Exploring the association between mental health and cooking practices in Canadian young adults: a cross-sectional study

By

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Thesis Preface

Ethical Standards Disclosure

This study was conducted in accordance with the Tri-Council Policy Statement. Consent was obtained from each participant before commencing the online survey. The University of Ottawa Office of Research Ethics and Integrity approved the ethical components of the study (file number H-06-24-9935, Approval Date 21/08/2024).

Author Contributions

With the supervision of Dr. Melissa Fernandez, Tanya Tanya (the MSc Candidate) is the principal investigator of this project and was responsible for review of literature, ethics approval, data collection, designing the analysis, performing statistical analysis, creating tables and figures, interpreting the results, writing, communication of the results, and submission of the thesis. Dr. Marie-Claude Audet was a collaborator and an advisor on this project. Tanya Tanya is the first author of the thesis, Dr. Fernandez is the senior author, and Dr. Audet is the co-author.

Abstract

Home cooking has declined in recent years, with households spending less time preparing meals, cooking less frequently, and eating out more often. This shift occurred alongside an overall rise in mental health concerns. Prior research has found that limited cooking skills and greater reliance on processed foods were associated with poorer mental health in Canadians. These trends raise important questions about the relationship between mental well-being and cooking practices. To address this, the present study explored the associations between symptoms of depression and anxiety and cooking intensity (which is a product of cooking frequency and duration) among Canadian young adults. The inclusion criteria were adults aged 18 to 29 years, residing in Canada, possessing a valid postal code, and being fluent in either English or French. A web-based survey collected demographic data, information on cooking practices, dining-out practices, and mental health symptoms. The Generalised Anxiety Disorder 7-item (GAD-7) and Patient Health Questionnaire-9 (PHQ-9) assessed anxiety and depression symptoms, respectively. Ordinal logistic regression model was used to assess the association between mental health symptoms and cooking intensity, while controlling for sociodemographic and eating-out variables. The analytical sample consisted of 1,310 participants, predominantly female (70.5%), students (96.9%), non-racialised (49.7%), and high school graduates (75.4%). Most (88.2%) participants reported cooking regularly. The mean PHQ-9 score was 9.9 (SD = 6.4), classified as mild severity, with 30.5% experiencing mild symptoms and 7.1% experiencing severe symptoms. The mean GAD-7 score was 9.2 (SD = 5.7), indicating a moderate level of severity, with 28.0% experiencing minimal symptoms and 16.5% experiencing severe symptoms. Regression results were significant for PHQ-9 ($R^2 = 0.008$, $P = 0.01$) but not for GAD-7 ($R^2 = 0.005$, $P = 0.09$). Similarly, in fitted models, cooking intensity showed a weak but significant association with PHQ-9 scores ($\beta = 0.01$, $P = 0.03$), but not with GAD-7 ($\beta = 0.01$, $P = 0.06$). Depression symptoms explained only a small portion

of the variability in cooking intensity, indicating that other factors also play a role. Thus, future research should focus on exploring other psychological variables, such as self-efficacy and motivation, to better understand the influence of mental health factors on cooking practices.

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Chapter 1. Introduction

Celebrations and mourning are integral to the life course of a human being. Unique traditions and customs mark these events. Amidst the diversity of these events, a common thread among them is the act of eating (Mingay et al., 2021; Szmigin & Canning, 2015). While various social animals gather to eat together, humans stand out as the only species that cook their food (Luca et al., 2010).

However, there has been a decrease in the time allocated to domestic food preparation (Plessz & Étilé, 2019). Over the last 5 years and more, there has also been a reduction in the global frequency of cooking (Gallup and Cookpad, 2023). This decline in home cooking frequency and duration has coincided with a noticeable surge in dining-out experiences (Saksena et al., 2018). Data from the General Social Survey (Canada) reveals that 40% of participants attribute the increase in dining out to reasons such as time constraints, lack of interest in cooking, or inadequate cooking skills (Statistics Canada, 2016).

Various factors influence home cooking, which can be broadly categorised into socioeconomic and psychosocial determinants (S. Mills et al., 2017). These elements interact in complex ways to shape cooking behaviours. Consistent evidence supports the associations between home food preparation and key variables, including gender, time availability, employment, personal relationships, and cultural or ethnic background (S. Mills et al., 2017). In the psychological domain, self-assessed cooking skills have been linked to increased cooking motivation (Engler-Stringer, 2010; Jones et al., 2014). However, the association between the mental health symptoms of depression and anxiety and cooking remain largely unexplored.

