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UoA Scientific Summer Research Special

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Editors' Note

Kia ora koutou katoa, and welcome to UoA Scientific's first edition for Volume 3!

As is the usual for UoA students, these last few months have gone by far too quickly and we are already halfway through semester one. Already, so much has happened this year concerning the progress of the UoA Scientific magazine. Early into semester one, we released the first issue created by the 2023 team, which included a collaboration with the UoA Women in Science Club. The release of this issue happened to coincide with International Women's day which made this distribution even better. During the first few weeks of uni, you may have spotted us at one of several club events, including the Clubs Expo (City and Grafton campuses), Science Smart Start Week, the SCISA Science Carnival, or the Maker Club mass collab event.

Additionally, in January we released our scientific shorts series on our instagram account. Already, you can find short and interesting fact snippets about macrobacteria, crab evolution, colour perception, autoimmunity, and bioluminescence.

As for this issue, V3E1, we are focusing on the research UoA scholarship awardee students completed over summer. Oliver Frear investigates how health rehabilitation in Aotearoa can be improved. Anita Olmstead's research examines what proportion of fast food promotions in Aotearoa are healthy for kiwis. Sonja Neef discusses the impact of environmental variables on the fall risk of elderly persons living in residential care facilities. Moving into the field of chemistry, Amy Olley analyses a hypothesis concerning the function of the vasoactive intestinal peptide in regards to coronary blood flow. We also have some exciting research articles by executive members Sarah Moir who investigated mesenchymal stem cells in ophthalmological research and Jasmine Gunton who examined entomological biosystematics.

Thank you so much to all of our writers, their research supervisors, and everyone else who participated in the research presented in this issue. Additionally, thank you to the Science Faculty and in particular, Vanessa, Grace, Linda, and Irene for their invaluable assistance and support. Finally, we hope that all of our readers enjoy this special edition of UoA Scientific.

Ngā mihi nui,

Jasmine Gunton
2023 President of UoA Scientific

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Optimisation of Stem Cell Collection for the Improvement of Eyesight Restoration Therapies: Is There a Gradient of Mesenchymal Stem Cells Along the Umbilical Cord?

Sarah Moir

Opthalmology

This summer I joined Trevor Sherwin's lab group in the department of Ophthalmology to undertake my summer research scholarship project, funded by the University of Auckland. I was given the opportunity to investigate mesenchymal stem cells (MSC) of the human umbilical cord for the purpose of developing corneal restorative therapies. Using PCR techniques, I set out to discern a gradient of MSC concentration between the placental and foetal ends of the cord. We hope to optimise the efficiency of MSC work by distinguishing the location along the cord that yields the most MSCs. Evidently, PCR analysis produced some interesting trends.

The corneal transplant is a procedure required for distortion or damage to the stroma, a major component of the cornea. Keratoconus is a corneal dystrophy that produces the most common need for transplant and is thus the focus of this research. However, transplants are limited by a global lack of donor tissue, where at least 55.3% of the global population lacks access to these resources [1]. While largely successful, transplant tissue efficacy deteriorates over time. Corneal graft survival occurred in 90% of patients at five years post-procedure and reduced to 82% at 10 years [1]. Studies measuring the quality of life for keratoconus patients report poor mental health as a consequence of the disorder [2]. This was attributed in part to the early onset progressive nature of the disease and anxiety around the possible need for keratoplasty. Specifically, clinical presentations of the disorder include sudden near-sightedness, astigmatism, blurred or distorted vision, sensitivity to bright light, and the need for recurrent prescriptions [3]. These outcomes reportedly leave patients with a loss of functional capacity, activity limitations, reduced participation in pleasurable activities, reduced social integration, and low self-efficacy [4]. Evidently, it would be significantly beneficial to develop a means of overcoming the accessibility and longevity limitations of current corneal restorative therapies.

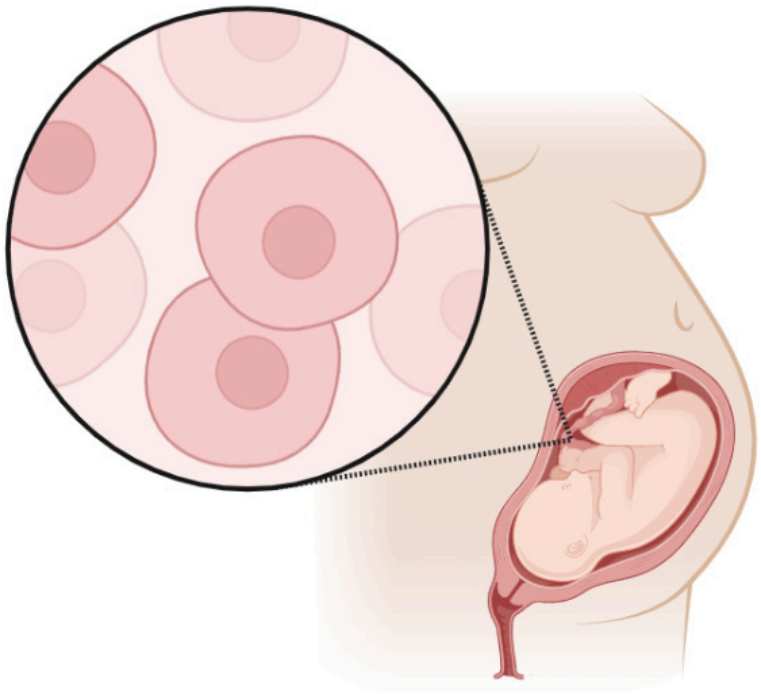
The overarching goal of this research is to develop Mesenchymal Stem Cells (MSCs) as a regenerative medicine for corneal disorders. MSCs are hoped to provide an inexhaustible source of cells for eye regeneration, where they are continually replacing damaged cells and renewing the stem cell population. MSCs can be sourced from multiple sites, including the human umbilical cord. Relative to other sites, including bone marrow or adipose tissue, umbilical cord cells are less likely to develop cancerous teratomas and have higher proliferation and differentiation potential [5]. In combination with the immune-privileged nature of the cornea, stem cell transplant is a promising treatment for corneal disease.

My contribution to this research expanded on a previous Masters' student's work in the lab group, Vicky Wen, whose objective was to identify and quantify the distribution of MSCs along the length and within the 3-dimensional anatomy of the umbilical cord [6]. The purpose of her work was to optimise the recovery of MSCs by establishing where the greatest quantity of MSCs exist within the umbilical cord. She found evidence to suggest there is a gradient of MSCs between the foetal and placental ends of the umbilical cord. To date, no studies outside of this lab group have explored the MSC umbilical cord profile, especially their ability to differentiate into corneal keratocytes.

I received one umbilical cord (due to time and resource constraints) to perform gene expression analysis by droplet digital PCR. I dissected 1cm fragments along a 75cm umbilical cord, giving me 46 samples in total. For every 2cm of neighbouring tissue sections, 1cm was used in PCR, and 1cm was used for immuno-labelling, leaving 23 tissue samples available for each procedure.

Due to the Auckland flood and cyclone events, as well as the time waiting to retrieve the cord, the immuno-labelling portion of my project could not be completed with me present. This taught me the way research projects work sometimes, or don't in this case, as highlighted by my supervisor.

Nevertheless, a significant portion of my project focused on learning PCR skills, where I extracted RNA from 23 umbilical cord samples to analyse for gene expression. Following DNase treatment to remove genomic DNA, I conducted RNA quality control processes, including the SPUD assay [7] to check for the presence of PCR inhibitors and the Tapestation instrument to check for the quantity and quality of RNA. After confirmation of sample quality and quantity, I synthesised cDNA from the umbilical cord RNA. The success of cDNA synthesis was checked by performing a PCR for the beta-actin gene and looking for the existence of the gene using gel electrophoresis. I continued on to learn ddPCR for gene expression analysis for my chosen genes of interest (GOI), in addition to a panel of six reference genes. The Normfinder algorithm was used to determine the most stable reference genes, and the geometric mean of the three most stable genes was used for normalisation. Normalised relative expression quantities were calculated and this allowed comparison between the 23 samples along the length of the cord [8].



Graphic pregnant women and foetus: Infographic showing stem cells of the umbilical cord. Sourced from BioRender.

My research discovered the presence of some interesting trends in MSC marker genes across the length of the umbilical cord used in my study. In particular, positive MSC markers CD90 and CD105 indicate an increase in MSC gene expression near the placental end of the cord relative to the foetal end of the cord. Positive marker CD73 shows relatively higher expression at each end of the cord; the middle section of the cord appears to have the least expression relative to the foetal end of the cord, while the placental end of the cord has a relatively similar expression to the foetal end.

Evidently, there is support for the initial hypothesis that there appears to be a pattern of MSC differentiation potential between the foetal and placental ends of the umbilical cord [6]. Our results suggest targeting the placental end of the umbilical cord will provide the most favourable yield of MSCs.

However, not all the GOI showed obvious trends of expression along the cord. These results are preliminary, as only one umbilical cord was studied. This data will thus support future grant proposals to develop this research.

Conclusions

Keratoconus exemplifies the importance of developing sustainable, successful therapies for the treatment of corneal disease. The development of effective, resourceful, and timely therapies for the treatment of keratoconus will improve the quality of life for these patients, both mentally and physically. Mesenchymal Stem Cells are a promising area of study where their optimised retrieval is an important component in supporting this wider research.

My experience in the lab was very positive and beneficial to my learning of the typical research process. I gained valuable wet lab experience, where I learnt lab etiquette and skills, including PCR and tissue sectioning/freezing. As mentioned, I learnt the way research doesn't work sometimes (in the face of collection delays and relentless weather events), which meant I also learnt the importance of maintaining a positive attitude and persistence. All members of the Ophthalmology department were friendly, accommodating, and eager to help me if needed. I am thankful for the ongoing support and encouragement that developed my confidence and good attitude throughout my project.

