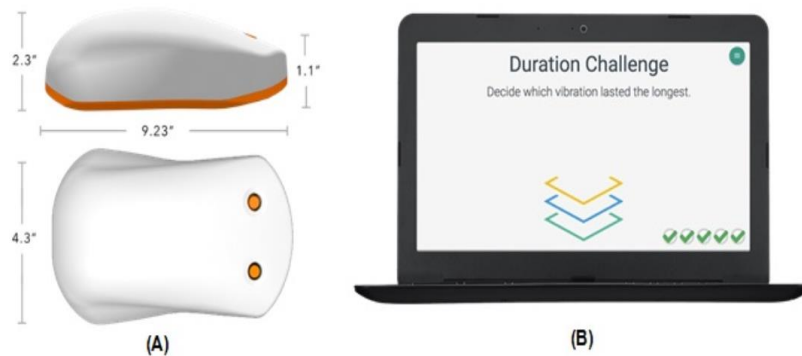


Figure 8: “The ‘Brain Gauge’ (A) two-digit vibro-tactile stimulation handheld device and (B) example of visual cueing test screen” (King et al., 2018, p. 3).

During the test, the Brain Gauge probes deliver a vibratory stimulus (with a flutter range of 25 to 50 Hz) to the participant’s non-dominant index and middle fingers, and the application presents the participant with a range of nine tasks related to this stimulus. For example, the participant may be asked to click the mouse key (using the dominant hand) as quickly as possible when they feel a vibratory stimulus delivered through the probes, in order to record the reaction time between when the stimulus is delivered and the participant’s response.

The nine tasks delivered by the application measure²:

- Speed – reaction time and reaction time variability, with fatigue as a variable
- Accuracy – sequential amplitude discrimination and simultaneous amplitude discrimination
- Temporal Order Judgement and Connectivity – to measure sequencing and how well brain cells are communicating with each other
- Timing Perception – duration discrimination
- Plasticity – to measure how well the brain is integrating, processing and adapting to information from the external environment

² For ease of reference, the six attributes measured during the testing will be capitalised throughout the report.

- Focus – associated with motivation, attention span, determining similarities and differences between objects or events, and the ability to predict future consequences (King et al., 2018; Tommerdahl, 2017).

Brain Gauge also calculates an overall composite score (cortical metric), together with individual task scores, which are presented alongside normative scores (Cortical Metrics, 2017; see also Figure 9). These performance measures can be applied to the strategic, tactical and operational cognitive aspects needed to understand driver capacity and performance (Barkley & Cox, 2007).

Brain Gauge has test–retest functionality (meaning results are not compromised with repeated use), and has been used in more than 60 major studies measuring traumatic brain injury, drug use and autism, resulting in 45 peer-reviewed publications. In addition, Brain Gauge is increasingly being used (in the United States and, more recently, New Zealand) as a field-side neurosensory measure to assess concussion in professional sport (chiefly American football and rugby union).

For this study, testing was completed in a computer lab adjacent to the *faikava* venue, where each Brain Gauge device, together with a standard computer mouse, was connected to a Dell Optiplex (9020) desktop computer running the Brain Gauge application. Participants were instructed to place their non-dominant hand on the Brain Gauge mouse, in such a way that their index and middle fingers were in contact with the probes, and their dominant hand on the standard computer mouse. If participants pressed too hard, the Brain Gauge application would instruct them to loosen their grip.

Participants were requested to read the test instructions on the computer monitor carefully and to focus, while at the same time staying relaxed and answering each question to the best of their ability. The Brain Gauge application presented participants with a brief demonstration of what vibrations would feel like on their fingers. It then led the participants through the test battery, with each test taking between 1 and 3 minutes. The participants had to complete three practice trials at the beginning of most tests and were required to answer all three trials correctly before they could progress. Feedback was given on the practice trials, but not task trials. The total test battery took between 10 and 20 minutes to complete.

Each participant was allocated to one of several research assistants who monitored their progress and addressed any issues during their use of the Brain Gauge tool. Once participants had completed the test battery, they were redirected to the Brain Gauge home page. The research assistants then directed them back to the *faikava* venue. Participants were not made aware of their scores or performance at any time during the testing.

3.8 Testing intervals

The study's 6-hour duration was selected to represent the period of a typical traditional kava session (Aporosa & Tomlinson, 2014), and was consistent with the two earlier kava-cognition studies undertaken by the author (Aporosa, 2017b; 2020; Aporosa et al., 2020).

Testing with the Brain Gauge tool occurred at three points during the study:

- T1: baseline prior to any kava consumption
- T2: halfway through the kava session (when participants had been drinking for 3 hours)
- T3: when the kava session had ended, 6 hours after the consumption of the first *bilo* of kava.

The participants were given 5-minute warnings before each test session. Brain Gauge baseline testing (T1) commenced at 6.30pm, and as explained earlier, was followed by *isevusevu*. The final Brain Gauge testing (T3) was undertaken following the sixth hour of kava consumption at 12.30am.

On returned to the *faikava* space, after the final testing, the participants were acknowledged with *tatau*. *Tatau* is similar to *isevusevu*, and in this case thanked participants for their time and participation. It also complies with Pacific cultural expectations and obligations, and the post-development methodological framework and *faikava methodology* used in the study (Aporosa, 2014a; Aporosa et al., 2021).

The *tatau* provided an opportunity for some of the control participants to consume kava for the first time, and was followed by a substantial meal, and presentation of a \$100 gift voucher to thank each of the participants for their time. All participants were provided with a ride home. The test session took approximately 7.5 hours to complete.

3.9 Analysis of the test data

Brain Gauge test results are presented in both illustrative and numerical format, with the latter easily exported to a variety of software options for data analysis.

Figure 9 shows a typical data output in illustrative form, as produced by the Brain Gauge application. The figure was produced following the feasibility study, and shows the test results for participant AA at baseline (T1), the midpoint at 3 hours (T2) and the completion of kava drinking at 6 hours (T3) (Aporosa et al., 2021).

Although this mode of illustration is extremely valuable for interpreting the data of individuals, it is less clear for presenting group data.

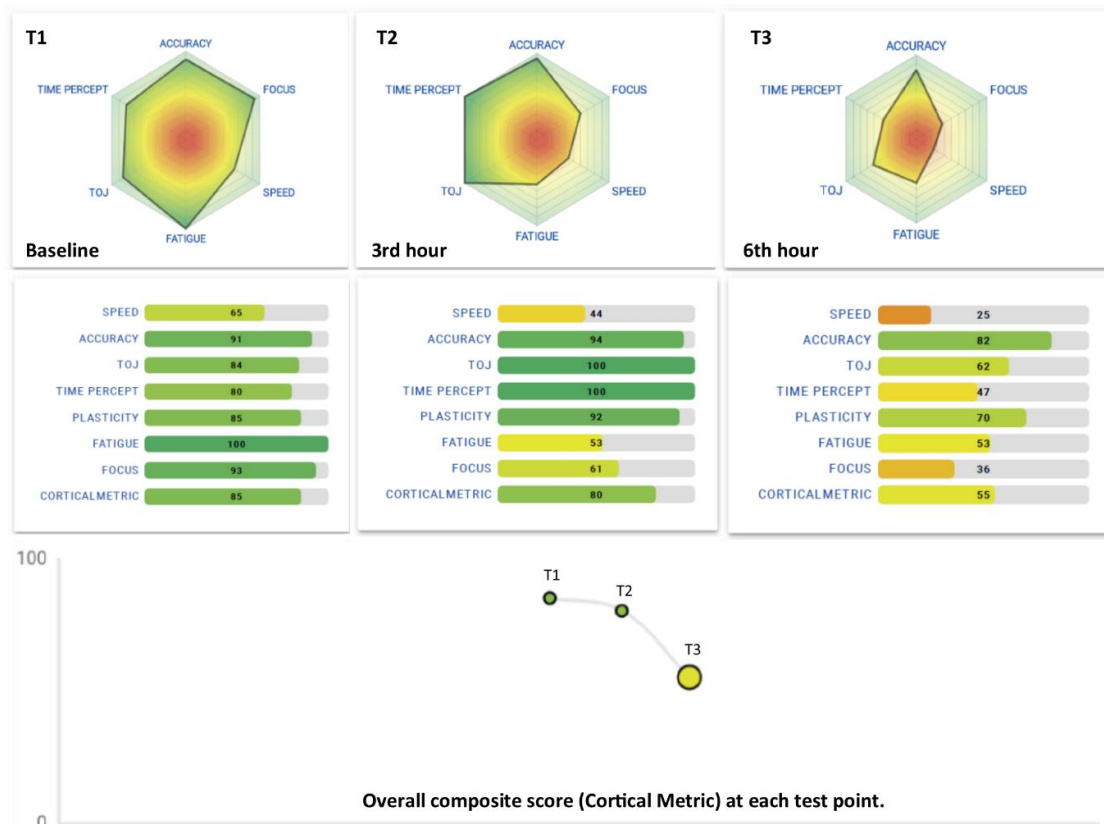


Figure 9: Brain Gauge output data: at baseline (T1); the 3-hour midpoint (T2); and at the conclusion of kava consumption at 6 hours (T3) for participant AA (Aporosa et al., 2021)

In the study, instead of generating Brain Gauge illustrations, the numerical data was exported and analysed using Student’s *t*-test (Normal), a nonparametric statistical test that comes in two versions: the Wilcoxon signed-rank test and the Mann-Whitney U test (rank sum); together with Bayesian inference techniques.

Student’s *t*-test and non-parametric analysis compares and measures the significance of differences between paired groups: in this study, that was the difference between the active and control groups. Bayesian analysis produces a ‘Bayes factor’, which is used for comparative analysis. A Bayes factor represents a ratio of the likelihood of a specified hypothesis (e.g. the effect of a treatment) compared to a second hypothesis (e.g. the treatment having no effect).

4 Results and discussion

4.1 Kava analysis

Several weeks after completion of testing, the author took a 200gm (7.05 ounce) sample of the Green Gold kava powder used in the testing to the New Zealand Institute of Environmental Science

and Research in Wellington for analysis. While there, the author also mixed a sample of kava using the same recipe as used for testing.

Both the powdered Green Gold kava and the mixed sample were tested by an institute scientist. The kava was found to contain no adulterants, with a strength rating of 5 per cent total kavalactones by dry weight, a chemotype of 462531, and a mean kavalactone content of 115mg per 100ml of kava beverage.

4.2 Kavalactone ingestion volumes

All 20 of the active participants consumed the maximum of 3.6 litres (7.6 pints) of kava over the 6-hour test period, drinking the full 100ml of kava at each serving.

With the analysis showing the presence of 115mg of kavalactones per 100ml of kava beverage, this equates to each active participant having consumed 1,840mg of kavalactones by the time of the T2 Brain Gauge test after 3 hours of kava drinking, and 3,680mg after 6 hours of kava consumption, just prior to the final test (T3).

This level of consumption is almost 15 times greater than the pharmacologically recommended dose.

4.3 Psychometric test data

As explained in Section 3.7, the Brain Gauge test battery comprises nine tasks which measure six cognitive attributes or domains: Speed (with Fatigue as a variable), Accuracy, Temporal Order Judgement, Timing Perception, Plasticity and Focus.

Additionally, in section 3.10, it was explained that while the Brain Gauge application presents the test data of individuals in a user-friendly illustrative format, as shown in Figure 9, this is not the case with group data. Therefore, the data analysis in this study will, in the first instance, be presented in Tables 2, 3 and 4. These will be followed by specific points of discussion, accompanied by simple box-plots (and in one case violin-plots).

Within the Tables, p-values for *t*-test and nonparametric statistical test data meeting statistical significance (≤ 0.05), and Bayesian analysis data greater than a cutoff of 2.5, are either highlighted in **bold** text or underlined. This will aid discussion in the following sections.

Tables 2.1, 3.1 and 4.1 present within-cohort data (comparing control group data with control group data, and active kava using group data with active kava using group data) at the three test points (T1, T2 and T3, as explained in section 3.8). Although some of that within-cohort data is statistically significant (≤ 0.05) (for instance, the control group shows a marked regression in

Plasticity, or how well the “brain is integrating, processing, and adapting to information from [the] external environment” (King, Hume, & Tommerdahl, 2018, p. 4) between their T1 baseline and T2 midpoint third-hour test [$W=0.002838$; $t=0.001382$; $BF=27.93537$], whereas no change is evident among the active participants for the same period) only one data set (active group Focus) will be discussed here.

Concerning the within-active-cohort Focus data, Table 2.1, 3.1 and 4.1 show a statistically significant level of impairment to the Focus of the active participants at T2 (or following 3 hours of kava use): [$W=0.03315$; $t=0.02225$; $BF=2.651865$]. However, at T3, and following 6 hours of kava drinking, the Focus of the active participants shows a (non-statistically significant) level of improvement: [$W=0.08003$; $t=0.0599$; $BF=0.1243$]. That change in a positive direction (as opposed to a regression) can be seen in Figure 10, which is a simple box-plot showing the results of the group statistics t -test analysis.

Together with an observational comment in section 4.4, this positive change in Focus will be discussed in section 4.5 in relation to driving.