There is a growing epidemic of mental issues worldwide, in a broader context (WHO, 2022b). The onset of the pandemic has exacerbated this issue, leading to a 25% increase in the

worldwide prevalence of anxiety and depression (WHO, 2022b). Several of these mental health challenges significantly influence food-related behaviours. Individuals with high anhedonic traits (reduced capacity or inability to experience pleasure; a core clinical feature of depression) report experiencing reduced pleasure from food and perceiving weaker post-ingestive sensations from healthy foods compared to those with low affective flattening (Frederiksen et al., 2025).

There has been growing interest in the interplay between nutrition and mental health, with recognition of bidirectional yet complex relationships between the two (Jeffery et al., 2009; Jolieke C. van der Pols, 2018). A study using the CCHS 2012/2013 annual components highlighted a correlation between inadequate cooking skills, reliance on processed foods, and poorer mental health outcomes (Fernandez et al., 2024). Yet the specific associations between various mental health symptoms/ disorders and time spent cooking and its frequency remain unexplored. This thesis aims to explore symptoms of anxiety and depression as psychological determinants of cooking practices and thus the association between the two in young adults in Canada.

Chapter 2. Literature review

2.1 Cooking Practices

2.1.2 Evolution of cooking

The evolution of cooking has seen pivotal milestones, from the mastery of fire control to advancements in agriculture, livestock farming, controlled fermentation, and the eventual forces of globalisation, as well as the "invention of the internet" (Vilgis, 2017). Cultural anthropologist Claude Lévi-Strauss explains cooking as the metamorphosis of food from its raw state to the cooked state, from a natural to a culturally celebrated state (Graf & Mescoli, 2020).

Around 1.8 million years ago, early humans began to harness fire, which not only promoted cooking but also was one of the significant factors in the rise of homo erectus (Carmody & Wrangham, 2009a; Richard Wrangham, 2009). Brace and colleagues (1987) highlighted the importance of cooking for human survival in harsh winters, when early humans needed to thaw frozen meat to eat (Brace et al., 1987). Cooking didn't just help with survival; it also improved the quantity and variety of food people could eat (Carmody & Wrangham, 2009; Wrangham & Conklin-Brittain, 2003; Wrangham et al., 1999). It made food softer, easier to digest, and brought people together around fires where food could be shared more regularly (Carmody & Wrangham, 2009). By reducing the time spent chewing raw and tough food (a task that primates still spend hours on), early humans had more time and energy to invent tools, start farming, and form social bonds (Richard Wrangham, 2009). Thus, anthropologist Richard Wrangham rightly argued that cooking made the human diet "human" and proposed it as the most plausible driver behind the evolutionary expansion of our brains and bodies beyond those of our ape ancestors (Richard Wrangham, 2009).

In the modern world today, the ability to prepare and cook food is an essential activity of daily living, which, from evolutionary, anthropological, and archaeological perspectives, has various social, physical, developmental, dietary and emotional benefits, such as better connections, a positive mood and higher dietary quality. (Aiello & Wheeler, 1995; Farmer & Cotter, 2021; Mechling et al., 2008; Wadley et al., 2020; Wrangham et al., 1999). Cooking interventions have been predicted to have a positive effect, such as a three-session nutrition and culinary program for older adults, which has been shown to enhance self-reported psychological well-being (Satu K Jyväkorpi et al., 2014). These benefits are partly driven by positive emotional responses that cooking elicits, activating a feedback-reward loop that encourages continued participation (Farmer & Cotter, 2021). Regular engagement in cooking behavior is associated with a 40% lower risk of death among Taiwanese elderly individuals in 10-year follow-ups compared to those who did not cook (Chen et al., 2012).

2.1.2 Perceptions of cooking

S.D.H Mills et at., in 2017, defined cooking as the actions required for preparing hot or cold foods at home, including combining, mixing and often heating ingredients. However, cultural and social perspectives on cooking vary, even within the same households, communities and countries (Wolfson, Bleich, et al., 2016a).

In the U.S., cooking is perceived in three ways: using convenience foods, scratch ingredients, or cold preparations without heat (Wolfson, Smith, et al., 2016). 'Home cooking' often excludes many convenience foods but includes time-saving ingredients like dried pasta and tinned tomatoes (S. D. H. Mills et al., 2020). Around 83% consider cooking to involve scratch/raw ingredients, though only 32% believe it should be limited to them (Wolfson, Smith, et al., 2016). Cooking from scratch is often associated with love, care, and the role of a provider (S. D. H. Mills et al., 2020). Nostalgia also shapes perceptions, as home-cooked meals from

childhood are fondly recalled, reinforcing the idea of home as a place of warmth and security (S. D. H. Mills et al., 2020). Individuals who define cooking to include convenience foods tend to have lower confidence in their culinary skills, including cooking from scratch, following a recipe, or preparing a healthy meal, compared to those who do not (Wolfson, Smith, et al., 2016). Additionally, 45% of respondents believe that cooking does not necessarily require heat, further highlighting the evolving and diverse interpretations of what constitutes cooking (Wolfson, Smith, et al., 2016). Thus, cooking is a complex concept with no single agreed-upon definition in the literature.