Acknowledgements

I would like to express my gratitude to the University of Auckland for funding my summer research project with Trevor Sherwin's lab group in the Ophthalmology department. I would like to thank my supervisor, Professor Sherwin, for his attention and help throughout my project. I would also like to thank Salim Ismail for his patience and guidance throughout my PCR work and Judy Loh for her encouragement and guidance throughout my immunohistochemistry work. I would also like to express my thanks to Anmol Sandhu for her help in both collecting and preparing the umbilical cord and to the donor of the cord.

Sarah Moir - BSc, Biological Sciences
Sarah has just finished her third year of study at UoA as a Biology major. She is staying with *Scientific* as the head editor this year before she returns for postgraduate study. Having just finished her summer research project, she is off on her gap year.

Research

Stumbling Blocks and Safety Nets: Addressing Falls among Nursing Home Residents

Sonja Phutachad Neef

Aged-Care

Examining the impact of modifiable risk factors on falls is essential for facilities designed to support our elderly. This study examined how environmental and life-space factors impact falls in elderlies living in residential care facilities.

"A society that does not value its older people denies its roots and endangers its future. Let us strive to enhance their capacity to support themselves for as long as possible and, when they cannot do so anymore, to care for them." - Nelson Mandela, 1998 [1]

Introduction

By 2028, an estimated one million elderly persons will live in Aotearoa, New Zealand [2]. Research on elderly populations has increased in recent years, particularly on the risk of falling. Falls are a major cause of injury, rapid deterioration of health, and death. Thus, examining environmental influences on falls and fall risk are essential so that facilities such as nursing homes can be designed to protect and support our elderly people more effectively. Older persons in aged-residential care are three times more likely to experience falls than their community-dwelling peers [3]. Past studies have concluded that the causes of falls are multifactorial [4] and that fall risk is strongly related to the interaction between a person and their environment [5].

My summer research project topic looked at *Environmental factors in the movement space of aged-care residents and their impact on falls and fall-related injuries in participants from the Staying UpRight study.* This project was an environmental sub-study of the larger Staying UpRight parent study. Staying UpRight is a randomised controlled study looking at the efficacy of a long-term exercise program to prevent falls of elderly living in long-term aged-residential care. Our sub-study research question focused on whether environmental indices are associated with falls and fall-injury risk. We also looked at whether changes in life space mobility during the COVID period were associated with falls. Life space refers to the area a resident moves in and from over a given time [6]. Several studies have looked at falls and fall risk in community-dwelling elderly and those in hospital care settings. However, to our knowledge, this is the first study looking at both fall-risk and life space mobility in long-term aged-residential care. We hypothesise that residents exposed to more hazards will have higher fall rates, as found by Jiang and colleagues (2021) [7].

Methods

The sub-study sample included 126 participants (main study = 303) from 12 facilities (main study = 25) in the Auckland | Tāmaki Makaurau region. Several research assistants carried out data collection. Due to the impact of the COVID-19 pandemic and subsequent lockdowns, particularly affecting residential care facilities, data collection spanned almost two years (see timeline in Figure 1[8]).

Data collection was conducted in two parts. In Part A, research assistants (RAs) interviewed the caregivers on how often the resident went to areas such as the toilet and the specific route the resident takes to get to these areas. For the Nursing Home Life Space Diameter (NHLSD), caregivers were asked about the residents' movement within their room, outside the room (but within the unit), outside the unit (within the facility), and outside the facility. The index score was calculated using an equation from Tinetti and Ginter (1990) [6]. Due to the COVID-related delays, RAs also asked caregivers to think back to how the resident's movement was one to two years prior to the interview when the main study began. The level of assistance required for walking, showering, and using the toilet was also collected.

Part B of data collection involved the RAs collecting environmental data. Environmental hazards were counted and scored in each area, adapted from a questionnaire by Jiang and colleagues (2021) [7]. Environmental hazards were scored on a scale of zero to two (zero = no hazards present). They included hazards such as unsecured furniture, slippery/uneven floors, and unmarked light switches (examples in Figure 2). Other environmental factors included bed and toilet height, and the distance from the resident's bedroom to other areas in the facility (e.g., bedroom to dining). Elevations in these routes were also calculated and converted into a yes/no variable. Falls data and data on each participant's physical, cognitive, and health indicators were taken from the Staying UpRight main study.

Distance and hazard scores were calculated and adjusted for weekly exposure to create distance and hazard indices. For example, a resident who needed to walk 21 metres to get to the dining room from their bedroom and who went to the dining room twice a day was assumed to have a weekly dining distance index of around

590 metres. After completing the calculations, falls and confounding variable data were merged from the Staying UpRight main study. Subsequently, preliminary data analysis was carried out, including analysis of the descriptive statistics for each variable and a correlation matrix of all variables in SPSS. The primary regression analysis used negative binomial regression and Cox proportional-hazard models.

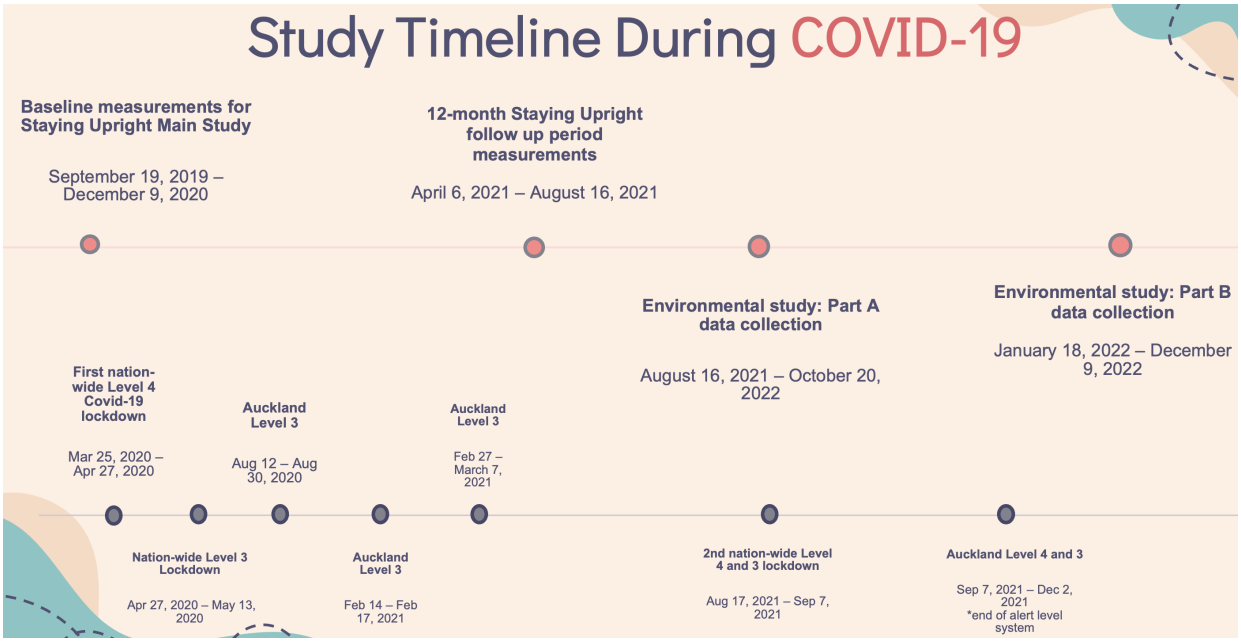
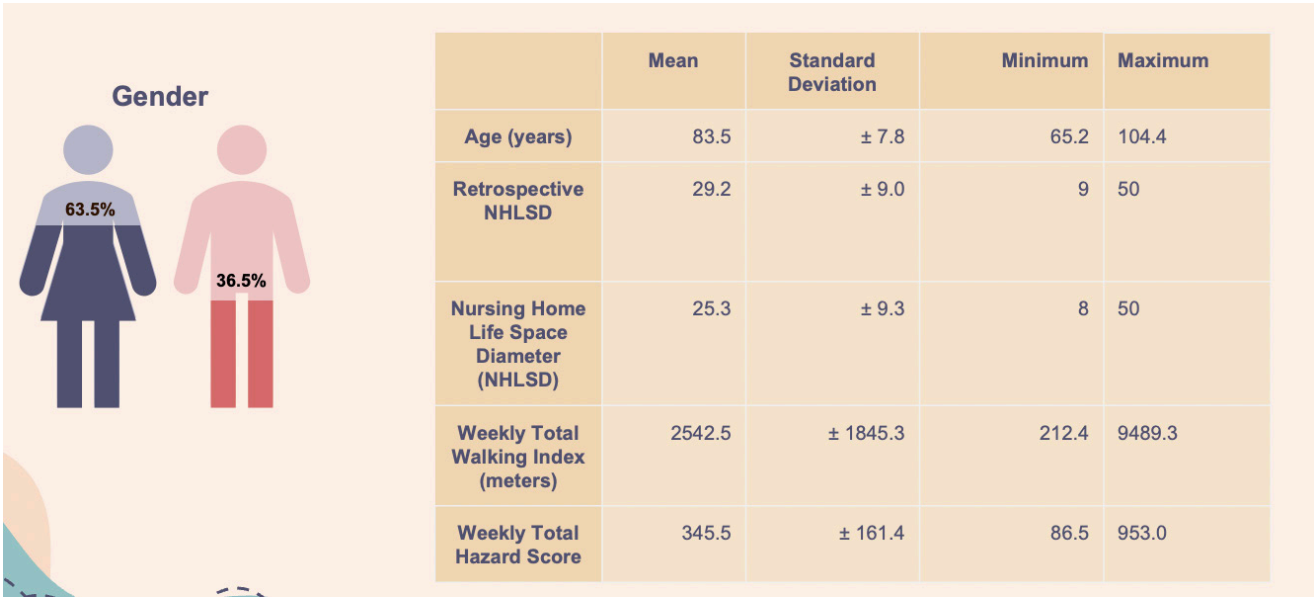


Figure 1. Study Timeline During the COVID-19 Pandemic and Lockdowns

Figure 2. Typical fall hazards in an elderly home. Photo credit: Author's own

The average age of our participants was 83.5 years (± 7.8). 63.5% of participants were female, and the rest were male (36.5%). Tables 1 and 2 outline the mean scores for distance and hazard indices, including the maximum and minimum possible scores for hazards (weekly and raw scores).