Table 2: Non-parametric analysis of Brain Gauge output data

2.1 Group-wise (analysed with the Wilcoxon signed-rank test [W])

Test	Focus	Accuracy	Temporal Order Judgement	Timing Perception	Plasticity	Fatigue
Control-T1 v Control-T2 Control-T1 v Control-T3	0.06491 <u>0.04377</u>	<u>0.003521</u> 0.6699	0.2361 0.09922	0.6024 0.3058	<u>0.002838</u> 0.1688	<u>0.02874</u> 0.07028
Active-T1 v Active-T2 Active-T1 v Active-T3	<u>0.03315</u> 0.08003	0.3801 0.07013	0.7798 0.2572	0.08502 0.0908	0.5958 0.2943	0.3636 0.9687

2.2 Test-wise (analysed using the Mann-Whitney U test (rank sum) [MW])

Test	Focus	Accuracy	Temporal Order Judgement	Timing Perception	Plasticity	Fatigue
Control-T1 v Active-T1 Control-T2 v Active-T2 Control-T3 v Active-T3	0.09256 0.5669 0.1284	0.2154 0.5174 0.4218	0.6432 0.556 0.01199	0.3264 0.1969 0.4986	0.3049 0.4478 0.2111	0.9146 0.3381 0.1534

Of greater interest are Tables 2.2, 3.2 and 4.2, which present the between-cohort data (comparing data from the control group and the active kava using group) at the three test points (T1, T2 and T3).

Table 3: *t*-test analysis of Brain Gauge output data

3.1 Group-wise [t]

Test	Focus	Accuracy	Temporal Order Judgement	Timing Perception	Plasticity	Fatigue
Control-T1 v Control-T2 Control-T1 v Control-T3	<u>0.03943</u> <u>0.04786</u>	<u>0.003769</u> 0.6725	0.2057 0.08645	0.7241 0.2126	<u>0.001382</u> 0.1324	<u>0.0267</u> 0.05641
Active-T1 v Active-T2 Active-T1 v Active-T3	<u>0.02225</u> 0.0599	0.6374 0.07084	0.8907 0.2512	0.09863 0.1242	0.9972 0.2446	0.3301 0.8949

3.2 Test-wise [t]

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

Table 4: Bayesian analysis of Brain Gauge output data represented as Bayes Factor [BF]

4.1 Group-wise [BF]

Test	Focus	Accuracy	Temporal Order Judgement	Timing Perception	Plasticity	Fatigue
Control-T1 v Control-T2 Control-T1 v Control-T3	1.705228 1.464235	<u>11.82067</u> 0.2580279	0.4995444 0.9301191	0.2516297 0.4885296	<u>27.93537</u> 0.6795536	2.327754 1.288536
Active-T1 v Active-T2 Active-T1 v Active-T3	<u>2.651865</u> 1.207349	0.2576112 1.061227	0.2343741 0.4286033	0.8267202 0.6976325	0.2323277 0.4361348	0.3611313 0.2342181

4.2 Test-wise [BF]

Test	Focus	Accuracy	Temporal Order Judgement	Timing Perception	Plasticity	Fatigue
Control-T1 v Active-T1 Control-T2 v Active-T2 Control-T3 v Active-T3	0.9029292 0.5596713 0.8067667	0.4422151 0.5227868 0.3327489	0.321491 0.3621285 6.193058	0.4458265 1.114496 0.4108801	0.4095644 0.484628 0.4634306	0.3207528 0.4419345 0.4753166

Focus

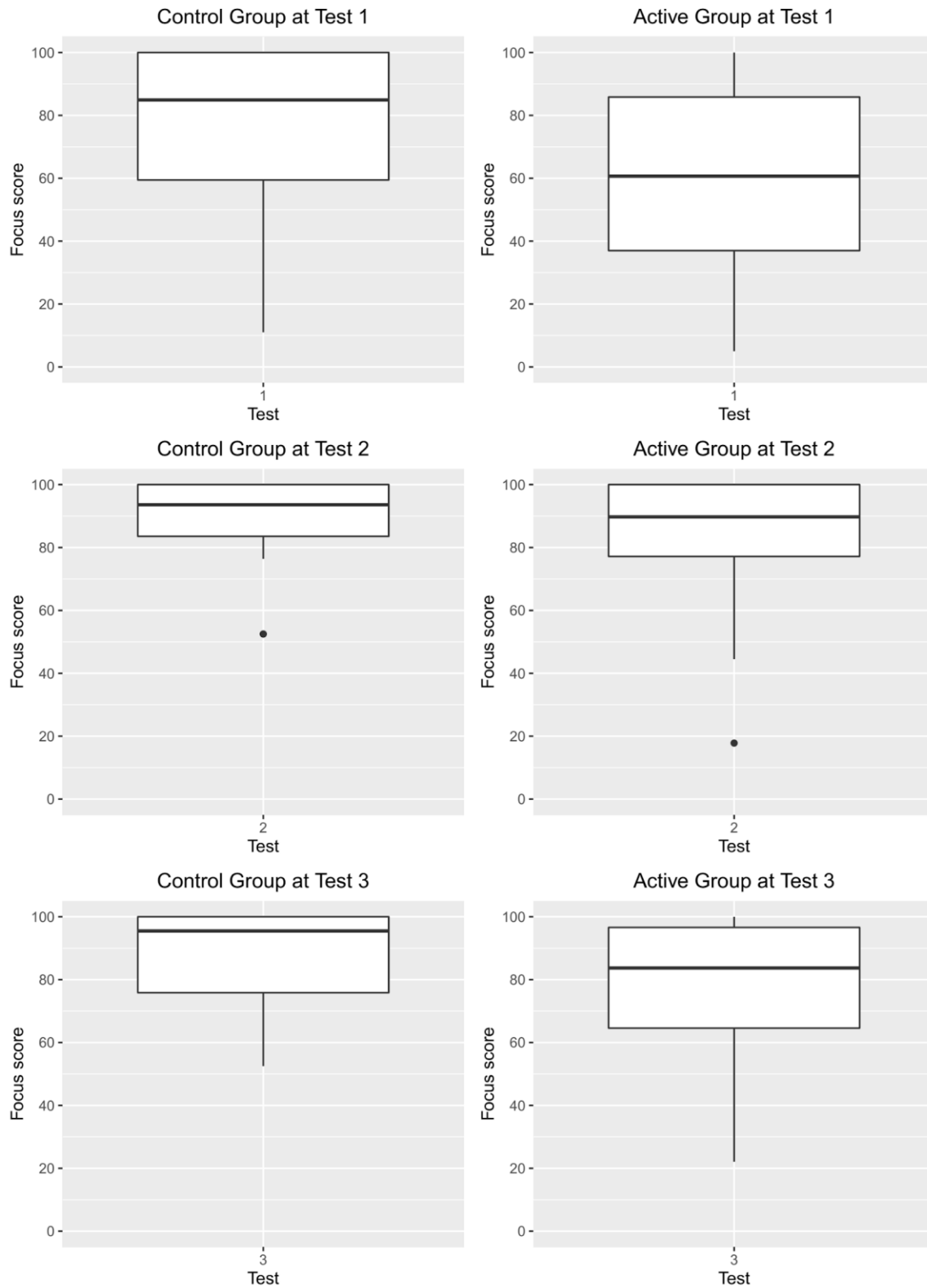


Figure 10: Simple box-plot showing the Focus data

At odds with the hypothesis (as presented in section 2.4), the results show no statistically significant level of impairment to the following five cognitive attributes or domains for the active participants (when compared with the control participants) over the course of the 6-hour kava-use session.

- Focus – or how well the “brain is able to concentrate on the task at hand” which is “associated with motivation, attention span, determining similarities and differences between objects or events, and the ability to predict future consequences” (Pawluk, 2018c).
- Accuracy – or how well the “brain is able to differentiate between similar sensations or stimuli” which is “responsible for integrating sensations that are detected by different parts of the body” (Pawluk, 2018a). A simple box-plot showing the Accuracy data is presented in Appendix A.
- Timing Perception – or how well the “brain is able to keep track of time” which is linked to “motor learning, balance and coordination, and timing accuracy” (Pawluk, 2018f). A simple box-plot showing the Timing Perception data is presented in Appendix B.
- Plasticity – or how well the “brain is able to react and adapt to changes in [the test subjects] surroundings”, allowing response adjustments to new situations and environmental change (Pawluk, 2018d). A simple box-plot showing the Plasticity data is presented in Appendix C.
- Fatigue – or how the “brain tires during a mentally demanding task”, which has an impact on reaction time (Pawluk, 2018b). A simple box-plot showing the Fatigue data is presented in Appendix D.

Although the data described above shows no statistically significant changes for five of the domains measured by the Brain Gauge, there are nevertheless two points of interest.

The first point of interest relates to Timing Perception. Tables 2.2, 3.2 and 4.2 (and Appendix B) show no statistically significant change in Timing Perception for the active group when compared with the control group over the 6-hour period ($[MW=0.4986; t=0.4068; BF=0.4108801]$). Within the Brain Gauge test definitions, Timing Perception includes “balance and coordination”. Therefore, the data suggests kava use over 6-hours has no negative impact on the drinker’s ability to maintain body position control during the execution of a task. This finding contradicts a recent master’s degree study in which participants ($n=6$), who also attended a 6-hour kava-use session employing the *faikava methodology*, had their balance and coordination assessed using a force-plate and y-balance measure (Aughton, 2020). Preliminary results from a reanalysis of the data suggests participant balance is statistically significantly compromised at T3. That study will be published in coming months.

The second point, which is of greatest interest, is the Temporal Order Judgement test scores. Data in Tables 2.2, 3.2 and 4.2, which compares the Temporal Order Judgement scores of the

active kava users (with those of the control group), shows a significant level of regression in participants' Temporal Order Judgement at T3: [$MW=0.0119$; $t=0.007301$; $BF=6.193058$]. Figure 11 presents a simple box-plot of the results of this data. Figure 12 shows the same data presented as a violin-plot, to provide alternative illustration.

Temporal Order Judgement includes sequencing and is associated with "how well [the] brain is able to keep track of the order of events" (Pawluk, 2018e). King, Hume and Tommerdahl (2018) add that Temporal Order Judgement, as assessed by the Brain Gauge, is a "metric associated with the 'when' pathway (frontal-striatal)" (p. 4). With "frontal-striatal pathways control[ing] many of the brain's executive functions, including decision making, behavioral control, and information processing" (Pawluk, 2018e), this is argued to have implications for safe driving, a theme that will be discussed in section 4.5.

This finding of regression in participant's Temporal Order Judgement supports, to some extent, the study hypothesis (as presented in Section 2.4), with the acknowledged limitation that kava appears to impact only one of the six domains measured by the Brain Gauge. Due to the large knowledge gaps concerning kava neuroscience and neuro-psychopharmacology, which is exacerbated when associated with naturalistic kava use (Aporosa et al., 2021; Bwarenaba et al., 2017), reasoning or speculation will not be offered concerning the apparent lack of impact on the other five domains.

4.4 Observations

Following the approach adopted in Experiment 1, the author and research assistants discussed any observations they made during the test period regarding changes in the participants' behavior.

As with Experiment 1, subtle changes were noted in many of the active participants, with these changes often becoming more noticeable after 4 hours of kava use (Aporosa et al., 2020). Changes noted included slowed psychomotor response, a somnolent-like state, slightly altered word pronunciation and a slowed speech rate.

These observations align with reports from both New Zealand and Pacific-based police, who state that kava drink-drivers observed during road-side stops typically exhibit decelerated body movement and slurred or slowed speech (Berry et al., 2019; Galuvoa, 2018; Kalura, 2018; Mishra, 2018; Morgan, 2014; 2017; Tokalau, 2020; Welsh, 2017).

Temporal Order Judgment

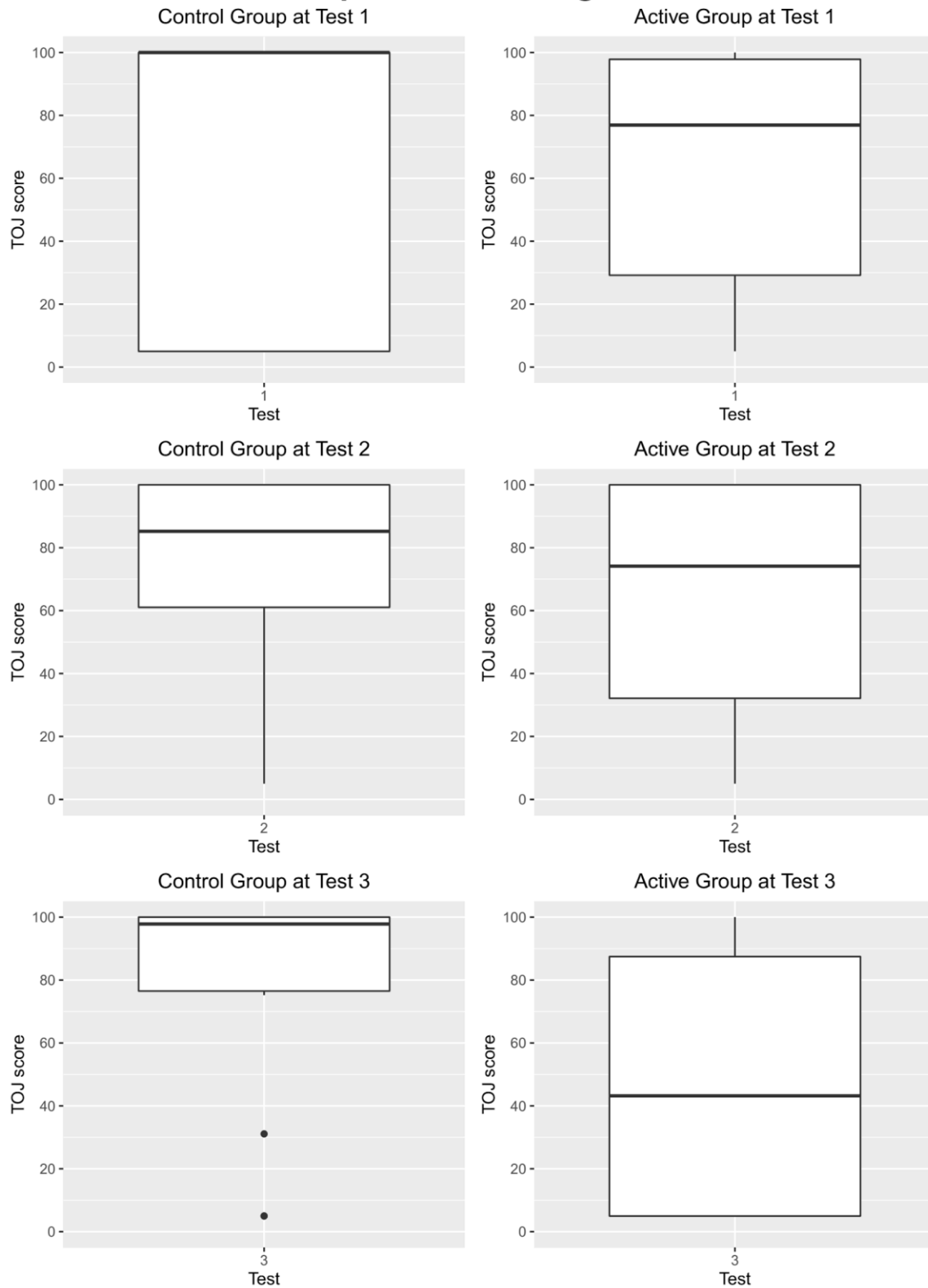


Figure 11: Simple box-plot showing the results of the Temporal Order Judgement data