Within our sample, 68.8% of residents experienced falls, with an average fall rate being 3.6 (/person-years ± 11.9) (Figure 3).

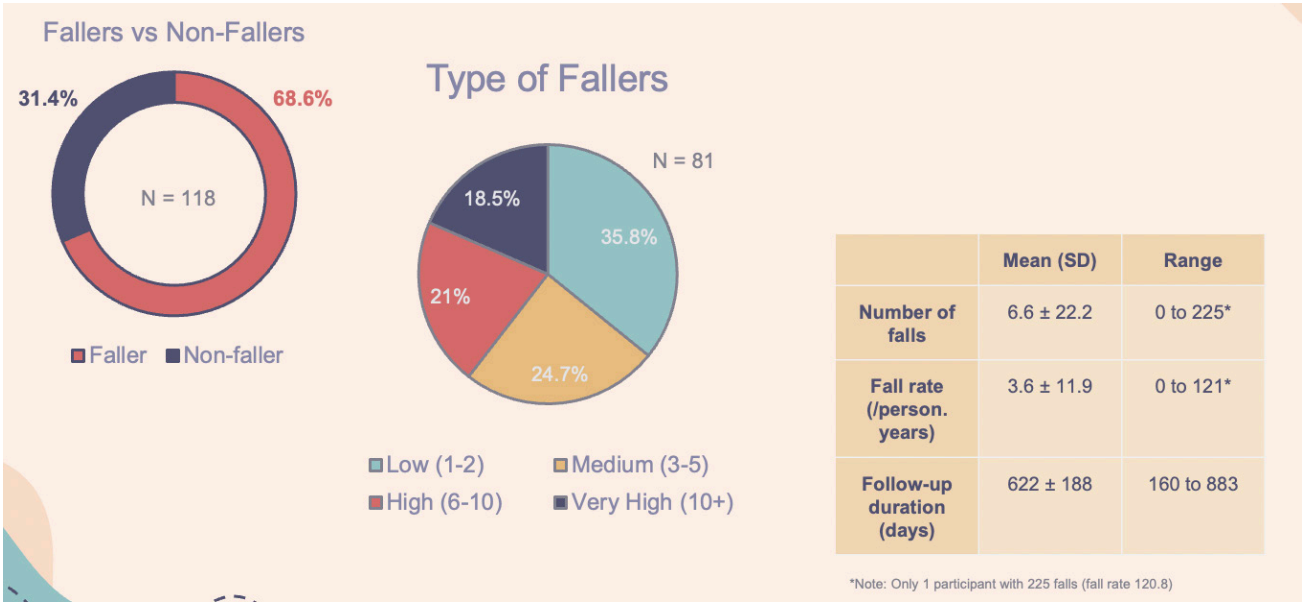


	Mean	Standard Deviation	Minimum	Maximum
Age (years)	83.5	± 7.8	65.2	104.4
Retrospective NHLSD	29.2	± 9.0	9	50
Nursing Home Life Space Diameter (NHLSD)	25.3	± 9.3	8	50
Weekly Total Walking Index (meters)	2542.5	± 1845.3	212.4	9489.3
Weekly Total Hazard Score	345.5	± 161.4	86.5	953.0

Table 1: Descriptive Findings.

Hazard Scores	Raw Score			Weekly Score		
	Mean (± SD)	Range	Maximum Possible Score	Mean (± SD)	Range	Maximum Possible Score
Bedroom	**6.3** ± 3.0	2 to 16	26	**142.3** ± 79.1	0 to 420	728
Dining room	**1.4** ± 0.9	0 to 4	8	**23.4** ± 21.7	0 to 112	224
Lounge	**2.0** ± 1.2	0 to 5	12	**31.2** ± 24.2	0 to 84	336
Shower	**3.7** ± 3.1	0 to 12	24	**20.7** ± 17.5	0 to 60	168
Toilet	**3.1** ± 2.4	0 to 10	30	**91.1** ± 76.2	0 to 350	1,050
Hallway	**4.8** ± 1.7	0 to 8	12	**37.9** ± 50.9	0 to 196	336
Total	**21.4** ± 8.1	8 to 45	112	**345.5** ± 161.4	86.5 to 953.0	2,842

Table 2: Descriptive Findings - Weekly Hazard Scores.



	Mean (SD)	Range
Number of falls	6.6 ± 22.2	0 to 225*
Fall rate (/person. years)	3.6 ± 11.9	0 to 121*
Follow-up duration (days)	622 ± 188	160 to 883

*Note: Only 1 participant with 225 falls (fall rate 120.8)

Figure 3: Falls data for the sub-study participants from Staying UpRight.

The project's results have been interesting and at the same time, quite unexpected. Findings from the bivariate analysis indicate that hazard scores and distance indices were significantly associated with falls, albeit negatively (See Tables 3, 4, and 5). This contradicts our hypothesis that more hazards would be linked to higher fall rates, as residents who were exposed to more hazards were associated with fewer falls. However, the correlation coefficients are relatively weak, between -0.15 to -0.40.

Results from the initial negative binomial regression and Cox proportional-hazards regression model suggest that the only variable that significantly predicted falls (p-value < .001) and time to first fall (p-value = .002) in our sample was walking assistance. This may suggest that walking assistance may accurately indicate frailty, which would be associated with elderly persons being more prone to falls.

This project is still ongoing. Therefore, data cleaning and calculation processes will be repeated and re-checked before re-running the main regression in the coming months.

	Weekly dining distance (meters)	Weekly lounge distance (meters)	Weekly shower distance (meters)	Total distance raw index (meters)	Weekly total distance index (meters)
Fall rate	-0.197* p-value: 0.034	-0.250** p-value: 0.007	-0.256** p-value: 0.006	-0.304** p-value: <0.001	-0.248** p-value: 0.007
No. of falls	-0.246** p-value: 0.008	-0.270** p-value: 0.003	-0.230* p-value: 0.013	-0.320** p-value: <0.001	-0.281** p-value: 0.002

(*) - Correlation is significant at the 0.05 level (2-tailed).
(**) - Correlation is significant at the 0.01 level (2-tailed).

Table 3: Falls data for the sub-study participants from Staying UpRight.

	Duration of recruitment to index (days)	NHLSD total	Bed height (meters)	Av. toilet height (meters)
Fall rate	.237** p-value: 0.01	-.182* p-value: 0.049	.278** p-value: 0.003	.290** p-value: 0.002
No. of falls	.291* p-value: 0.001	-0.185* p-value: 0.045	.278** p-value: 0.003	.265** p-value: 0.04

	Weekly dining hazard	Weekly lounge hazards	Weekly toilet hazards	Weekly shower hazard	Total hazard raw score	Weekly total hazard
Fall rate	-.231* p-value: 0.013	-.224* p-value: 0.015	-.336** p-value: <0.001	-.312** p-value: <0.001	-.280** p-value: 0.002	-.377** p-value: <0.001
No. of falls	-.254** p-value: 0.006	-.256** p-value: 0.006	-.315** p-value: <0.001	-.283** p-value: 0.002	-.248** p-value: 0.007	-.352** p-value: <0.001

(*) - Correlation is significant at the 0.05 level (2-tailed).
(**) - Correlation is significant at the 0.01 level (2-tailed).

Table 4 & 5. Significant correlations between fall rate, number of falls with hazards scores, and other key variables

Discussion

This study examined whether environmental and life-space indices may predict falls and fall risk of the elderly living in aged-residential care in Tāmaki Makaurau | Auckland. While the findings suggest a weak negative association may be present between distance travelled, exposure to hazards, and fall rates, this may result from facilities improving the environment of residents who have had more falls or moving more frail individuals to a room closer to common areas. Thus, in an effort to prevent more falls, their surrounding environment was made less hazardous. Therefore, participants who were not prone to falling may not have required any intervention. Perhaps looking at the cause of the falls could shine a light on whether a hazard caused the fall and where facility staff may have modified a hazard to improve the room's safety for that resident.

Jiang and colleagues (2021) assumed that participants from one facility were exposed to the same number of hazards, and these hazards were not adjusted for exposure [7]. Therefore, a strength of our study is that each participant has a raw hazard score based on the rooms they visit and an adjusted hazard score based on their weekly hazard. Thus, we can examine whether the frequency of movement to a specific room may be indicative of fall risk.

Limitations of the study include a relatively small sample size, which was impacted by the COVID-19 pandemic. In Auckland NZ, this had the greatest impact through late 2020 to early 2021, and again in late 2021. As the study only looked at movement, distance, and hazards at the time of the interview and one to two years prior, changes in mobility and environment as a result of falls and subsequent mitigation and adjustment of hazards could not be examined. Future research should examine whether the weak negative associations between fall rates with distance and environmental indices may be due to rapid intervention by aged-residential facilities. Thus, longitudinal studies should analyse whether such interventions effectively prevent falls and fall risk in this vulnerable population.

Conclusion

In the next five years, around one in five people in Aotearoa will be aged over 65 [2]. As many move from the community into purpose-built facilities, improving facility design to minimise fall and fall injury risk is imperative. Our study findings allude to the complex interactions between personal and environmental factors that drive fall-risk in a nursing home context. These findings also have implications for elderly people living in other settings, including community-dwelling and those living in acute care homes. The multifactorial nature of falls and how both environmental and person-related factors interact must be considered when implementing fall-prevention measures and conducting future research.