Temporal Order Judgment

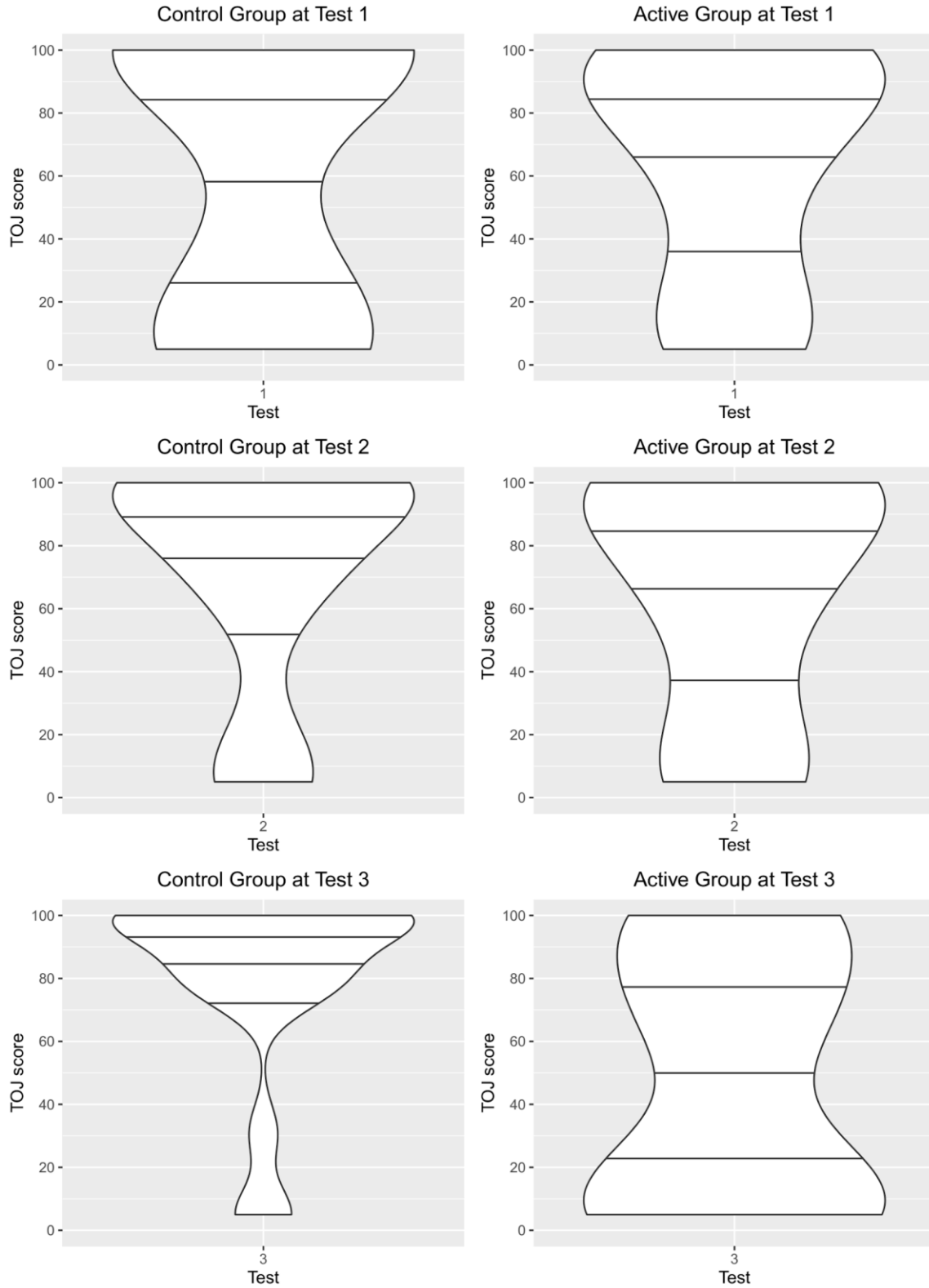


Figure 12: Violin-plot showing the results of the Temporal Order Judgement data

Observationally, there is an additional point of interest. At T1 baseline testing, the control participants generally appeared a lot more focused on the computer screen than the average active participant. For instance, the control participants appeared to lean further forward in their chair, allowing closer proximity to the computer screen and suggesting an increase in concentration when undertaking the Brain Gauge task. At T2, the control participants appeared slightly less intent and focused, adopting a slightly more relaxed posture, when compared with T1. At T3, the control participants were vastly more relaxed, giving the appearance they either 'knew' the test and were comfortable with it and their surroundings, or they were tired.

However, the possibility of tiredness must be treated with caution; particularly as the data does not support this idea. For instance, at T2, the data shows the control participants as having a statistically significant level of Fatigue: [$W=0.02874$; $t=0.0267$; $BF=2.327754$], whereas at T3 the data shows an improvement in Fatigue: [$W=0.07028$; $t=0.05641$; $BF=1.288536$].

Conversely, the active participants appeared more relaxed than the control group at T1, although at T2 and T3 there appeared to be an incremental increase in how they sat in their chairs and focused and interacted with the Brain Gauge task. For instance, at T1, the active participants appeared relaxed and 'laid-back' in their seated position, engaging with the Brain Gauge task in a more relaxed manner than their control counterparts. However, at T2, they appeared to lean forward more in their chairs, moving slightly closer toward the computer screen and suggesting a greater level of concentration on the task when compared with T1. That increased level of perceived vigilance though did not appear to be carried back into the *faikava* environment, following the T2 test. The active participants appeared to relax back into the kava-use session after the test, exhibiting early stages of somnolence and a slight slowing of speech rate, as already described.

At T3, most of the active participants appeared even more focused on the Brain Gauge task than they did at T2. This included moving further forward toward the computer screen and bodily, assuming a subtle, yet greater, degree of postural rigidity (with less body movement) than at T2. On return to the *faikava* space following the final T3 test, the active participants appeared to return to their pre-T3 test relaxed state, with some stating it was 'good to be able to *now* relax and enjoy the kava', suggesting testing had been demanding.

Admittedly these comments are based on speculation linked to observation. However, this change in demeanor by the active participants from T1 to T3 – from a relaxed state to a more focused and intent presence – also appears to be reflected in the active participant Focus scores and the shift from a statistically significant level of regressed Focus at T2 [$W=0.03315$; $t=0.02225$; $BF=2.651865$] to an improved level of Focus at T3 [$W=0.08003$; $t=0.0599$; $BF=0.1243$].

This improved level of Focus is also reflected in the Fatigue data, showing a non-statistically significant level of Fatigue improvement from T2 [$W=0.03636$; $t=0.03301$; $BF=0.3611313$] to T3 [$W=0.9687$; $t=0.8949$; $BF=0.2342181$].

4.5 Focus, Temporal Order Judgement and driver safety

The data shows an improvement in the Focus (and Fatigue) of the active participants between T2 and T3, despite the fact that the participants had been at the test venue for over 6 hours and the final T3 test was conducted at 12.30am. With kava's dominant effects reported as soporific, anxiolytic and relaxant (Cairney, Maruff, & Clough, 2002; Duffield & Jamieson, 1988; Pittler & Ernst, 2003; Singh & Singh, 2002), it would be expected that the data would show a regression in both the Focus and Fatigue scores as the testing progressed. Due to large gaps in kava neurophysiological, metabolism, drug half-life and neuro-psychopharmacology understanding, it is not currently possible to provide a physiological reasoning for this Focus and Fatigue score improvement on the part of the active participants.

Taken at face-value, what the results currently suggest is that kava may have a small positive effect on Focus; that following 6 hours of traditionally influenced kava use, this potentially improves how well the "brain is able to concentrate on the task at hand" (King et al., 2018; Tommerdahl, 2017), as well as enhancing "motivation, attention span ... and the ability to predict future consequences" (Pawluk, 2018c). This in turn would slightly enhance a driver's alertness and therefore improve driving safety. However, it is argued that that statement should be treated with caution, as the data shows a very different effect on Temporal Order Judgement.

At T3, at a time when each active participant had consumed 3,680mg of kavalactones, data shows a significant level of impairment to participants' Temporal Order Judgement [$MW=0.0119$; $t=0.007301$; $BF=6.193058$]. As a reminder, the Brain Gauge measure of Temporal Order Judgement is associated with the "integrity of the frontal-striatal cortex ... the frontal-striatal pathways control[ing] many of the brain's executive functions, including decision making, behavioral control, and information processing" (Pawluk, 2018e).

In their comprehensive literature review evaluating measures of executive function, Asimakopulos and colleagues (2012) report that executive function plays a vital role in safe driving. To assist their claim, they define the operational components of executive function as,

Decision-making / judgment - The assessment and 'ordering of various competing actions and goals'.

Impulse control / inhibition - 'The ability to suppress automatic actions that are inappropriate in a given context that interfere with a certain behaviour'.

Self-awareness / insight - The 'ability to critically appraise our own actions and the actions of those around us'.

Cognitive flexibility - 'The ability to shift between response sets, learn from mistakes, devise alternative strategies, divide attention, and process multiple sources of information concurrently'.

Planning - 'The ability to envision both the ideas contained in a strategy and the steps involved in a tactical approach to realising the strategy'.

Working memory - Executive process responsible for the temporary storage and manipulation of information in both simple (e.g. recalling a series of digits, such as a phone number) and complex cognitive tasks (e.g. coordinating two tasks simultaneously). (p.403)

Anstey and colleagues (2005) add that "executive function is necessary for integrating information and planning a response" (p. 46). They illustrate the importance of the connection between information integration and response planning on the one hand, and safe driving on the other, by stating that as we age our faculties of executive function decrease. They then hypothesise that the over-representation of elderly drivers involved in motor vehicle accidents at intersections (noted to be driving situations that involve complexity: "(i.e., the planning and decision-making part of the driving task)") correlates with that decline (p. 46).

What is confusing in the current study is that although the data shows an improvement in Focus scores for the active kava drinking participants from the T2 to T3 tests, it also shows a significant decline in Temporal Order Judgement, and therefore a negative impact on executive function, over the same period. Put another way, the data suggests that while the active kava drinking participants showed improvements in concentration "motivation, attention span ... and the ability to predict future consequences" (Pawluk, 2018c) from T2 to T3, they equally showed a significant decline in their ability to coordinate complex tasks and in "planning and decision-making" (Anstey et al., 2005, p. 46).

This confound was discussed with several psychopharmacology experts who, although unable to explain the anomaly, recognised that understanding of the effect of kava on cognition when consumed at traditionally influenced volumes (as opposed to modified pill-style kava) is still new and evolving.

However, what also needs to be recognised is that "[Executive function] is a complex construct to both understand and assess" (Asimakopulos et al., 2012, p. 423), suggesting that the confound cannot be solely explained by reference to the kava-science knowledge gap. Where this anomaly may have application is in clarifying comparisons between kava and benzodiazepine, particularly as kava is often compared to this prescription anxiolytic. For instance, when benzodiazepine dose is markedly increased, effects commonly include interference with reasoning or judgement, over-sedation, loss of coordination, marked euphoria, excitability, aggression and loss of consciousness

(Liebrenz et al., 2016). This does not occur when kava is consumed at high volumes. Put simply, kava and benzodiazepine have similar effects at low dose. However, at high dose they are very different, with the consumption of high kava volumes not leading to a marked loss of thinking clarity, control or consciousness.

It is valuable at this point to further consider kava's effects in comparison to other drug substances, particularly as the effect of kava has been compared with alcohol intoxication – leading to the commonly used term *kava intoxication* – as well as laudanum, cannabis, opiates (narcotics), and hallucinogens (Aporosa, 2019a). In an earlier section, it was stated that unlike alcohol and most other recreational drugs, kava drink does not cause marked euphoria or hallucination, instead inducing relaxed feelings and clear-headedness (Aporosa, 2011; 2019a; Carlini, 2003). Much of that understanding is based on ethnographic commentary. These current findings add quantitative support to that qualitative data, demonstrating that kava's effects are not only different to high-dose benzodiazepine use (as described above), but also vastly different to many of the drug substances kava is compared with.