The quote at the start of this article encapsulates the overall aim of this study and related research, which is to improve facilities and practices that would provide the elderly with opportunities to remain independent for as long as possible. Once they are unable to live independently, they should receive exceptional care and support tailored to their individual needs, which would improve the overall outcomes for all elderly people in our society.

Key Lessons

Lessons that I have learned from this summer research project were:

- Do not underestimate the time and importance of data cleaning, as starting with a clean data-sheet is nearly impossible. Trying to get it as clean as possible is vital before continuing with data analysis, as this would reduce the need to go back and fix errors post analyses.
- Get as much knowledge and professional insights from your supervisors by asking lots of questions, engaging in debates, and being open to exploring the project deeper than you expected. Your supervisors are there to help and support you both in enhancing your understanding and thinking critically about your research process and results.
- Do not be afraid to apply for projects outside your faculty and degree, as you may find new interests and develop new skills that will be vital in future jobs and academic endeavours.
- Take every opportunity to practice presenting your findings to your supervisors, family, faculty staff, and fellow students, as they may suggest interesting ideas that help explain specific findings.
- Constructive feedback is crucial to improve how you conduct research, data cleaning, data analyses, and data presentation for your future studies and subsequent jobs.

Acknowledgements

I was motivated to apply for this summer research project due to my personal experiences with my grandfather, who had Parkinson's Disease, and my grandmother, who was his primary caretaker. I want to thank my supervisor, Dr Catherine Bacon, for all her continued support and guidance over the past few months. I would also like to acknowledge my supervisory team, Dr Lynne Taylor and Professor Ngaire Kerse, and the Staying UpRight main study statisticians, Simon Moyes, and Alana Cavadino, for all their help and feedback, and statistical guidance. I want to thank the HOPE Foundation for funding my summer research scholarship and giving me the opportunity to learn from an incredible group of researchers in the field of ageing, in which I hope to continue my studies. I want to acknowledge all the work done by the research assistants who completed data collection despite several COVID-19 lockdowns and restrictions in aged-residential care homes.

Sonja Phutachad Neef - MSc, Psychology

Sonja will graduate in May with a BSc in Psychology and will be starting her Research Master's majoring in Psychology. She is passionate about improving the emotional, psychological, physical, health, and cultural outcomes of the elderly. Additionally, she is interested in the cross-cultural differences in aging.

Research

Trials and Tribulations of Rehab Service for Older Adults

Oliver Frear

Rehabilitation

What does it mean to age well and how does rehab help achieve this? Over my studentship, we conducted a qualitative study into patient perspectives on what makes rehab successful. We asked how the rehabilitation service can better serve older adults.

Photo by De an Sun from Unsplash

Over recent decades, there has been an ever-increasing push for a patient-centred approach in health care delivery [1]. However, this does not always occur. In my summer research, I conducted a qualitative study into the older patient's perspective of what constitutes success in rehabilitation from strokes and fractures. We conducted interviews in Te Whatu Ora Wāitemata. This article sets out to explore some of the challenges and successes of older adults undergoing rehab.

It is important to set the scene for some of the challenges older adults face. The event of either a fracture or stroke can be debilitating [2]. It can be a life-altering event that potentially takes people out of their past life and into an institutionalised setting with their routines, tasks, and lives decided for them [2]. Older adults and the desire to lead a meaningful and good life in later years have gone through a renaissance in popularity recently. This is firstly due to the expanding older adult group percentile of our population, but also due to the New York Times best-seller "Being Mortal" by Atul Gawande. This has thrust discussions of quality of life and mortality into the mainstream. However, there is still a significant stigma around older adults and their role in shared decision-making in clinical settings [3].

We found from our results that there was a huge unmet need for the psychological aspects of rehab. Overall, individuals were pleased with the physical rehab aspect for their health, albeit with a fair amount of pragmatic acceptance, but found a huge lack of mental support to deal with their lifestyle change. There should not be an understatement to just how big of a shock a debilitating event can be to some people. Their lives are often flipped overnight. A lack of mental health support can cause their quality of life to suffer.

One interviewee said, "I've gone through a death, but where is the rehab to deal with those feelings?". This demonstrates the enormous complexity of emotions these people are going through. And sadly, many feel like a burden. This feeling of being an onus was a common theme throughout our interviews, which was heartbreaking to hear. These people have lived long, fulfilling, and generously contributive lives and they deserve to feel worthy of therapeutic treatment and, most importantly, to be valued in society. Many do consider older adults as an afterthought; as the parabole goes, "the measure of a society is how we treat our most vulnerable", and older adults are worthy and deserving of the utmost care, respect, and admiration.

I personally had great admiration for how resilient these older adults were. Some confided truly horrific stories of illness, loss, and grief. But what struck me was how in many of their words, "they just got on with it". There were people who had lost their husbands of sixty-plus years months earlier to having a stroke, and people with all their family and support systems

overseas, out of reach. Despite having their lives turned upside down with a lot of reasons to shut down and reclude, they decided to proceed with determination. It was incredible to see the mismatch of wider society's views of older adults slowing down when what I saw was some of the strongest willpower to continue on regardless.

Another surprising theme that arose was the language used in the rehab setting and the effect that it could have on the mindset of older adults. One lady described the use of rehab itself with connotations of drug rehabilitation. Which she was certainly not in for. Another 82-year-old lady described how the language used by the medical team of being either uplifting or pessimistic greatly altered her belief of what could be done. These semantics were not just superficial; they had a tangible impact on what people believed could, should, and would change and therefore ended up impacting the results of rehab [4]. This demonstrates that in a clinical setting, the words that are chosen play a huge role in impacting care. It is a sad reality that every interaction health care professionals have with patients will ultimately be more memorable for the patient and that patients hang off every word said in consultations, rounds, and appointments [5]. Therefore, the utmost care and thought should be placed into framing not only what information is delivered, but by what choice of language, and who is present. This taps into an interesting issue, as there is not one communication style or use of language that will be beneficial to everyone [5]. The variety in people's beliefs is something that I found fascinating. Thus, weaving a tapestry of knowledge of what makes someone who they are and what will help them and their whānau the most will be a question that should be answered every time a person enters the clinic.

Another major theme that came up was goal setting. In rehab, a lot of the goals were identified by people as being conventional goals (i.e. everyday aspects of living) rather than functional goals, or goals that were related to what they found important in life. This appeared to lead to a larger dissatisfaction with their rehab. Some people did not see the point of rehab if it wasn't designed for them reaching their functional goals. This led to a view that rehab was a series of red tape obstacles to get over rather than something that carries the purpose of improving their lives. This presents an opportunity to alter some goals to further increase older adult buy-in to the rehab service. As it is exceedingly difficult to motivate someone when they do not see the point of it. This motivation can extend to life as well, certain older adults (not all it needs to be pointed out) see life as not having much left to give. However there is value, and meaning to life in the twilight years. It may look different from years gone by but it can still be found.

I hope that you take away some of the challenges, resilience, and inspiration that older adults demonstrate. The care and kindness shown towards older adults I saw during my time on the wards was heartwarming. The healthcare team showed dedication to their craft, and compassion day in and day out which is something that is not always recognised and valued in society. However, the value of rehab to the older adults' lives could not be understated. I want to pay thanks, especially to Dr Katherine Bloomfield who supervised me on this project. It was an eye-opening experience that I hope this piece does justice to.

Oliver Frear - MBChB

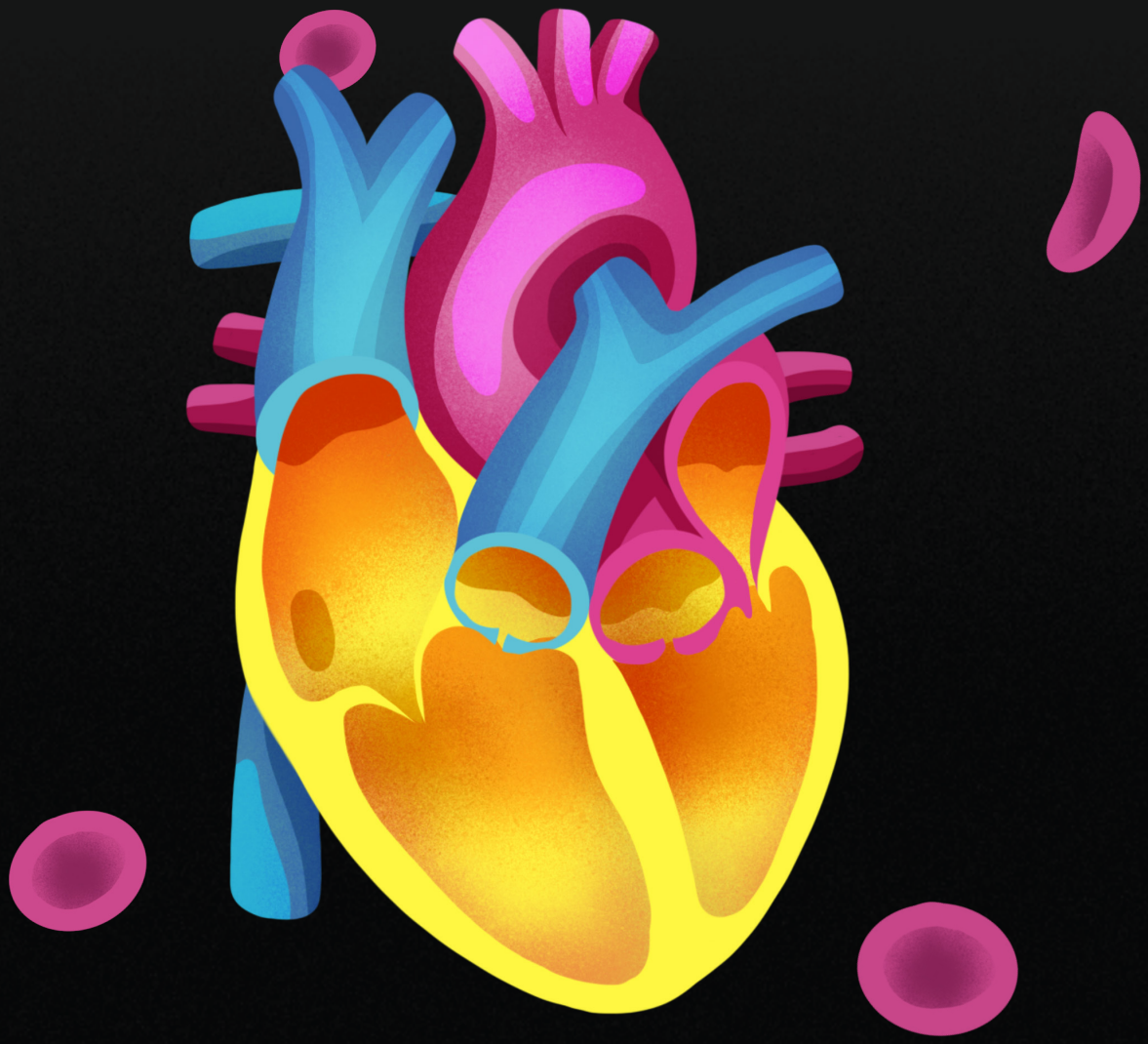
Oliver Frear is a third-year Medical Student at Otago University. He is originally from Auckland and went up for the summer to complete his summer studentship. He is still an ardent blues supporter, the highlanders have not swayed him yet.