For instance, in their chapter on the 'Influence of drugs on cognitive functions', Juárez-Portilla and colleagues (2018) explain how a selection of depressant and stimulant drugs impact cognitive faculties. Stimulant drugs, which include methamphetamine and cocaine, are not discussed here as kava has not (to the author's knowledge) been compared with these drugs. Instead, this discussion focuses solely on two key depressant drugs: alcohol and cannabis.

Juárez-Portilla et al. note that alcohol has a "biphasic effect on brain activity, causing excitation and euphoria ... confusion, loss of awareness and selective attention begin to occur, significantly diminishing the execution of working memory and its long-term consolidation." (p. 63) Cannabis is also noted to induce mild euphoria leading to impaired basic motor coordination, disrupted planning, organisation and problem-solving ability, and interference with decision making and emotional and behavioral control. The authors point out, though, that the severity of any impairment depends upon cannabis cultivar strain, use quantity and frequency, with habitual use playing "an important role in the diminution of gray matter". (p. 64)

As the findings of this study show, while kava has a significant impact on Temporal Order Judgement, no interference occurs to most of the cognitive faculties disrupted by alcohol and cannabis use. This also shows that kava effect cannot be described as hallucinogenic; with drugs that do fall under this category typically causing hallucinations and anomalies in perception together with considerable change in subjective thought, consciousness and emotion (Goldberg & Dillon, 2005). Additionally, this study shows that kava's effects cannot be described as narcotic,

also a common effect descriptor applied to kava³. As the U.S. Drug Enforcement Administration (2020) explains, “the term ‘narcotic’ comes from the Greek word for ‘stupor’” and is linked to high opiate use (p.1), an effect clearly lacking in high-volume kava use.

Finally, the present discussion demonstrates that the common term used to capture kava’s effects following high-volume use, ‘kava intoxication’, is misleading and incorrect. This is particularly the case when ‘intoxication’ is commonly defined as “having physical or mental control markedly diminished” (Merriam-Webster online dictionary).

By drawing on the study findings and literature that explains how selected drugs impact cognitive faculties, this study clearly shows that kava, when consumed in naturalistic settings over many hours, has unique but subtle effects. These are vastly less impactful on cognitive faculties, and very different to the effects of alcohol, cannabis, hallucinogens and narcotics. However, it must be noted that although this present discussion explores differences in effect between differing substances, it is not suggesting that kava has no impact on driver safety.

In the early stages of this report, it was explained that naturalistic traditionally influenced kava consumption typically occurs in communal environments, over many hours, with users routinely drinking more than 20 times the pharmaceutically recommended daily dose; and an estimated 70 per cent of those users then driving home, some long distance and inter-city. It was also explained that police are stopping what they suspect are increasing numbers of kava-impaired drivers, but lack suitable evidential-standard measures to assess these drivers’ competency (for example, blood or breath-screening tests, which “research has shown ... is the most effective way to deter drink-driving” (Smith, 2013, p. 24)).

This study indicates that high traditionally influenced volumes of kava consumption can significantly impair decision making, behavioral control and information processing linked specifically to Temporal Order Judgement as defined in the Brain Gauge descriptor. This raises the issue and challenge of how to modify driver behavior when it comes to combining kava consumption and driving. This challenge will now be discussed.

4.6 Encouraging driver behavioral change

In relation to drug-impaired driving, Watson and Mann (2018) explain that, unlike alcohol drink-driving, research shows,

³ A search of the authors Endnote library lists 57 books, published papers and news items describing kava as a ‘narcotic’.

relatively high degrees of willingness or intent to engage in [drug impaired driving ... as] many users do not view their driving as impaired... In some contexts, [drug impaired driving], therefore, appears to be a fairly 'normalised' behaviour among people who use drugs, particularly if it is common among one's peer group. (p. 106)

With 70 per cent of kava users reportedly driving home following kava use, and some of that driving being long distance (Auckland to Hamilton and vice-versa being common, for instance), this would suggest driving following kava use is also a fairly normalised behavior.

Watson and Mann (2018) suggest a harm-reduction approach to address drug-impaired driving. The central theme of harm-reduction theory acknowledges that societies will never be drug free, yet "recognizes that the [substance] user has the ability to act responsibly and to make choices to stop or modify risky behavior" (Loue, 2003, p. 74). A key aspect of modifying risky driver behavior, including drug-impaired driving, is education that considers the cultural and social norms of the target audience (Lewis et al., 2019; Negi, 2020, p. 9). In their paper focused on designing and evaluating road safety messaging and campaigns, Lewis and colleagues (2019) explain the "transforming approach", a harm reduction measure that "aims to influence community-wide attitudes, values, and norms relating to risky and/or illegal road user behaviors ... [which] is intended to motivate people to align their behavior with perceived community expectations, values, and norms." (p. 299)

Across the Pacific, community expectations, values and norms are associated with cultural respect-based ideals linked to what is inferred as 'chiefly behaviours'. These ideals are encapsulated in (although are not limited to) *rispeck* in the Bislama-speaking nations of the Western Pacific (Papua New Guinea, the Solomon islands and Vanuatu); *vakaturaga* in Fiji; *faka'apa'apa* and *anga fakaTonga* in Tonga; *tautua fatama'ali* and *fa'aaloalo* in Samoa; *kauraro Rarotonga* in Te Au Maohi (or the greater Rarotonga island group); *ke'ano pono* in Hawai'i; and *tikanga* in Aotearoa New Zealand (Aporosa et al., 2021, p. 76; Hemi et al, 2021, p.30).

Drawing on these Pacific-wide ideals, and with the aim of using respect (together with education, harm reduction and a transforming approach) to reach readers and reduce risky driving following lengthy kava use, a three-fold A4 (DL size) user-friendly brochure was produced by the author (see Figure 13). The brochure included a simple summary of police concerns about the effects of kava on safe driving; together with an explanation of the research and its findings, in particular kava's impacts on Temporal Order Judgement (explained, for simplicity's sake, in the brochure as *slowed thinking and decision making*). This information was combined with a challenge to kava-using drivers to reconsider whether they should drive after consuming kava, and if they choose to do so, whether this would align with their Pacific values of respect for other road users.

Been drinking kava?

**Stop and think ...
Will my driving
endanger my passengers
or other road users?**

**If in doubt,
don't drive!**

**KAVA
AND
DRIVING**

IT'S ABOUT RESPECT

For more information on:

- [the cultural importance of kava](#)
- [kava use and safety](#)
- [kava and driving](#), see:

www.aporosa.net/kava-and-driving

hrc Health Research Council of New Zealand

This brochure is based on research by Dr Apo Aporosa at Te Huataki Waiora School of Health at the University of Waikato, and funded by the Health Research Council of New Zealand.

THE UNIVERSITY OF WAIKATO
Te Kōwhiri Wānanga o Waikato

TRG
Transport Research Group

Photographs by award winning photographer Todd M. Henry

Did you know drinking kava can affect how well you drive?

The police and government are increasingly concerned about the effect that kava use is having on safe driving. This has led to three major studies funded by the New Zealand Government.

What is kava?

Kava is a culturally important plant and drink for Pacific people, and a key part of many Pacific celebrations and social occasions.

For many people, drinking kava is relaxing and encourages clear-headed discussions. As a result, kava is often drunk in sociable groups, over many hours, and late into the night.

Kava is not alcohol and does not affect drinkers in the same ways that alcohol does. It is non-addictive, safe to use, and has a number of health benefits.

This makes it very popular, with non-Pacific people also increasingly using kava. Kava is now drunk all around the world.

What effects can kava have?

Studies have shown that drinking kava can slow thinking and decision-making. This, in turn, affects how safely people drive.

For those who drink concentrated (strongly mixed) kava, similar to what is consumed in Vanuatu and some areas in the west Pacific, these negative effects can come on faster. In places where kava is mixed less strong, such as Tonga and Samoa, the effects take longer to develop.

Either way, drinking kava can make it unsafe to drive.

It's an offence to drive impaired by kava

It is against the law to drive a motor vehicle when impaired by kava. If stopped by the police, you risk being arrested, losing your licence and possibly going to prison.

More importantly, driving while impaired by kava puts your own safety at risk, as well as your passengers and other road users. If you kill or injure someone when under the influence of kava, you could be sentenced to a term of imprisonment.

It's all about respect

Pacific people value respect. Respect also underpins kava use. Respect drives Pacific values such as gudfala tingting mo fasin, vakaturaga, anga fakaTonga, fa'aSamoa, kauraro Rarotonga, ke'ano pono and tikanga.

So if you've been drinking kava, stop and think: Am I respecting my passengers and other road users? Could my driving be putting them in danger?

**If in doubt,
don't drive!**

Figure 13: Cover and inside of English language kava drink-driving brochure

To ensure the greatest possible reach and comprehension for the brochure's message, it was translated into (standard) Bislama, Fijian, Tongan and Samoan (see Appendices E to H, respectively). This arguably provided language accessibility for the dominant kava-using nationalities.

4.6.1 Trialing and evaluating the brochure and its kava drink-driving message

Before distribution, the brochures were trialed and evaluated in several *kalapu* (kava-use venues) in Auckland, Hamilton and Canberra, Australia. COVID-19 travel restrictions prevented travel to, and testing of the brochures in the Pacific islands, as had been originally planned.

In total, 62 people (male and female, representing a wide range of Pacific nationalities, together with some non-Pacific participants) took part in the evaluation. Initially, the brochures (in all five languages) were simply placed on the floor at the *kalapu*, unaccompanied by any commentary, to assess interest. At all *kalapu*, the people nearest the brochures immediately picked them up, with some drawing the attention of others present who then asked for a brochure. At the Canberra *kalapu*, a male Tongan in his 30s was asked why he had picked up the brochure so quickly. He replied, "The picture [indicating the cover of the brochure], it's about kava. I want to know."

During this initial period, attendees showed enthusiastic interest, with some asking for a brochure in their own language when they became aware this was available. There appeared a great deal of interest in the translated versions of the brochure, demonstrated in *talanoa* (discussion) about word comparisons across the various languages.

The simple placement of the brochures on the floor at *kalapu* (without commentary) also led to unprompted *talanoa* about kava's effects on cognition. This *talanoa* related to the brochure's statement that, "Studies have shown that drinking kava can slow thinking and decision-making. This, in turn, affects how safely people drive."

Reading this prompted several people to describe their experience of driving following kava use. For instance, a Fijian male in his 40s explained how he had to stop and sleep while driving from South Auckland to Hamilton in the early hours of the morning after drinking kava. He asserted that his driving was fine, and that he had only stopped due to tiredness. Conversely, another male, also Fijian and in his 40s, commented that, "One time, I was so dope [a colloquialism for the effects of high kava use] I drove over the Dinsdale roundabout"; prompting a laugh from many in attendance.

At a different venue, a Fijian woman in her late 30s, whose husband was also present at the *faikava*, recalled a late-night trip home with her husband, who was driving, after drinking kava. She explained that her two children were in the back of the vehicle asleep, and that as they drove into a small rural town, she noticed the vehicle was slowly moving to the right and into the oncoming lane. She stated that if she had not been awake, and had it not been for the streetlights, which enabled her to see that her husband's eyes were closed, or had there been an oncoming car, it was likely they would have died. The husband responded that it wasn't the kava that had caused him to nod-off, but, "we got called out and I was working [the night before]. It was family, so we had to go up"; meaning that following an overnight work shift, he drove to another city for a family commitment, which involved kava use. The woman followed with, "Yes, he was tired. He only drinks [meaning 'drank'] a little bit [of kava]".

At a separate venue, and after a participant asked the author for more information on what was meant by "slow thinking and decision-making", at which Temporal Order Judgement was explained, another participant (a Tongan male in his early 30s) explained that when driving following kava use, and particularly when approaching intersections, he went through (what was described as) a ritual: double-checking the colour of the traffic lights, and even triple-checking for approaching cars to ensure the way was clear. He commented that, "I know that when I drive after grog [a common colloquialism for kava], I have to be more careful, so I go through *the* system".

Another participant present (a male European in his 30s) added, "True. You have to concentrate more. But I can drive OK, but you have to concentrate." Later in the discussion, the same participant warned, "... and never text when you drive after kava. It's like you get fixed on the screen [of the mobile phone] and don't know time is passing. I almost ran up a car in front"; a comment that prompted some teasing from others about the dangers of texting and driving.

When participants were asked what they thought of the brochure, there was overwhelming agreement on the value of providing a research summary in a Pacific-flavoured and Pacific-language-friendly medium. This value has also been recognised by academics. For instance, Hemi and Aporosa (2021) explain that translating research "into their own [Pacific] languages" provides opportunity for dialogue, accountability and correction (p. 58). They also argue research translation is both necessary and complies with ethical standards and research ethic requirements (p. 57); "We envision opportunities to check inaccuracies, to corroborate and bear testimony and to find consensus, to validate histories and experiences, knowledges and truths. We hope to challenge and address histories of assimilation, discrimination and colonisation by education—and by research." (p. 58) The reaction of the participants to the Pacific-flavoured and translated brochures supports Hemi and Aporosa's work.

A 33-year-old Fijian male commented that, “This [the brochure] is good. You know us, we don’t read things when they long”; suggesting brevity was necessary. A Samoan male in his mid-20s typified the comments of several participants when he said, “... people will read this coz it’s in the language”; inferring the translated language. A Tongan male in his late-20s asked if he could have some to take to the *kalapu* he typically attended on a Friday night, “for the boys”.

While the aesthetics of the brochures, the content and language friendliness were well received and praised by some, their value in prompting immediate behavior change was not as encouraging. Participants were asked if they felt the brochures would make them reconsider driving following high kava use or defer them from driving. Initially most said ‘yes’, indicating the brochures would encourage them to reconsider. However, as the *talanoa* unfolded, it was clear the initial reaction lacked substance. For instance, a Tongan male in his early 30’s commented,

Most of the *faikava* boys are uneducated so they won’t care, they will just drive. Some might listen to the *Faifakau* [the Minister], just a small percent, so that would be good. And some who know someone who dies after driving and *faikava* might listen. Like me; my cousin died in a crash in Tonga after drinking kava. So I know my limit and go home when I’m still safe to drive. That brochure is only for a small percent, because most people been driving after kava for years and they will keep doing it.

Another Tongan male of similar age added,

Many of the *faikava* boys come because they have turned away from alcohol [drink kava instead of alcohol]. Some of them used to drive after alcohol. They know kava is nothing like alcohol; it doesn’t affect driving like alcohol, so they say they are safe to drive.

A Tongan male in his 40s stated,

You can’t teach old dogs new tricks; they will still drive. The way that some might be encouraged to think about driving after kava is if you use the Church, get the *Faife’au* [Minister] to give the message and some will listen. I think the hook is the Church. I planned a sports event and the registrations were low, so I asked the *Faife’au* to promote, and we got plenty of people. I think that will be the only way, but then some don’t go to Church.

A Tongan male in his early 50s at a *kalapu* in Canberra stated,

These [brochures] are good for the young boys no good in driving [inferring a lack of driving experience]. I live over ... [a town approximately an hour’s drive away]. I always come here [to the *kalapu*] and drink [kava] then drive. Sometimes the sun is coming [meaning daybreak] and I drive. I know the way [home]. I am good, never have a accident, coz I know the way and I can drive [inferring experience].

A Samoan male in his mid-20s stated,

This is good information, I understand it [meaning both the content and Samoan language]. But some of the younger people won't understand it coz some of the language is a bit formal. But then that's the only way you can properly convey the message. We Samoan's don't drink as much kava as Fijians and Tongans, its mostly the older generation [who drink], like the ones in their 60s and then they drive. So this is good for them [inferring the language translation for older Samoan kava drinkers].

The same Samoan male was asked about the value of using of Pacific respect-based values, and the suggestion in the brochure that driving after using kava was likely to endanger other road users and hence counter to those values. He responded,

Yes, it will make them think. I don't think there will be dramatic change, but they will be more aware. When the older people see this [brochure written in Samoan], they will pick it up straight away, they will like it. They will like the values. But the younger people probably won't read past the first few sentences coz that's young people, they don't read much, and they aren't connected to the traditional values the same as the older people.

A group of kava drinkers, of mixed Pacific ethnicities and in their early 20s were asked what they felt would be the most impacting way to get the kava drink-driving message across to those in their age group. A Fijian female suggested,

I think short videos would be the best, about 30 seconds long, coz that's what they [the younger generation] go for. And if you could have influencers in the videos, like rugby hero's, I think that would get the message across.

A Rarotongan female followed with,

I think, you need to come up with something real simple, but a clear message. Like in Rarotonga they ran this STD [sexually transmitted disease] campaign, very simple: '*Did you remember: car keys, wallet, condom*' People remembered it and would even say it to each other. Short, simple, good.

Although the brochures appeared to have limited effect in prompting immediate behavior change – evidenced in the fact that most of the attendees at the *kalapu* where the brochures were trialed, having consumed kava for 6 hours or more, then drove home – the brochures are nevertheless argued to have some value. For example, they led to lengthy *talanoa* on the effects of kava on cognition and driver safety; *talanoa*, which the author noticed continued over subsequent *faikava* he attended. In addition, the brochures have been requested by *kalapu* attendees and when produced, sparked further *talanoa*.

Following the trial, a large number of brochures were commercially printed and distributed to a variety of Pacific-focused community services, as well as being given to kava users to leave at their various *kalapu*.

Road safety campaign design and evaluation experts Lewis and colleagues (2019) caution the need to “dispel the notions of the ‘silver bullet’ and ‘one-size-fits-all’ approach” when it comes to promoting driver safety (p. 299). In the case of this study, the focus need not simply be on the *value of the brochures in curbing problematic kava drink-driving behavior*. The *talanoa* associated with the brochures, and the subsequent unpacking of related themes that they stimulate (such as discussion around kava’s effects on cognition) are also valuable. As Lewis et al. (2019) state,

To change unsafe behavior is usually a long-term process. It is therefore unrealistic to expect that road users will suddenly change their behavior after being exposed to one campaign, especially if the behavior has become habitual or if they continue to believe that they will escape any penalty. (p. 312)

Again, in the case of this study and the goal to curb unsafe driving post-kava use, ongoing exposure to the brochures is necessary, together with the associated *talanoa*, as is “the need to assess effects over time, including longer-term exposure (i.e., beyond immediate post-exposure measures).” (Lewis et al., 2019, p. 312).

5. Limitations

The limitations associated with conducting double-blind placebo-driven research within naturalistic kava-use settings have been discussed in several publications (Aporosa 2020; Aporosa et al. 2020, 2021).

Aporosa and Tomlinson (2014) comment that, “randomized controlled trials ... considered the ‘gold standard’ for health research ... is next to impossible under the conditions in which kava is normally consumed” (p. 164). Reasons for this judgement include the cultural significance of kava, and the Pacific values associated with its use, which prevent deception by inferring a substance was kava when it was not. To do so would be culturally disingenuous and therefore contrary to Pacific respect-based values and ideals. In addition, kava research requires experienced kava drinkers who can consume typical average kava volumes over 6 hours. Further, experienced kava drinkers would immediately recognise a placebo, as kava not only has a unique taste, but also produces a tingling in the mouth as a result of selected kavalactones interacting with oral sensory nerves; sensations that are difficult to replicate in an inactive substance (Aporosa, 2018a; 2020; Aporosa et al., 2014; 2020; 2021).

In addition, knowledge gaps in kava ethnobotany and lactone consistency and distribution (AECOM-Kalang, 2017; Bian et al., 2020) add further complications, creating additional gaps in current kava understanding. These include gaps in understanding about:

- kava metabolism and dose relationship (Singh et al., 2004; Bian et al., 2020)
- kava half-life and elimination (Aporosa et al., 2020)
- how kavalactones interact with neurophysiological mechanisms (Bwarenaba et al., 2017)
- kava reverse tolerance and sensitisation (Aporosa et al., 2020)
- how to interpret kavalactone levels and elimination in blood samples (Poulsen & McCarthy, 2017)
- the role of “set, and setting” (Zinberg 1986; McElrath & McEvoy, 2002); or how social and environmental influences, when combined with how a drug user feels at the time, effect kava use across differing environments (Aporosa et al., 2020).

It is likely to be a number of years before many of these limitations have been mitigated, and it is for this reason that the World Health Organization has called for more research into all areas of kava psychopharmacology, particularly during, following and related to naturalistic kava use (Abbott, 2016, p. viii; also see Bian et al., 2020, p. 23).

The author argues, though, that these limitations do not invalidate the learnings from this or previous kava drink-driving studies. Kamboj and colleagues (2018) support this claim when they comment,

‘naturalistic studies’ (i.e. those conducted in ecological settings) ... [may lack the] high levels of experimental control afforded by double-blind laboratory studies ... [they] are nonetheless potentially valuable in allowing efficient preliminary hypothesis testing ... [as] these can then pave the way for more tightly controlled studies if promising effects are observed. Previous naturalistic drug studies have yielded novel findings that were subsequently independently replicated in double-blind laboratory experiments. (p. 1135)

6 Conclusions and recommendations

The study and understanding of kava psychopharmacology can be confusing. This is because much of the terminology used in ethnographic studies and the media to explain kava’s effects at high dose is misleading. Additionally, most research aimed at understanding how kava effects cognition and behavior has used tablets or capsules (containing selected extracted kavalactones administered at a maximum daily dose of 250mg kavalactones) as part of their methodology (Bian et al., 2020; Lim, 2016; Sarris et al., 2011).

Studies such as Sarris and colleagues' (2013) double-blind, randomised, placebo-controlled work, which highlighted the efficacy of small daily doses of tablet-form kava (containing either 120, 240, or 250mg of kavalactones) in reducing generalised anxiety disorder, have encouraged interest in kava's potential for helping users who ingest a single-tablet dose with a glass of water and assert they are taking 'literal kava'.

As has been explained elsewhere, extracted tablet-form kava is vastly different to kava consumed in *faikava* settings (Aporosa, 2019a; Aporosa et al., 2021). In addition, very little research aimed at understanding kava psychopharmacology has been completed using kava as it is typically consumed in traditionally influenced settings (Aporosa et al., 2021).

In *faikava*, users typically sit cross-legged on mats on the floor, often for long periods of time, and engage in *talanoa* (discussion). *Faikava* attendees usually follow traditionally influenced use protocols, in which they prepare a beverage using the dried and pounded rhizome of the kava plant, and where each drinker routinely consumes 3.6 litres (7.6 pints) of kava over a 6-hour period, while engaging in *talanoa* and observing (to varying degrees) cultural practices based on Pacific respect values. Kavalactone ingestion volumes at *faikava* frequently exceed 20 times the kavalactone potency administered in kava tablet clinical trials or when kava is given as a medicinal aid to reduce anxiety (Aporosa & Tomlinson, 2014). Moreover, kava consumed in these traditionally influenced settings contain all the kavalactones, currently believed to number more than 20 (Bian et al. 2020), together with some of the fibre and additional minerals from the plant.

Also of significance is that an often-overlooked aspect of any substance use is the associated influences and impacts of 'set and setting', or a person's mindset related to the social and physical environment of the substance use (Zinberg 1986; McElrath & McEvoy, 2002; Aporosa et al., 2021). Nevertheless, kava psychopharmacology understanding is chiefly viewed through the lens of inaccurate effect descriptors and research associated with tablet-form kava use, with that latter understanding often applied to, or overlaid on, kava users who drink in naturalistic traditionally influenced settings.

Further contributing to kava psychopharmacology confusion is the inconsistency and subjectivity across studies reporting kava's impacts on cognition, with some research suggesting that kava improves mental function, whereas others state "kava to have little or no negative effect on cognitive processes" (Sarris & McIntyre, 2017, p. 16). Again, these studies used tablet-kava, although the findings have often been interpreted as applying to naturalistic traditionally influenced kava users.

Add to this the increasing reports from police of stopping drivers, mostly of Pacific ethnicity, who they believe are impaired by kava use, and their limited ability to measure and deal with this; and the also increasing anecdotal reports linking kava use with Pacific people's over-representation in motor vehicle accident statistics, and it becomes apparent why both the police and the New Zealand Institute of Environmental Science and Research have called for research to understand the effects of naturalist high-volume kava use on driver safety.

In this second study of its kind, a somatosensory psychometric tool (Brain Gauge) was used to measure slight changes in six specific neurological functions – namely Focus, Accuracy, Temporal Order Judgement, Timing Perception, Plasticity and Fatigue – during and following *faikava*. This found that following the sixth hour of kava use, at which time each research participant ($n=20$) had consumed 3.6 litres of beverage kava equating to 3,680mg of kavalactones (or 14 times the pharmacologically recommended dose), there was no statistically significant impact on the Focus, Accuracy, Timing Perception, Plasticity or Fatigue of the active kava user, when compared against the control group ($n=19$).

However, analysis of within group data (which compared active kava users with each other) found that between the third and sixth hour of testing, these kava drinking participants showed a small improvement in their Focus (and Fatigue), despite being at the test venue for over 6 hours and the final test not being conducted until 12.30am. This slight improvement was unexpected, particularly as kava's dominant effects are reported as soporific, anxiolytic and relaxant. Additionally, while this finding would suggest increased driver alertness overall, and therefore improved driving safety, the data showed a very different effect on participants' Temporal Order Judgement.

Temporal Order Judgement, or "how well [the] brain is able to keep track of the order of events" (Pawluk, 2018e), which is associated with a person's executive function, was shown to be (strongly) statistically impaired when compare with the control group. This is both a unique and new finding, and suggests kava at traditionally consumed volumes compromises driver safety, although the nature of this impairment is vastly different to alcohol, cannabis, and other euphoric and hallucinogenic substances. The findings also add quantitative understanding to ethnographic data on kava effects, suggesting the often-used term 'kava intoxication' is misleading and incorrect.

Although this study generated new neurophysiological understanding concerning kava use, it also further highlights the huge knowledge gap that exists concerning kava psychopharmacology. That knowledge gap is demonstrated in the lack of interpretation of much of the study data, particularly around how kava impacts on selected cognitive facilities but not others. That

understanding is not likely to advance until, at a minimum, “the neurophysiological mechanisms associated with kavalactone metabolism” (Bwarenaba et al., 2017, p. 5) when consumed at traditionally influenced use volumes, are understood. That lack of understanding essentially hampers further kava drink-driving research, except for learnings likely to derive from testing kava users in a driving simulator.

That lack of understanding also hampers road policing, particularly as the interpretation of kavalactones in blood tests, and therefore the ability to use blood samples for evidentiary purposes, is linked to understandings of the “neurophysiological mechanisms associated with kavalactone metabolism”. Further, with kava not metabolising on the breath in a similar manner to alcohol, therefore excluding current breath-test measures, it is likely to be some time before road policing has suitable evidential-standard measures to assess kava drink-driver competency. When it comes to alcohol, such measures are considered “the most effective way to deter drink-driving” (Smith, 2013, p. 24).