Research

Vasoactive Intestinal Peptide is not the Dominant Mediator of Coronary Blood Flow During the Carotid and Aortic Bodies' Chemoreflexes

Amy Olley

Cardiac and Translational Physiology



The chemoreflex is an autonomic reflex which maintains oxygen supply to vital organs during hypoxia. This involves the heart via an increase in coronary blood flow, which is mediated by parasympathetic activity through unknown mechanisms. This project investigates the role of parasympathetic neurotransmitter, vasoactive intestinal peptide, in the increase of coronary blood flow during the chemoreflex.

We stimulated the chemoreflex and then compared the coronary blood flow response with and without VIP antagonism. The VIP antagonist had no effect on the coronary blood flow chemoreflex response. This indicates that VIP does not increase COBF during the chemoreflex.

Rationale

I began my summer research project with a literature review, where I was able to delve deeper into cardiac physiology than provided during my undergraduate degree. From this, I became interested in the autonomic control of the heart, particularly during the chemoreflex.

The chemoreflex is an autonomic reflex that is activated by hypoxia and is often upregulated and mechanistically distorted during heart failure [1-2]. Peripheral chemoreceptors include the carotid body (CB) in the neck and the aortic bodies (AB) in the aortic arch [2-3]. These sense changes in blood oxygen content, sending signals to the brain via the carotid sinus and vagal nerves, respectively [4]. **Sympathetic** and **parasympathetic** neural outputs then trigger bradycardia and increased respiration, blood pressure (BP), and **coronary blood flow (COBF)** [3-4]. These responses maintain the blood and oxygen supply to vital organs [3-4]. The coronary arteries stem from the aorta which supplies oxygenated blood to cardiac tissue [5]. COBF is determined by the drive of blood out of the left ventricle (LV) and into the aorta and the resistance of the coronary vessels against blood flow [5]. The level of resistance is manipulated by vessel diameter, with a smaller diameter imposing a greater resistance [5]. **Autonomic innervation** controls this alongside local metabolic factors [3-5]. A visual representation of these relationships is outlined in figure 1.

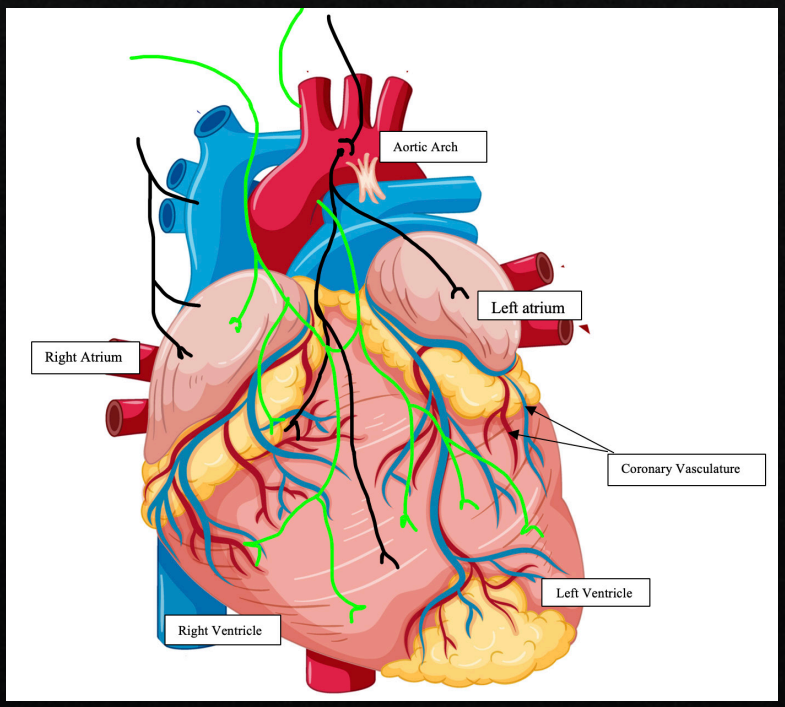


Figure 1. A simplified illustration of the heart's anatomy, including the coronary vasculature and the approximate major autonomic branches [6], [7]. Note that the black represents parasympathetic innervation, and green the sympathetic. This image was adapted by the author of this article.

Not only are both arms of the autonomic nervous systems activated during the chemoreflex, but stimulation of each increases COBF [1-3]. This has made it difficult to determine their distinct roles in increasing COBF during the chemoreflex. The **neurotransmitters** responsible for these processes are still being investigated.

The AB and CB chemoreflexes may use different neurotransmitters. Investigations into sympathetic modulation have found that **propranolol** had no effect on the COBF response during both AB and CB stimulation

Glossary

Sympathetic: One arm of the autonomic nervous system. Traditionally thought of as 'fight or flight'.

Parasympathetic: The other arm of the autonomic nervous system. Traditionally thought of as 'rest and digest'.

Neurotransmitter: A signalling molecule typically released from a nerve axon that binds a receptor on another neuron or tissue.

COBF: Coronary blood flow

Autonomic innervation: Where a tissue is supplied with nerves, enabling the nerve to manipulate cellular function via the release of neurotransmitters

Propranolol: A beta-adrenergic antagonist.

Atropine: An acetylcholine antagonist.

Acetylcholine: The 'main' parasympathetic neurotransmitter.

Control: No VIP antagonist administered.

Antagonist: Binds a specific receptor type without activating them. This blocks other molecules from binding and exerting an effect.

Beta-adrenergic: A sympathetic receptor involved in the relaxation of blood vessels and airways. Bound by adrenaline or noradrenaline.

KCN: Inhibits aerobic metabolism via acting on mitochondrial cytochrome C oxidase. This inhibits the electron transport chain – responsible for producing large amounts of ATP. As a result, cells must rely on anaerobic metabolism, producing large amounts of lactate and thus hypoxia.

HR pacing: Maintains a stable HR and energy demand. This reduces the number of variables that could alter COBF.

[2-3]. This suggests that neither the AB nor CB chemoreflex utilises the **beta-adrenergic** system to increase COBF. Vagally, **atropine** attenuated the COBF response with AB stimulation, but had no effect during CB stimulation [2-3]. This indicates that the CB chemoreflex does not use **acetylcholine** to increase COBF. In contrast, the AB chemoreflex does use acetylcholine. However, the persistence of the COBF response suggests acetylcholine is not the sole parasympathetic neurotransmitter involved [2].

My summer research project investigated the role of vasoactive-intestinal peptide (VIP) in increasing COBF during the CB and AB chemoreflexes. It is known that electrical stimulation of cardiac vagal branches causes the release of VIP into cardiac tissue, leading to an increase in COBF [8-9]. Furthermore, direct administration of VIP into the coronary arteries dilates the vessels to increase COBF [9]. This is despite a muscarinic and beta-adrenergic blockade, indicating that VIP increases COBF via binding to its own VIP-specific receptors [9]. Based on this, I created the following aims:

1. Investigate the role of VIP in the COBF chemoreflex response using a VIP **antagonist**.
2. Document any differences between the role of VIP in the AB and CB chemoreflex.

I hypothesised that the VIP antagonist would attenuate the COBF increase during the CB and/or AB chemoreflex. I also expected to observe a difference between the CB and AB chemoreflex COBF response upon VIP antagonisation, although I was unsure what that would be.

Methods

My project stimulated the AB and CB chemoreflexes using potassium cyanide (**KCN**). In a conscious and anaesthetised large animal model (University of Auckland, AEC #2268), doses of 10µg/kg, 20µg/kg and 30µg/kg of KCN were used. KCN was administered through the carotid artery in the neck to stimulate the CB chemoreflex and into the LV to stimulate the AB chemoreflex. A VIP antagonist was infused to block any VIP effects. I then analysed the data using SPIKE2 and Excel. The baseline was defined as the 15s period prior to KCN administration.

Research outcomes

In Figure 2A, the KCN30 dose produced the greatest increase in COBF of approx. +13mL/min from baseline as expected [1, 3]. In Figure 2B, the VIP antagonist was infused, yet COBF reached a value similar to the **control** of approx. +16mL/min from baseline. There is no statistically significant difference between the control and VIP antagonist COBF CB chemoreflex response. This indicates that VIP does not increase COBF during the CB chemoreflex.

Due to the small number of trials performed [3], it would be interesting to repeat this project with a larger sample size. Furthermore, this project did not investigate whether the VIP antagonist was effectively binding to the VIP receptors. If these larger sample investigations are consistent with this project's findings, then these results prompt future research into whether VIP is released during the chemoreflex, as it requires high-frequency vagal nerve activity [8-9]. Additionally, this project is unaware of any direct vagal nerve recordings during the chemoreflex, and as atropine has not attenuated this response, it may be possible that parasympathetic activity does not modulate the CB chemoreflex like it does the AB chemoreflex [1-3]. From this, research could be directed towards sympathetic transmitters.

In Figure 3, the control reached a peak COBF of approximately 48mL/min above baseline after the LV KCN30 dose. Compared to Figure 2A, this was much higher than the COBF response to CB stimulation despite the **HR pacing**. Like other studies, this project indicates that

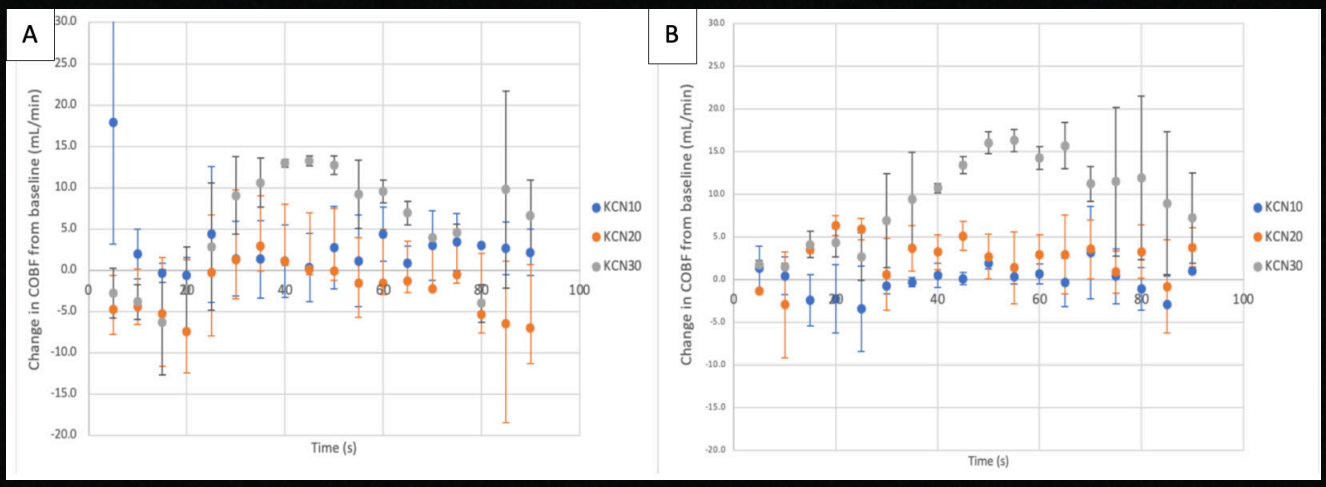


Figure 2. The effect of intracarotid KCN on COBF where the KCN dose was administered at 0s. Image A displays the control and image B with VIP antagonism.

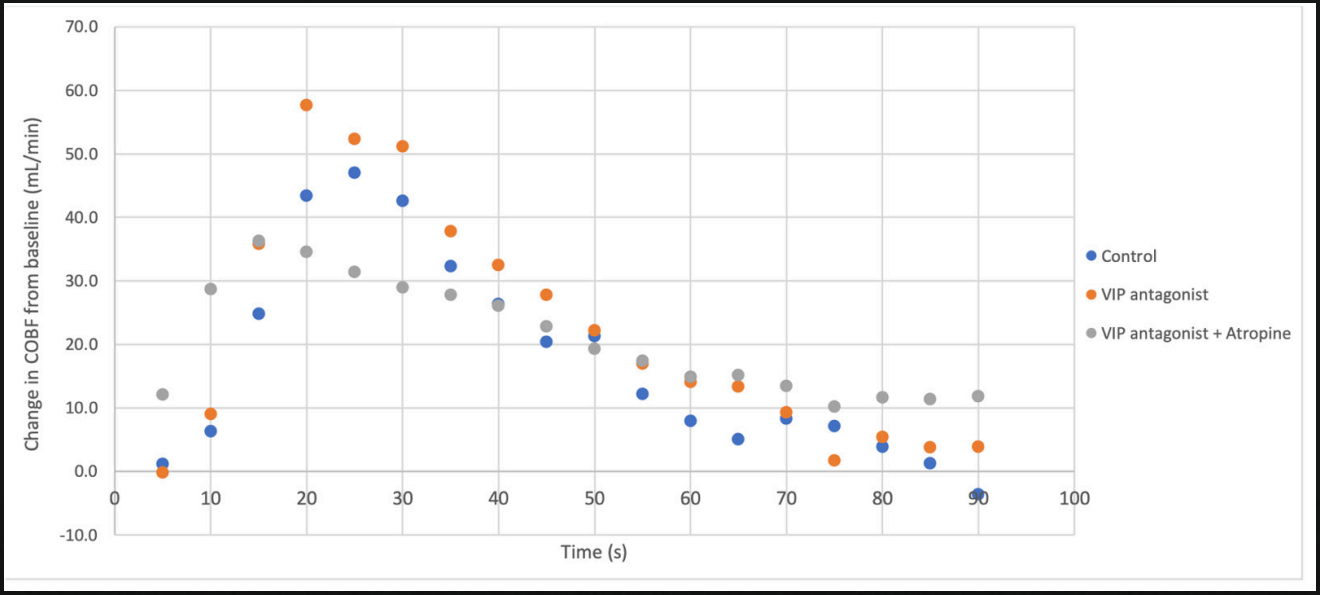


Figure 3. The effect of LV KCN30 to activate the ABs on COBF. This was observed with and without (control) VIP antagonism and atropine. KCN30 was administered at 0s, and HR was paced at 85bpm.

the AB may have a more cardiac-focused response to hypoxia, whereas the CB may have a more peripheral-vasculature-focused response [1-3]. Any neurotransmission differences between them are thus vital to understanding how this differential control occurs.

In Figure 3, the VIP antagonist appeared to increase the COBF response to LV KCN30 compared to the control, reaching approx. 58mL/min above baseline. This result does not agree with prior hypotheses and research where cardiac administration of a VIP antagonist abolished the increase in coronary blood flow resulting from vagal stimulation [2, 8-9]. As only one trial was conducted, it could be assumed that there would be no statistically significant difference between the control and the VIP antagonisation. If future trials agree with this outcome, it is likely due to similar reasons as explained for the CB chemoreflex.

In Figure 3, infusion of atropine attenuated the COBF response to LV KCN30 compared to control, reaching approx. 35mL/min above baseline. This agrees with Pen et al. [2] and Hackett et al. [10]. Thus, this project agrees that the AB chemoreflex utilises acetylcholine to increase COBF. However, because the COBF response was not abolished, other parasympathetic co-transmitters should be investigated, particularly Substance P [2, 8-9].

My summer research project improved my laboratory and data analysis skills, fortified my interest in cardiac physiology, and improved my confidence as an independent researcher. Although this project cannot conclude a role for VIP in the COBF response during the AB and CB chemoreflexes, it cannot rule out the need for investigating this role further, particularly in heart failure models. Already, it has been revealed that the chemoreflex has altered neurotransmission in hypertension and heart failure [1-2]. Thus, whether there is a difference in VIP's role between healthy and diseased models is critical in improving the knowledge and treatment of heart failure.

Acknowledgements

I would like to thank the Heart Foundation for funding this project. I would also like to thank Dr. Julia Shanks for their mentorship, feedback, and support, as well as the Cardiac Physiology lab group's PhD students and fellows for their patience and teaching.

Amy Olley - BSc, Physiology

Amy has just completed her undergraduate Bachelor of Science degree, majoring in physiology. Over the years, Amy has developed a specific interest in cardiac physiology, particularly as a consequence of disease.

Research

Digitisation of Pinned Specimens From the Insect Orders Diptera and Hymenoptera Within the New Zealand Arthropod Collection

Jasmine Gunton

Biosystematics

Often not considered by the wider public, museums and other natural history collections play several roles other than to simply entertain or educate. The existence and upkeep of these collections assist research in areas such as biosecurity, natural resource management, and biodiversity research. So just what role can collection research play in solving some of New Zealand's largest science problems?

Image from Landcare Research Manaaki Whenua - New Zealand Arthropod Collection.

The benefits of natural history collections are not solely bound to the population of the locality in which the collection is found. Biological collections can be shared amongst a much larger population through the process of digitisation. Through digitisation, scientists can study specimens from across the world simply by accessing a global database. In a global database, a researcher may be able to find details about an individual specimen's collection date, location, and morphology [1]. Often, the international non-academic population is also able to reap the benefits of digitisation. For example, London's Natural History Museum and Boston's Museum of Science both offer virtual interactive tours of their public collections. Digitisation is therefore an area of focus that collection specialists are beginning to prioritise [2].

However, how does one begin to digitise a collection that has more than 6.5 million specimens? This is the case in the New Zealand Arthropod Collection (NZAC) managed by Manaaki Whenua Landcare Research. Through my research, I aimed to digitise a portion of the NZAC to determine how strategised digitisation could benefit Manaaki Whenua and the wider scientific community.

For some quick context, Manaaki Whenua Landcare Research is a Crown Research Institute that focuses on the environment, biodiversity, and sustainability [3]. Within Manaaki Whenua exists the NZAC, consisting of thousands of pinned specimens and even more specimens held in ethanol. In fact, NZAC has the most complete coverage of terrestrial invertebrates in New Zealand (NZ) [4].