The study also tested the value of a Pacific-flavoured, valued and language-friendly brochure aimed at providing kava drink-driving education to curb unsafe post-kava driving. While the brochure was well received and prompted a lot of *talanoa* about the effects of kava on cognition and experiences of post-kava-drinking driving, immediate changes to participants’ behaviour appeared limited. Drawing on road campaign design and evaluation work by Lewis and colleagues (2019), long-term exposure to this brochure and its associated information is recommended as required before an impact can be expected.

This study has nevertheless made a major contribution to kava neuroscientific understanding, particularly in relation to neuro-psychopharmacology. The study has highlighted the need for more research in understanding the effects of kava when consumed at traditionally influenced volumes. The study also responds to the World Health Organization's call for more understanding on kava psychopharmacology related to traditionally influenced use volumes, and Watson and Mann’s (2018) request for more research and understanding on the “social [and] cultural ... patterns of [drug impaired driving ... and the] many types of psychoactive substance use (licit and illicit, recreational and therapeutic) that can impair driving” (p. 107).

7 Acknowledgements

This work was generously funded by the Health Research Council of New Zealand Health (Pacific post-doctoral award No. 19/002), and supported by Te Huataki Waiora School of Health and the School of Psychology’s *Traffic and Road Safety Research Group* at the University of Waikato.

The author is also grateful to Cortical Metrics for its generous donation of hardware and software, which allowed the collection of the research data.

The author wishes to acknowledge the support of Associate Professor Kirsten Petrie, founding Dean of Te Huataki Waiora School of Health, who played a strategic role in this study's academic placement. Also, to Professor Nicola Starkey and the University of Waikato's *Traffic and Road Safety Research Group*, Associate Professor Brett Langley from Te Huataki Waiora School of Health, and Dr Jan Prosser (Psychology Worx) for their advice and expertise, which moved this study to a new level following anomalies and inconsistencies in the previous kava drink-driving study.

The author is extremely grateful to Dr Keakaokawai Varner Hemi (Assistant Vice Chancellor Pacific, University of Waikato), Dr David Taufui Mikato Fa'avae (lecturer, Te Kura Toi Tangata School of Education, University of Waikato), and Jenny Robertson and Bridget Holland (Research Managers, University of Waikato) for their wisdom and guidance; and to Jacinta Ford (PhD student, Anthropology Programme, University of Waikato) and So Hyun Park (PhD student, Te Huataki Waiora School of Health, University of Waikato) for their excellent support as research assistants. Also worthy of recognition are Dr Martin Atkins (School of Engineering, University of Waikato), Hakau Ballard (Master's student, Department of Computer Science, University of Waikato) and Dr Ray Littler (Honorary Fellow: Statistics, University of Waikato) for their statistical analysis expertise.

The following people and their kava club connections were also critical to the research project: Associate Professor Malakai Koloamatangi (former Directorate: Pasifika, Massey University) and the Grey Lynn, Auckland, *fofo'anga* (Tongan kava club), Asaeli Tulagi, Ravulolo Tuikubulau, Ispa Swamy and the Hamilton Fijian kava community, Troy Wihongi and the Hamilton Dox Brother's *Kalapu*, the University of Waikato's *Fono* at the *Fale* crew, Todd Henry and Anau Mesui-Henry at the *Four Shells Kava Lounge*, Auckland, and Dr Edmond Fehoko (Research Fellow, University of Auckland). Dr Sione Vaka (Senior Lecturer, Auckland Technical Institute), pediatric surgeon Mr Jitoko Cama (Waikato District Health Board), and Professor Matt Tomlinson (Australia National University) must be acknowledged for their academic insights; malo 'aupito kei vinaka vakalevu sara! Critical to the kava drink-driving brochure production were the translators: Marie-Christine 'Kitty' Wells (Bislama), Faifekau (Reverand) Siosaia Sisitoutai (Tongan), uso Lance G. Matemate Fuimaono (Samoan) and Usaia Gaunavou Jr (Fijian; Masters student, University of Waikato). Additionally, the study was made possible with the following supporters: Arcia Tecun (Dr Dan Hernandez, Department of Anthropology, University of Auckland), Sianiti Nakabea Bulisala (Pacific Student Success Coordinator, University of Waikato), Leni Lolohea (former Future Students Advisor – Pacific, University of Waikato), and the author's family, friends and associates in Fiji,

particularly Tevita and Evia Bainimoli (Natolalau, Kadavu) and Sekove Bigitibau Degei (Visama, Nakelo, and lecturer, Fijian Studies, University of the South Pacific).

The author is especially thankful to the following personnel and their relevant law enforcement, road safety, and road research units for their support toward the project: Acting Superintendent Gini Welsh and Inspector Pete McKinnie at the New Zealand Road Policing Unit; Sergeant Mike Morgan, Counties-Manukau Police, Auckland; Sally Fletcher, Otahuhu Police Prosecutions Office, Auckland; Commissioner of Police Fuiavailili Egon Keil, Samoa; Executive Officer Leasi Galuvao, Land Transport, Samoa; Deputy Commissioner of Police, Sālote Grewe, Tonga; Sergeant Edward Kalura, Road Safety Division, Vanuatu Police; Senior Superintendent Mahesh Mishra, Police Traffic Division, Fiji; and Dr Helen Poulsen and Dr Mary-Jane McCarthy, Motor Vehicle Accident Research Unit, New Zealand Institute of Environmental Science and Research.

Finally, this study would not have been possible without those who joined the study as research participants. Due to confidentiality, they cannot be named.

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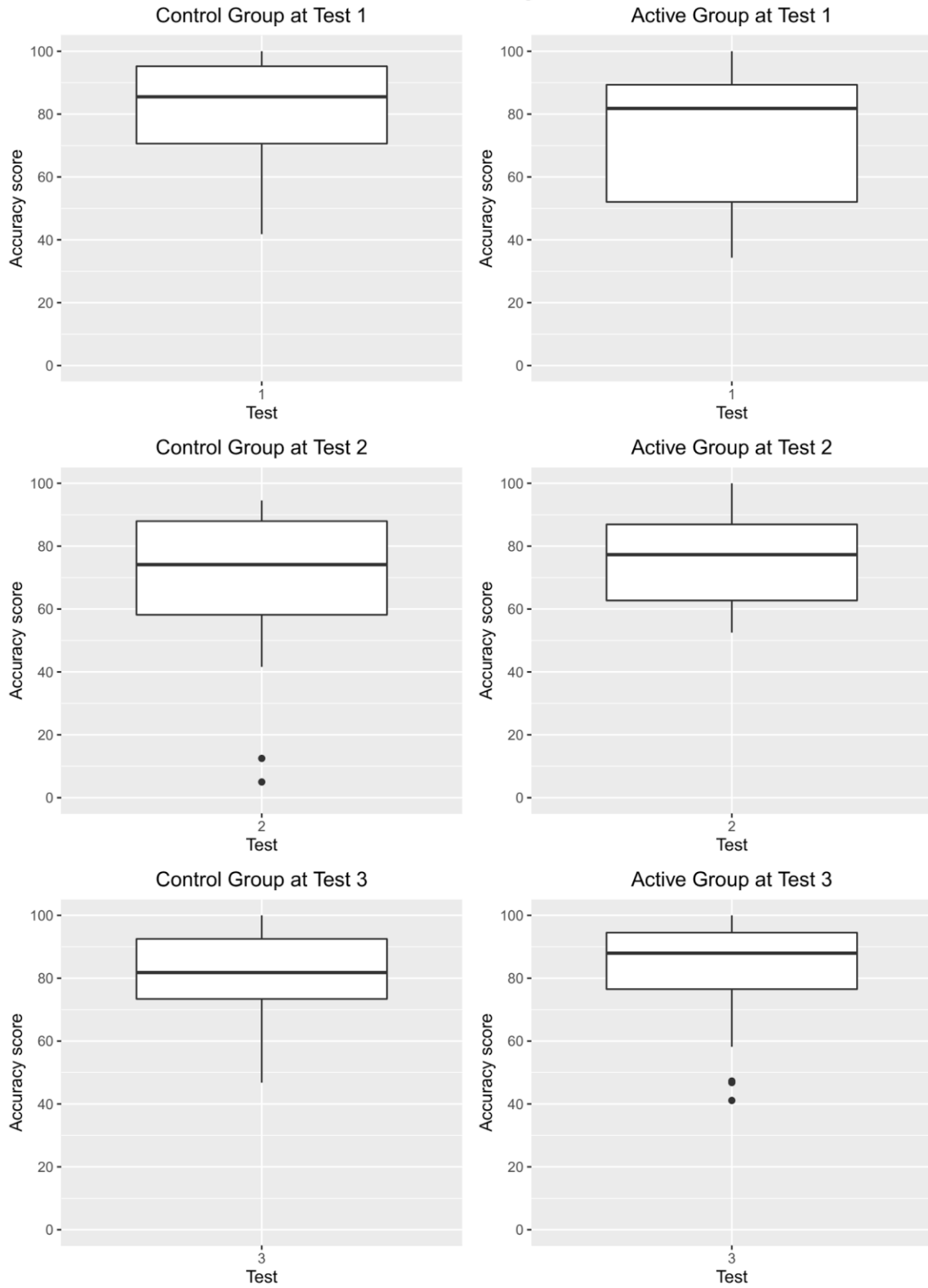
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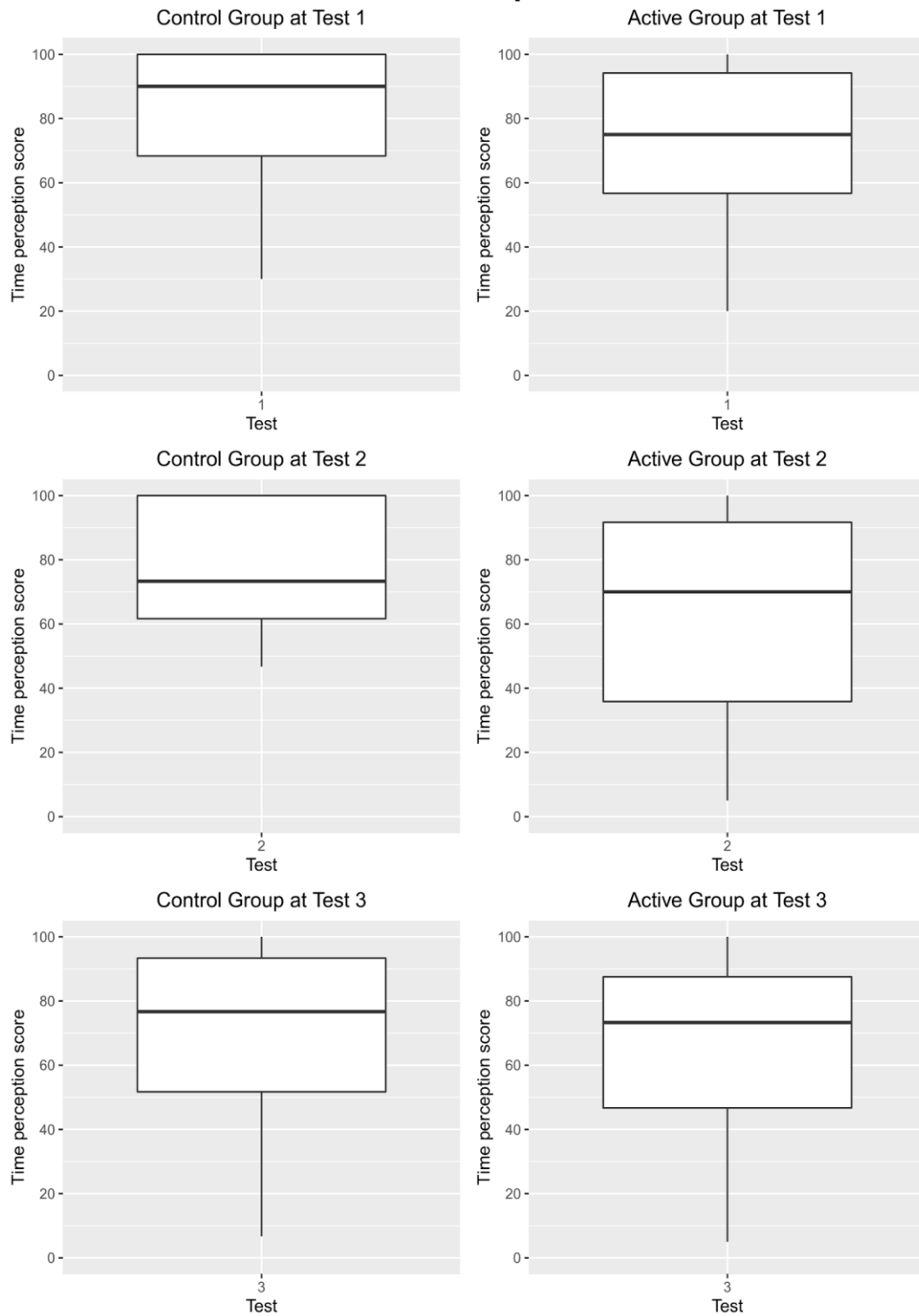
Appendix A: Simple box-plot showing the results of the Accuracy data