Over the summer, I worked at Manaaki Whenua as a junior lab technician. My research project was to digitise over 2300 Arthropod specimens. These included specimens from the orders Hymenoptera and Diptera. Various details about each specimen's taxonomic and collection information were recorded on excel spreadsheets. Specimen variables were as follows:

- Specimen kind
- NZAC accession number
- Country
- NZ area code
- Locality
- Altitude
- Collection date
- Collector name(s)
- Collector number
- Collection method
- Macrohabitat & microhabitat
- Collection event notes
- Life stage notes

From this mass digitisation project, I was able to collect spatial and temporal data on the NZAC.

For context, the order Hymenoptera includes wasps, bees, and ants. The Diptera order includes various fly families. The specimens digitised in this study were from three families within Hymenoptera and Diptera: Braconidae, Anisopodidae, and Tephritidae. Braconidae is a family of parasitoid wasps within the order Hymenoptera. The species within this family are known to parasitise a large range of crop pests, including the Asian corn borer moth (*Ostrinia furnacalis*), the tomato hornworm (*Manduca quinquemaculata*), and the serpentine leafminer (*Liriomyza trifolii*) [5-7]. Anisopodidae is a family of flies known as wood gnats within the order Diptera. Wood Gnats play an important role in pollinating the Cheesemans spider orchid (*Corybas cheesemani*), which is endemic to New Zealand [8]. Finally, Tephritidae is a family of fruit flies belonging to the order Diptera. One species of Tephritidae, particularly *Bactrocera dorsalis*, parasitizes over 250 fruits and vegetables globally [9]. A large proportion of the species within these three families are either beneficial or potentially harmful to the native ecology and/or agriculture of New Zealand.

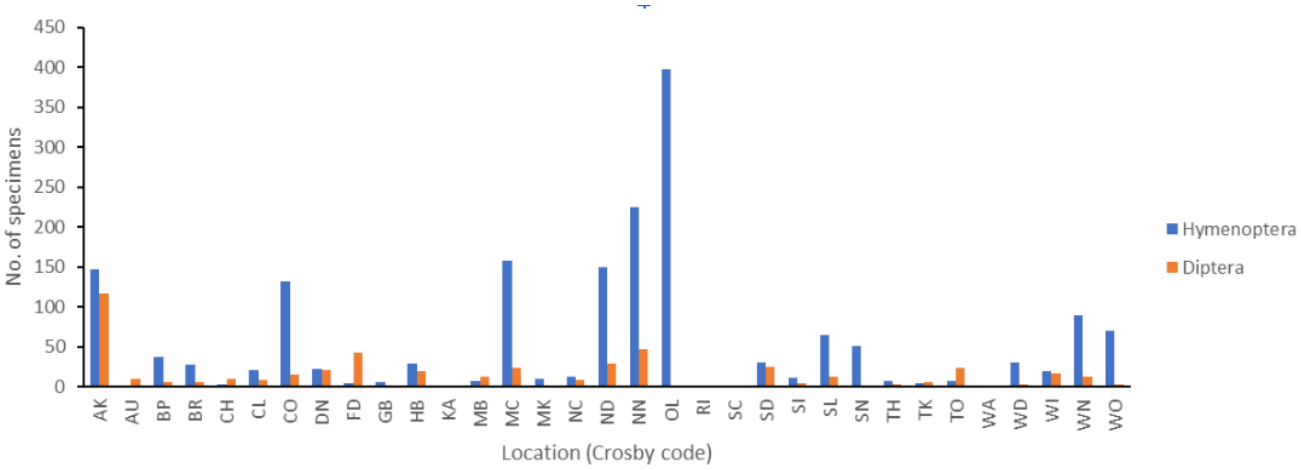


Figure 1. Total number of digitised Hymenoptera and Diptera specimens by location (Crosby code) in the New Zealand Arthropod Collection (NZAC).

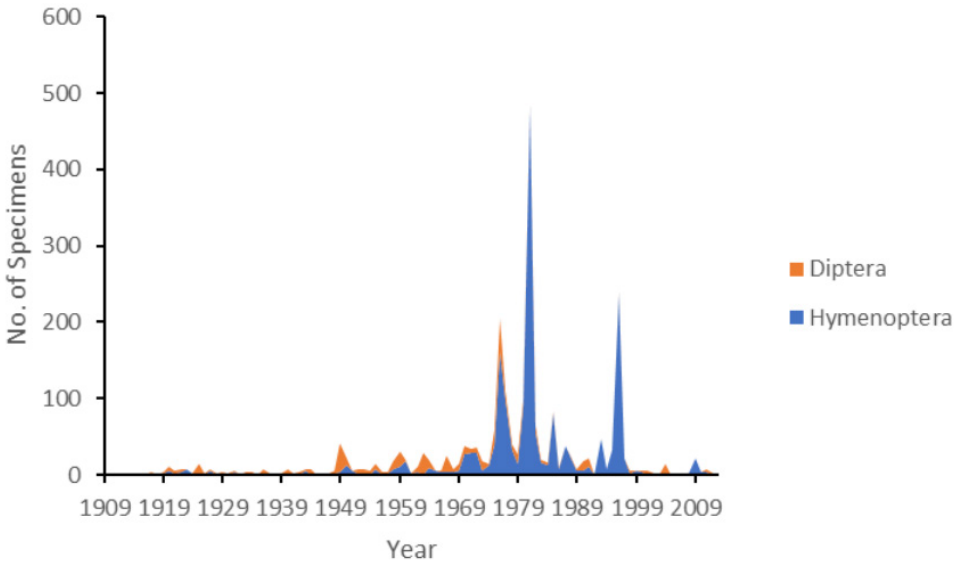


Figure 2. Total number of digitised Hymenoptera and Diptera specimens by year of collection in the New Zealand Arthropod Collection (NZAC). Specimens were collected between 1919 and 2011.

The digitised Diptera and Hymenoptera specimens displayed different spatial and temporal collection trends. Figure 1. shows that most of the Diptera specimens were collected in Auckland (AK) whilst most of the Hymenoptera specimens were collected in Otago Lakes (OL). The spatial Diptera data makes sense considering Auckland is NZ's most densely populated city [10]. However, the spatial collection trends of Hymenoptera specimens do not correlate with the population distribution of NZ. There may be an unusually high sampling effort of Hymenoptera in Otago, or more likely the data was skewed by sampling bias when choosing what species to digitise. Another explanation is that there is a high concentration of Hymenoptera species in the OL region compared to other areas in NZ. We need more information to be sure of either of these theories.

Figure 2. shows that most Hymenoptera specimens were collected around 1980, with another smaller peak around 1996. Most Diptera specimens were collected around 1975, with 4 other significant peaks between 1950 and 1965. Perhaps these statistics show that the Hymenoptera population in NZ grew suddenly in size in the 1980s and that Diptera species showed population growth cycles between the 1950s and 1970s. There is, however, another theory about the cause of the temporal collection trends shown in Diptera and Hymenoptera. Perhaps an increase in collecting effort during certain time periods between the 1950s and 1980s allowed for more insect specimens to be sampled. Although, this does not explain the differences in the Diptera and Hymenoptera temporal trends. Maybe in the 1980s, it was more popular among NZ entomologists to study Hymenoptera than to study Diptera species. As with the cause of the spatial collection trends, we need more information to be sure of the cause of the temporal collection trends of the specimens.

A possible explanation for the difference in temporal collection data between Hymenoptera and Diptera is that it reflects NZ's changing science policies and goals. As the priorities of NZ entomology shift, this will be reflected in the specimens collected for scientific research. Over the past few decades, NZ science policies have changed to reward innovation over research for the sake of knowledge [11]. Additionally, economic factors and demands have begun to influence scientific research more and more. Therefore, economically important species may be sampled more often during years in which the economic demand is evident.

There are some potential sampling issues within this study. The sample size of ~2300 is far too small compared to the total NZAC size (~1.6 million objects). Additionally, arthropod families were not chosen at random, but rather on the criteria of taxonomic groups that were a priority to finish databasing. Therefore, the sample specimens were likely not representative of all the Hymenoptera and Diptera specimens within the NZAC. Consequently, we cannot extrapolate the results of this study to the entire collection. Additionally, this study alone should not be used for making decisions regarding native arthropod pollination conservation in NZ.

As of May 2022, only 14% of NZAC had been digitised, meaning that any digitisation efforts are beneficial to the greater goal of total digital representation of the collection [12]. Supporting this fact, only 6.2%-12.5% of global natural history specimens were digitised as of 2020 [13]. More funding should be appointed to complete the digitisation of the NZAC and to research methods of mass digitisation via artificial intelligence (AI). Additionally, I would recommend the development of a digitisation precedence framework to determine which taxon should be the priority when choosing which specimens to digitise manually.

Acknowledgements

I would first like to thank Anna Santure for coordinating the School of Biological Sciences Summer Student Research Programme. Next, I would like to thank my supervisor, Darren Ward, for continually assisting and directing me with my report, presentation, and overall research project. Additionally, I would like to thank my lab partner, Tomas Blokker, for answering any lab questions I had (and for introducing me to the show Twin Peaks). Finally, I would like to thank the other entomologists at Manaaki Whenua who assisted with my internship: Aaron Harmer, Grace Hall, Richard Leschen, and Robert Hoare.

Jasmine Gunton - BAdvSci(Hons), Ecology

Jasmine is a third-year Bachelor of Advanced Science (Honours) student specialising in Ecology. She is interested in researching areas in insect ecology and ecological restoration. This year she is also a part of the Science Scholars programme.

Research

Cheap, Convenient Consumption: To What Extent do Fast Food Price Promotions in New Zealand Include Healthy Options?

Anita Olmstead

There is no doubt that fast food is consumed widely nationally and internationally. However, there is a lack of literature on price promotions of fast food in New Zealand, making it an ideal research project. As we break down the nutritional content behind the fast food marketed today, we address the question: "What proportion of fast food price promotions that target New Zealanders are actually healthy?"

When purchasing food, what factor influences our decisions the most? Price is a key influence on how New Zealanders spend their food budget, as is convenience [1]. Our society is witnessing an increasing dominance of fast-food chains and although some fast foods may be marketed by chains as "healthy", it is unclear whether this is true and to what extent. To investigate this, we undertook a four-week cross-sectional audit of temporary price promotions offered in major New Zealand fast-food chains. Temporary price promotions were divided into price reductions (discounted items) and combination deals. As I gained a deeper insight into the nutritional quality of price-promoted fast foods and their frequency of exposure to New Zealand consumers, could I simultaneously conquer the ever-present

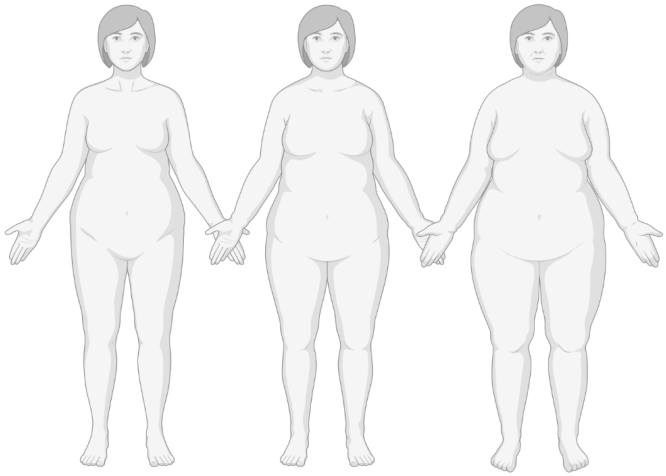


Figure 1. The stages of obesity development in a female adult. Figure produced by author using BioRender.

imposter syndrome and embrace the challenges and rewards of becoming an emerging researcher?

Fast Food and Its Repercussions

As fast-food chains have progressed, monopolised, conglomerated, and franchised over decades, the prevalence and accessibility of fast food have increased exponentially [2]. In 2020, national statistics revealed that the average New Zealander spent nearly a third of their annual food budget on restaurant and ready-to-eat meals [3].

It is widely known that most fast food contains excessive sodium, saturated fat, and energy [4]. Although adequate sodium intake is essential for multiple bodily functions, high sodium intake has health consequences, including an increased risk of elevated blood pressure and cardiovascular disease [5]. The majority of you have likely heard that fat is harmful to the body, but it is saturated fat in particular that increases certain types of cholesterol and thus the risk of cardiovascular disease [6]. Saturated fats are found in baked goods, pizza, hot chips, and foods sold at practically any convenience store or fast-food chain. Finally, we as individuals have our own unique energy needs that align with our genetics and activity levels. However, excess energy intake will upset the balance of "energy in, energy out", a simplistic theory critical to weight maintenance [7]. Prolonging a lifestyle of fast food dependence increases the risk of obesity and obesity-related illnesses, including diabetes [4]. This pattern is crucial to our current obesity epidemic as one third of the New Zealand population is classified as obese [8]. Yet, why does fast food continue to be so popular?

The Importance of Price

Will we ever be able to achieve "the perfect diet"? Numerous determinants come into play: income, access, and misinformation, to mention a few. Nonetheless, fast food purchasing decisions are primarily driven by price, with 67% of a population sample considering it "extremely or very important" for purchasing decisions [1]. However, as 2022 claims the largest annual surge in food costs in 32 years [9], fresh produce prices are at a national all-time high, and New Zealanders are finding it increasingly challenging to afford substantial whole foods. This recent sharp increase in the cost of living particularly affects those with lower incomes who may gravitate towards cheaper options including convenience and fast foods. This encompasses many university students, with two thirds of a student population sample revealing they lack sufficient finances to cover basic food, rent, and healthcare needs [10]. This

Figure 2. Takeaway pizza. Image by James Butterly from Unsplash.

leaves no doubt that price is a vital determinant of food choice for many New Zealand adults, providing a strong rationale alongside the health implications of frequent fast food consumption for this research project. So, when I investigated temporary price promotions at nine chains making up the top 51.7% of the fast food market in New Zealand, what did I find?

Temporary Price Promotions – Do They Differ in Healthiness and Affordability?

"Burgers" dominated the findings as the most price-promoted fast food group. Not only are fast food burgers highly processed with excess saturated fat, energy, and sodium, but the majority of promoted burgers were combination deals, suggesting the addition of a deep-fried side and soft drink. However, "Sandwiches & wraps" surprisingly had the highest mean energy per serving for both price reductions and combination deals. Price-promoted "Sandwiches & Wraps" also had the highest mean sodium per serving (2258 mg) compared with other groups, which in a single mean serving exceeds the daily recommended upper limit of 2000 mg [11]. This sodium overload poses a concern to unsuspecting consumers due to this group having a "fresh" or "whole food" appearance. Furthermore, almost two thirds (65.2%) of price promotions were classified as "Red" based on the Healthy Food and Drink Guidance for Schools [12], indicating they have poor nutritional value and should be consumed occasionally. A mere 7.7% were classified as "Green", the entirety of which were beverages where the healthiest (most conservative) option was chosen—water.

Interestingly, it was notable that some companies claimed unrealistically small serving sizes, e.g. a single slice of pizza as one serving. With this in mind, the data gathered may not be applicable to the real world; serving size guidelines will not always be followed and rules will be broken.

Combination deals of "Chicken" had the greatest mean change in price (original price minus promoted price) of $11.28 compared to all other promotions. This result came primarily from KFC price promotions, all classified as "Red". Concerningly, these unhealthy foods are those being heavily marketed at lower prices to society. These findings support why lower-income earners may incline towards cheaper and unhealthier foods, particularly in the current cost of living crisis.

Future Implications

These results brought a greater understanding of price-promoted fast food and their nutritional quality within New Zealand. To solidify the findings of this research project, further research would be ideal, particularly with a longer collection period to allow for the elimination of anomalies and more reliable results. This may have future implications in establishing policies for fast foods in the interest of preventing obesity and obesity-related illnesses, as well as enabling the population to access more affordable produce.

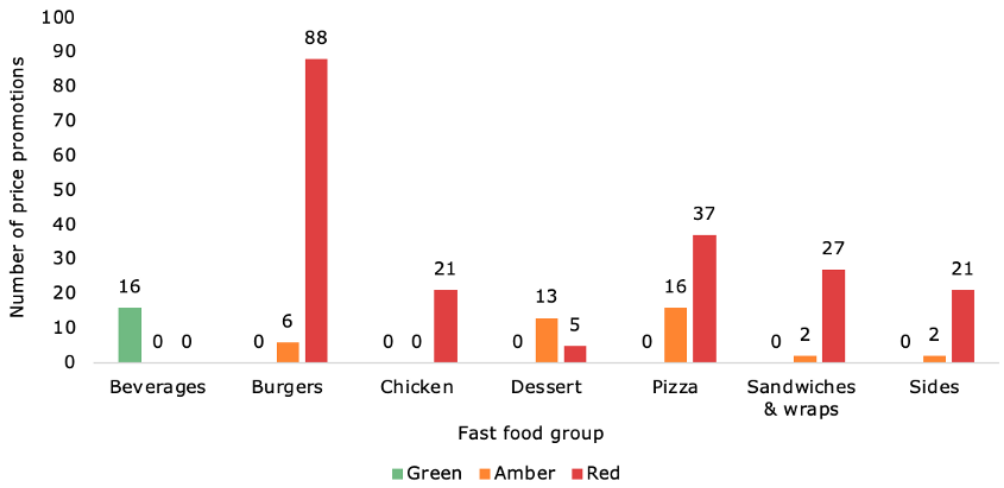


Figure 3. Number of price promotions (price reductions and combination deals) within each food group over the four weeks of data collection. Price promotions were categorised into "Green", "Amber", or "Red" based on criteria for the 2021 Healthy Drink and Food Guidance for Schools [12]. Classification of promoted items into food groups was determined based on the Nutritrack fast food categories [13].

The Footsteps of an Emerging Researcher

At the beginning of this project, I was doubtful as to whether I could measure up to the standards of a researcher; would I be able to produce quality, meaningful work that makes a valuable addition to the field of public health? Imposter syndrome was ever-present and is realistically something that many of us experience as university students. We as humans have all felt self-doubt in ourselves in various circumstances, yet we forget that success cannot be achieved without a starting point. After multiple changes in direction, scrapping of data, and additional Excel skills intertwined with a newfound appreciation for hard workers behind the scenes, it became clear that this project was my starting point in navigating the complex role of an emerging researcher in all its glory.

Acknowledgements

This research project would not have been possible without the guidance of my primary supervisor Helen Eyles and co-supervisors Stephanie Shen and Grace Shaw. The constant support and detailed feedback did not go unnoticed. A massive thank you to my team and to the University of Auckland for funding this project. Thank you to Professor Gary Sacks, who helped shape the beginnings of our protocol and lastly to my fellow summer students, who helped keep me sane throughout the entire experience!

Anita Olmstead - BSc, Nutrition

Anita is in her final semester of her BSc, majoring in Nutrition. Her ever-consistent fascination with food environments and their impact on society drew her towards the pathway of research and public health. Anita's prospects for the near future involve a role as Project Support Assistant with the National Institute for Health Innovation.

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Fun Fact

Bumblebee species are on average comparatively larger in New Zealand than in any other country.

Closing Comments

And that brings us to the end of our first edition for Volume 3. Again, we hope that you, our readers, have enjoyed this issue of UoA Scientific! Thank you once more to our guest writers, their supervisors, and to the executive team for all of your hard mahi. We are so excited to see what is to come for the remainder of 2023.

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