Accuracy



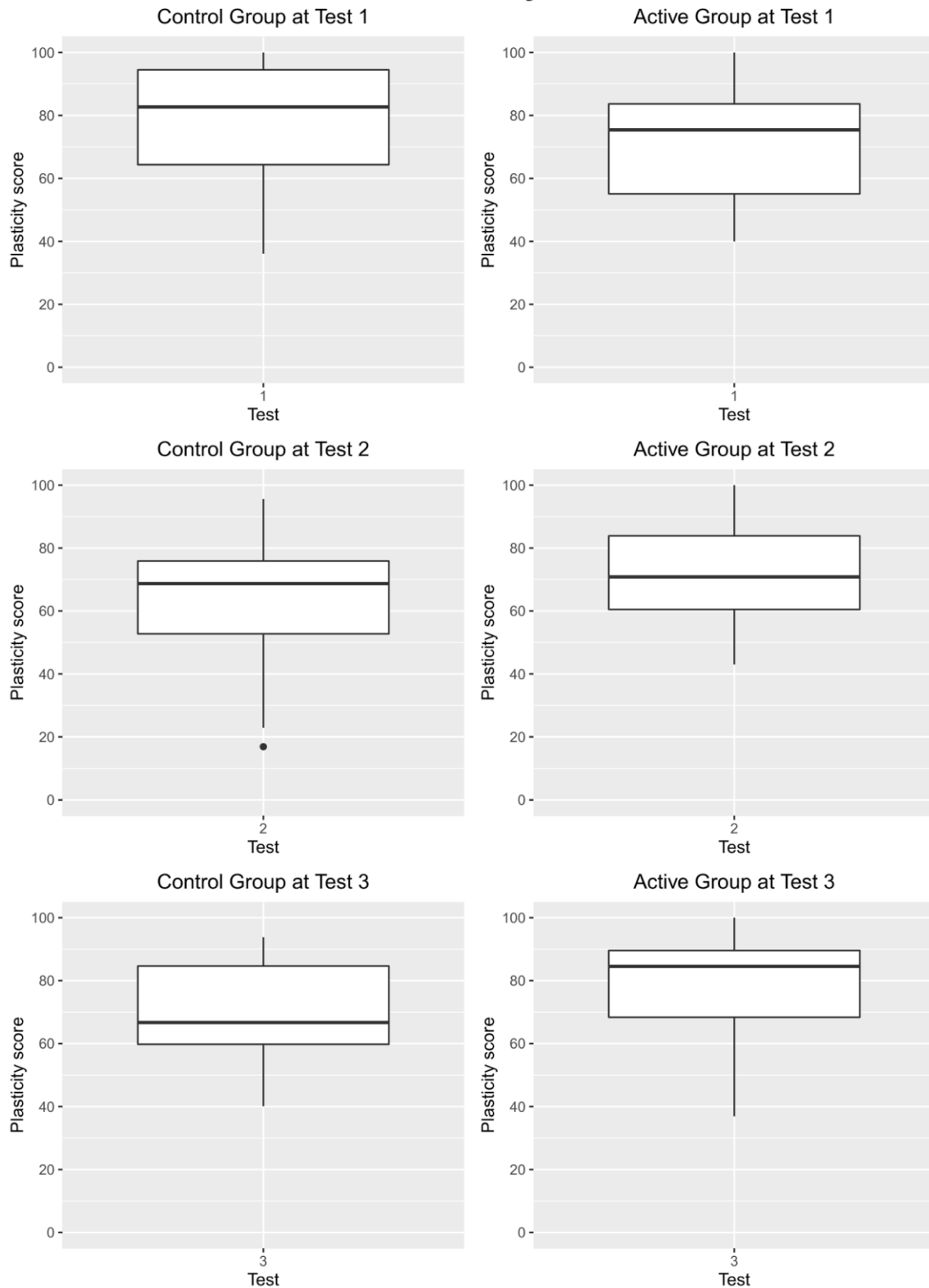
Appendix B: Simple box-plot showing the results of the Timing Perception data

Time Perception



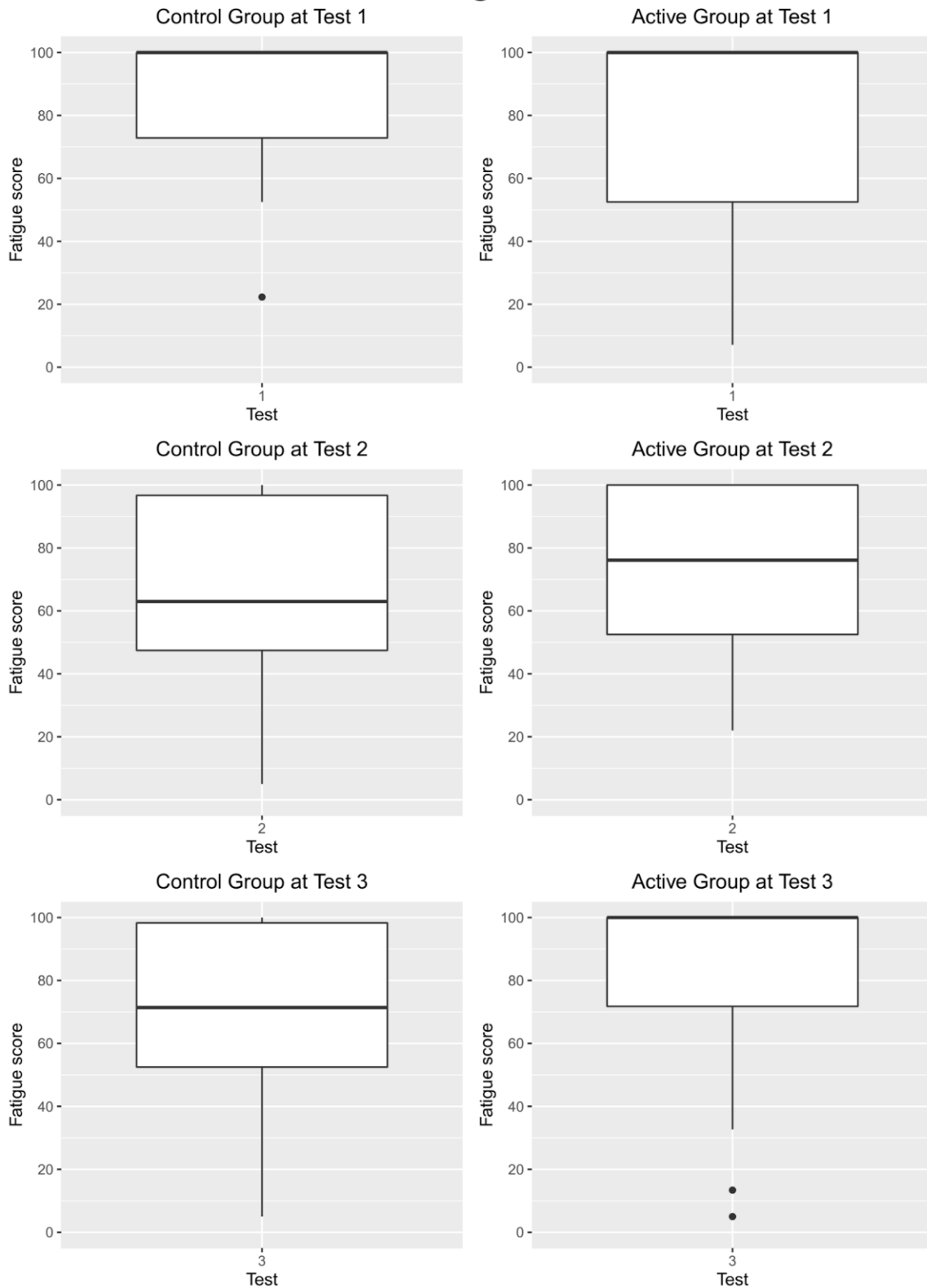
Appendix C: Simple box-plot showing the results of the Plasticity data

Plasticity



Appendix D: Simple box-plot showing the results of the Fatigue data

Fatigue



Appendix E: Cover and inside of Bislama language kava drink-driving brochure

Yu bin dring kava?

Stop mo tingting...
Sipos mi draev, bai mi putum laef blong ol pasenja blong mi mo ol narafala man long rot long denja?

Sipos yu kat tu tingting, yu no mas draev!

Infomesen yu save kasem long buklet ia:

- [mining blong kava long saed blong kastom](#)
- [fasin blong dring kava long wan wei we i sef](#)
- [dring kava mo draevem trak](#)

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hrc Health Research Council of New Zealand

Infomesen long buklet ia hemi kamaot long wan stadi we Dr Apo Aporosa blong Te Huataki Waikato School of Health long University of Waikato i bin mekem. Health Research Council of New Zealand hemi sponsa blog stadi ia mo buklet ia.

THE UNIVERSITY OF WAIKATO
Te Kōwhiri Whānau o Waikato

Todd M. Henry, wan nambawan man blong karem foto, hemi bin karem ol foto blong buklet ia.
Marie-Christine Walks i transkrem infomesen ya.

TRG
Transport Research Group

Yu save se taem yu dring kava, hemi save afektem wei we yu draev?

Ol polis mo gavman oli wari from se kava i afektem wei we man mo woman i draev. Problem ia i mekem se Gavman blong New Zealand i sponsarem tri bigfala stadi long saed blong dring kava mo draev.

Wanem ia kava?
Long saed blong kastom, kava hemi wan impoten dring blong ol man mo woman Pasifik. Oli yusum kava long ol impoten seremoni, miting, mo tu blong kam wan ples blong storian. Plante man mo woman oli dring kava blong rilax mo blong mekem ting ting i klia taem oli toktok, mekem se fulap man mo woman oli save stap storian kasem let taem long naet. Kava hemi no alkohol, mo hemi no save afektem man semak long alkohol. Kava hemi no save mekem man o woman i kam wan adiikt, kava hemi sef mo hemi kat sam gudfala samting long saed blong helt. Samting ia i mekem se nao ia, plante narafala man mo woman raon long wol oli laikem kava.

Wanem nao ol risal blong kava?
Ol stadi oli soemaot se kava i save sloem daon tingting blong man mo woman. Slo tingting i afektem ol disisen blong man o woman we i stap draev.
Long ol kaontri olsem Tonga mo Samoa we kava mix blong olketa i no strong, problem blo slo tingting ia i no kam kwik taem. Olketa long Vanuatu mo ol narafala kaontri long west said blong Pasifik we kava blong olketa i mo strong, problem blo slo tingting i save kam kwik taem.
Be no mata se yu dring wik kava o strong kava, tutugeta i save afektem wei we yu draev.

Hemi agensem lo blong dring tumas kava mo draev
Yu brekem lo sipos you draev afta we yu dring tumas kava. Sipos polis i stopem yu, oli save arestem yu, putum yu long prisen o yu save lusum laesens blong yu.
Bigfala problem we i stap sipos yu dring kava mo draev, yu save kilim yu wan, ol pasenja blong yu mo narafala man long rot. Sipos yu dring kava mo yu mekem man i karekil, o kilim man i tet, bai yu ko long prisen.

Yumi mas kat rispek
Fasin blong rispek hemi wan bigfala samting blong ol man mo woman Pasifik.
Wei we yumi dring kava i mas soemaot fasin blong rispek.
Long Pasifik, rispek hemi stamba blong gudfala fasin mo tingting.
Taem yu bin dring kava, afta yu ko long trak blong yu blong draev, yu stop mo yu tingting: Mi stap rispektem ol pasenja blong mi mo ol narafala man long rot?
Bai mi putum laef blong olketa long denja sipos mi draev?

Sipos yu kat tu tingting, yu stop; yu no draev!

Appendix F: Cover and inside of Fijian language kava drink-driving brochure



O seqai gunu yaqona oti mai?

Tu mada vakadua ka vakasama mada ... Ke vaka meu draiva, ena rawa beka li meu vakaleqa na nodra bula na noqu pasidia kei na nodra bula na dau vakayagataki gaunisala?

Ke vaka o vakatitiqa, kaku ni draiva!

Ke vaka o ni gadreva e vuqa tale na itukutuku me baleta na:

- [na bibi ni yaqona ena noda bula vakavanua](#)
- [na vakayagataki vakavuku ni yaqona](#)
- [na yaqona vata kei na draiva, mo raica na:](#)

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NA YAQONA VATA KEI NA DRAIVA

SA KA GA NI VEIDOKAI




hrc Health Research Council of New Zealand

Na lalakai oqo e yavutaki mai ena nona vakadidike o Dr Apo Aporosa ena Te Huataki Waiora Tabana ni Bula ena koronivuli ni vuli torocake e Waikato, ka vakailavo taka na matabose levu ni vakadidike ni tabana ni bula e Niusiladi.

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Vakarautaka na itaba na dauniveitaba vakaisausau o Todd M. Henry.

TRG Transport Research Group



O kila beka li ni tiko na revurevu ni gunu yaqona kina nomu vakatulewa taka vakavinaka na nomu draiva?

E rau sa vakaririkotaka sara vakalevu na tabana ni ovisa kei na matanitu na revurevu ni gunu yaqona ena kena dau vakatulewataki vakamatau na draiva. Oqo esa mai vakavurea sara na kena mai caka e tolu na vakadidike levu ka vakailavotaka na matanitu o Niusiladi.

Na cava na yaqona?
Na yaqona e dua na mataqali kau bibi vakavanua ka gunuvi talega vei ira na kai pasivika, ka tiki bibi ni veiqaravi ena vuqa na nodra soqo ni marau kei na vakasoqoni vata vakavanua. Kivei ira na vuqa, na gunuvi ni yaqona e kauta mai na vakacegu ka dau vakavurea talega na veitalanoa momona, bibi ka vakavotukana. Sa ikoya oqo na vuna levu edau gunuvi kina vaka mata isogoni na yaqona, ka dau taura edua na gauna balavu ka laki tini sara ena bogi na kena gunuvi. Na yaqona e sega ni tautauvata na waini ni veivakamatenitaki vakavavalagi, baleta ni sega ni vakavurea na veimataqali vukivuki e vuqa ka sakasaka, viavialevu se vuki baleya, ka dau basika ni gunuvi na wai ni veivakamatenitaki vakavalagi. E sega ni vei rawaj vakarawarawa, sega ni veivakaleqai ena noda bula, ka talei ni vuqa sara na vei ka vinaka e kauta mai ena noda bula. Sa ikoya oqo na vuna levu esa mai vakayagataki vakalevu sara na yaqona mai vei ira na veimata tamata e vuqa, e sega ni ra kai Pasivika. Ena gauna oqo esa gunuvi tiko na yaqona ena veimatanicagi e va ni noda vuruvura.

Na cava na revurevu ni gunu yaqona?
E vakaraitaka na veivakadidike eso, ni gunu yaqona e rawa ni vakaberabertaka na vakasama kei na vakatulewa ni tamata. Oqo esa qai dau tiko na kena revurevu ena nona vakatulewataki vakavinaka na nona draiva e dua na tamata. Kivei ira na dau gunu yaqona sosoko, me vaka na medra wai ni yaqona mai Vanuatu kei na veivanua ena mua-ira ni wasa pasivika, na vei revurevu ca oqo e rawa ni totolo sara na kena basika mai. Ena veivanua eso edau lose waicala me vakataki Toga se Samoa, na kena revurevu edau balavu sara na gauna qai dau vakilai. Ia, ena yasana ruarusu qo, se sosoko se waicala, na gunu yaqona e rawa ni vakavuna na noda sega ni vakatulewa vinaka ena gauna ni draiva.

E vakatabui vakalawa na draiva ke sa buwawa na nomu vakatulewa ni oti na gunu yaqona
E sega ni vakatarai vakalawa me dua e draiva taka edua na motoka ke sa buwawa na nona vakatulewa ni oti na gunu yaqona. Ke vaka ona tarovi mai vei ratou na ovisa, esa rawa saraga ni vesu, takali tani mai na nomu ivola tara ni draiva, ka sa rawa saraga nio laki curu e vale ni veivesu. Ia, e bibi cake sara meda kila ni vakau lori ena gauna e buwawa kina na vakatulewa e rawa ni vakaleqai lko, ira na nomu pasidia, ka vaka talega kina o ira na dau vakayagataki na gaunisala. Ke vaka o vakamatea se vakamavoia taka edua na dauni vakayagataki gaunisala ena gauna o draiva kina ni oti na gunu yaqona, esa na rawa saraga ni laki tau na kemu totogi mo laki curu e vale ni veivesu.

Sa ka ga ni veidokai
O ira na kai pasivika era mareqeta na veidokai kei na veirokorokovi. Na veirokorokovi e tiki ni vakarau ni kena gunuvi na yaqona. Na veirokorokovi kei na veidokai e suitu ni veika eda vakaliuca na kai pasivika me vaka na veivakaturaga taki ka sa ka bibi sara vei keda na itaukei. Mei tinitini, ke vaka o lesu mai na gunu yaqona, tu mada vakadua ka vakasama taka mada: Au dokai/rokovi ira tiko beka na noqu lewe ni pasidia kei ira na dau vakayagataki gaunisala? Ena rawa beka li ni vakarerevaki na noqu draiva, ka biuti ira ena dua na vanua rerevaki sara?

Ke vaka o vakatitiqa, kaku ni ko draiva!

Appendix G: Cover and inside of Tongan language drink-driving brochure

Na'a ke inu kava?



Taimi hifo mo fakakaukau...
'E fakatu'utāmaki nai 'eku faka'ulí ki he pāsesé mo e kakai kehé?

Kapau 'oku tāla'a, 'oua 'e faka'uli!

Ko e ngāhi fakamatala ki he:

- mahu'inga 'o e kavá 'i he anga fakafonua
- ngāue 'aki 'o e kavá mo e nofo malu
- kavá mo e faka'uli me'alelé, 'a'ahi ki he:

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Na'e fa'u 'a e tohi ni mei he fakatoto na'e fakahoko 'e Dr Apo Aporosa 'i he Te Huataki Waiora School of Health, 'i he 'Univesiti 'o Waikatō, fakapa'anga 'e he Health Research Council of New Zealand.



Faltaā na'e fal 'e he tangata faitā 'iloa ko Todd M. Henry. Hikí pea illu ki he Lea Tonga, Falekau Siosaia Sisitoutai.

KAVA & FAKA'ULI ME'ALELÉ

KO E 'UHINGÁ EÉ, KO E FAKA'APA'APA PĒ!





'Oku ke 'ilo 'oku lava ke uesia 'e he kava Tongá ho'o faka'uli me'alelé?

'Oku tupu fakautuutu 'a e tokanga 'a e Potungāue Polisi mo e Pule'angá ki he uesia tamaki e faka'uli, fakatupu 'e he kava Tongá. Kuo fakapa'anga ai 'e he Pule'anga Niu Silá ha ngāhi fakatoto fakako lalahi 'e tolu fekau'aki mo e kavá.

Ko e hā 'a e kava?
Ko e kavá ko e 'akau tu'u-fonua mo e ouau mahu'inga ki he kakai Pasifiki, pea 'oku ne pukepuke e molumalu 'o e ngāhi katoanga, mo e fakafeohi 'a e kakai 'o e Moaná. 'Oku hoko 'a e inu kavá ko e to'o ongosia, mo fakalā'āi e talanoa 'oku fakalahi 'iló. Ko ia, 'oku ngāue 'aki ai 'a e kavá 'e he ngāhi kulupu fakasōsia-lé, 'o lau houa, pea a'u pē ki he valenga 'a e poó. 'Oku 'ikai ko e 'olokaholo 'a e kavá pea 'oku 'ikai te ne uesia 'a e kau inu kavá 'o hangē ko e 'olokaholó. 'Oku 'ikai kaini kavea pe to'inevea, ka 'oku malu mo kau lelei ki he mo'ui fakasinó. Ko ia kuo manakoa ai 'a e kavá ki he kakai kehe mei hotau fa'ahingá. Kuo a'u eni 'a e inu kavá ki he ngāhi tapa kotoa 'o e kolopé.

Ko e hā e ngāhi me'a 'oku 'omi 'e he kavá?

'Oku ma'u mei he ngāhi fakatoto fakako 'oku fakatu'utāmaki 'e he kavá 'a e fakakaukau mo e mafai faitu'utu'uni 'a e tangatá. Ko ia, 'oku kaunga tonu 'a e kavá ki he tu'unga malu 'a e kakai 'i he hala pule'angá. Ko kinautolu 'oku inu kava taufuá, 'o hangē ko ia 'oku fai 'i Vanuatu mo e ngāhi feitu'u ni'ihí 'i he fakahihifo 'o e Pasifiki, 'e vave ange 'a e uesia tamaki kiate kinautolu. Pea ko Tonga mo Ha'amoá mo e ngāhi feitu'u 'oku 'ikai fu'u taufua ai 'a e kavá, 'e tuai ange 'a e uesia 'e hokó. Ka 'oku na tatau pē, 'oku lava ke fakatupu 'e he inu kavá 'a e faka'uli fakatu'utāmaki.

Ko e maumau lao 'a e faka'uli me'alele hu'akava'ia
'Oku fepaki mo e laó ke faka'uli ha taha 'i ha salio te mīsini 'oku hu'a-kava-'ia. Ka ta'ofi koe 'e he polisi, 'e lava ke puke koe, pe to'o ho'o laiseni faka'uli, pe ko e fakahū piilisoné. Ka 'oku mahu'inga ange, ke 'ilo ko e faka'uli hu'akava-'ia 'oku tu'u-lavea-nogofua ai 'ene mo'ui, mo e kau pāsesé, mo kinautolu 'i he hala pule'angá. Ka pekia (pe lavea lahi) ha taha koe'uhí ko ho'o hu'akava'ia, 'e lava pē ke tautea ngāue pōpula koe.

Ko e 'uhingá eé, ko e faka'apa'apa pē

'Oku fakamahu'inga'í 'e he kakai Pasifiki 'a e anga faka'apa'apa. Pea ko e faka'apa'apa 'a e mohenga 'o e pukepuke fonuá. 'Oku faka'ivia 'e he faka'apa'apa 'etau ngāhi koloá 'o kau ai 'a e anga fakaTongá. Ko ia ai, kapau na'a ke toki 'osi inu kava, ki'i tu'u hifo 'o fakakaukau ki heni: 'Oku ou toka'í nai 'eku kau pāsesé mo e tu'unga malu 'o e kakai 'i he hala pule'angá? 'E fakatu'utāmaki nai 'eku faka'ulí kiate kinautolu?

Kapau 'oku tāla'a, 'oua 'e faka'uli!

Appendix H: Cover and inside of Samoan language kava drink-driving brochure

Sa e inu ava?



Taofi ma e toe mafaufau...
Faamata e afaina la'u pasese o loo ou tauaveina poo isi tagata o loo faaogaina le auala i la'u aveave?

Afai e te leo mautinoa, aua e te aveina le taavale!

Mo nisi faamatalaga lautele i le:

- [O le faatauaina ole ava i lau tu ma lau aganuu](#)
- [Faaaogaina/taumafaina ole ava i se auala saogalemu](#)
- [Taumafa ava ma le aveave taavale, taga'i:](#)

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Health Research Council of New Zealand

O lenei pepa o faamatalaga e fa'avae i su'esu'ega a le Afioga Dr Apo Aporosa i le Te Huataki Waiora Aoga o le Soifua Maloloina i le Iunivesite o Waikato, ma fa'atupeina e le Aufono Su'esu'e o le Soifua Maloloina (Health Research Council) a Niu Sila.



O ata na pu'eina e se ali'i pu'eata Iauliloa o Todd M. Henry. Fa'aliliunia i le gagana Samoa e Lance G. Matemate Fulmaono.

AVA (KAVA) MA LE AVEAVE TAAVALE

E FAAALIA AI
LOU FA'AALOALO





Transport Research Group

E te silafia o le taumafa ava e mafai ona aafia ai le lelei o lau aveina o le taavale?

Ua faaalua le atugaluga tele o le malo o Niu Sila ma leoleo ona o le maualuga o aafia o le saogalemu o tagata ile aveina o taavale ao tagofia le ava. O le mafuaaga lea ua faia ai ni su'esu'ega tetele se tolu ma o loo faatupeina e le Malo o Niu Sila.

Ole a le ava (kava)?
O le ava o se laau faaleaganuu taua tele ma o se vaiinu mo tagata o le Pasefika, ma o se vaega taua i le tele o faafiafiaga ma le agafesootai i le Pasefika.

Toatele o tagata, o le inuina o le ava e malolo ma faamalosi ai talanoaga ma faafesoai manatu lelei. O le ava e masani lava ona inuina i faatasiga faaleagafesootai, i ni faapopotoga tetele poo le toalaifi foi mo se taimi umi pe puupuu foi.

O le ava e le o se ava malosí (pia) E le tutusa le aafia o le tagata inu ava (kava) ma le tagata e inu pia poo isi ava malosí. E le faatosina manaoga foi. O le inu ava e saogalemu ma e iai foi ona aafia lelei mo loo soifua maloloina. O le ala lea ua Iauliloa ai ile lalolagi Ua oo foi i isi tagatanuu e le o ni Pasefika, ua latou fiafia ai i le ava ona o ia aafia lelei mo i latou.

Oa ni aafia o le ava (kava)?
Ua iai ni su'esu'ega mautinoa ua faaalua ai o le inuina o le ava e ono faatelegele ai le mafaufau ile faia o filifiliga tatau. Ma e ono aafia ai foi ma lou aveina ole taavale.

Mo i latou e inuina le ava i se suiga malosí tele e pei ona faia e le atunuu o Vanuatu ma nisi motu ole Pasefika. E iai ona aafia tuga ma le lelei. Ae o isi motu o le Pasefika e pei o Toga ma Samoa o loo faaoga ma taumafa ai le ava i se suiga māmā. Ae poo lea lava le auala e faaogaina ai le ava e mafai ai lava ona le saogalemu le aveina o le taavale.

O se solitulafono le ave taavale ae o loo faasuaava
E fa'asa i le tulafono ona e aveina se ta'avale pe a fa'asuaava i le ava. Afai e taofi e le leoleo, e ono pu'eina oe, faaleaogaina lou laisene ma ono oo ai i se tulaga faa falepuipui.

E taua ona e silafia, o le ave taavale faasuaava e mafai ona lamatia ai lou saogalemu, faapea ma lau pasese ma isi tagata feoai i luga o le auala. Afai e oo le oti i se tagata, pe manu'a se tasi ia te oe i luga o le aafia o le ava, e mafai ona faasalaina oe i le falepuipui.

E faatatau mea uma i le faaaloalo
O tagata o le Pasefika e faatauaina tele le faaaloalo.

O le faaaloalo foi e faavaeina ai le faaogaina ma le taumafa ava.

O le fa'aaloalo e fa'atauaina ai tulaga taua o le Pasefika e pei o le fa'aSamoa.

Afai o loo e taumafa pea i le ava, ma ave le taavale, taofi ma mafaufau: O o'u faaali lou faaaloalo i la'u pasese ma isi tagata o loo fa'aaogaina le auala?

Faamata o loo lamatia i latou i lou aveina ole taavale?

Afai e te leo mautinoa, aua e te aveina le taavale!