2.1.3 Cooking as a food skill

The Canadian Food Guide recognises cooking as a key component of food literacy and skills, emphasising its promotion as a practical way to support healthy eating (Health Canada, 2007). As a food skill, cooking is defined as "a set of physical or mechanical skills" essential for meal preparation, including cooking methods (e.g., boiling) and food preparation techniques (e.g., peeling a vegetable) (Blackford et al., 2016).

Understanding not only what humans eat for well-being but also how they approach eating offers valuable insight into the connection between cooking and overall health (Farmer & Cotter, 2021). The Theory of Planned Behaviour (TPB) is a well-established theoretical model that explains the adoption of cooking as a health behaviour (Ajzen, 1991; McEachan et al., 2011). It posits that behaviour such as cooking is driven by motivational factors, including (a) one's attitude toward cooking, (b) subjective norms related to cooking, and (c) perceived behavioral control over cooking (Ajzen, 1991; McEachan et al., 2011).

Cooking remains a valuable life skill associated with improved diet quality, including increased consumption of fruits and vegetables, as well as a greater awareness of healthier food choices (McGowan et al., 2017; Tim Lang & Martin Caraher, 2001). The Canadian Food Guide emphasises cooking as a key strategy for promoting healthier eating habits by encouraging the

use of fresh ingredients, such as fruits and vegetables, while reducing reliance on processed foods (Health Canada, 2023). A 2025 U.S. study reported that individuals from households that engaged in frequent cooking practices (≥5 times per week) consumed, on average, 48.2 grams more fruits and vegetables daily compared to those from families with less frequent cooking (<5 times per week) (Baraldi et al., 2025). More home cooking was also associated with a 1-gram increase in daily fibre intake (Baraldi et al., 2025). A 2017 UK survey of 2,000 residents ranked "learning to cook" as the fifth most crucial life skill for modern living, the highest-ranked non-tech skill, following searching the internet, operating a mobile phone, connecting to Wi-Fi, and mastering online banking (KAZ, 2017).

Thus, ability and engagement in cooking are considered essential everyday activities (Mechling et al., 2008).

2.1.3 Determinants of cooking

The cooking determinants help us understand what, when, why, who, and how of cooking and can be divided into socioeconomic, health and psychosocial determinants (S. Mills et al., 2017b).

Research on the relationship between age and frequency of home cooking has yielded inconsistent findings. A 2006 study found no consistent rate of increase or decrease in home cooking with age (Larson, Perry, et al., 2006). However, older people tend to cook more; a study examining married young-to-middle-aged Japanese women found that younger generations (those 45 years or younger) spent less time cooking than women over 45 (Saito et al., 2019). This disparity was attributed to greater time constraints among younger individuals, resulting from work and family responsibilities (Saito et al., 2019). In a study of youth aged 9–12, 34% reported never or rarely helping with family cooking, although the overall sample was somewhat involved in home food preparation (Ford et al., 2019). Similarly, a study at the University of North Carolina at Chapel Hill found that 45.7% of college students reported

cooking often, 14% reported never cooking (Soldavini & Berner, 2021). Acquiring cooking skills at a young age is associated with a greater number of cooking-related practices and higher confidence in those skills compared to adult learners (Lavelle et al., 2016). Thus, the results so far have been heterogeneous. To gain a deeper understanding of the cooking practices of young adults in Canada, the study population focused on the 18-29 years age range.

The gendered nature of cooking is another facet to consider (Oleschuk, 2019). Historically, the task of cooking has been assigned to women, eventually being associated with female gender roles, responsibilities, and identity (Nickie Charles & Marion Kerr, 1988; Wolfson et al., 2021). Cooking was described as a monotonous chore that women were expected to engage in to serve their loved ones (Nickie Charles & Marion Kerr, 1988). Gender theorists propose the concept of "doing gender" to understand the production of gender through the actions one performs and repeats in interactions with others (West and Zimmerman, 1987). The division of labour in housework and childcare produces gender roles, where "femaleness" is associated with performing housework and "maleness" with eschewing it (Berk, 1985; Mandel et al., 2020; Treas & Tai, 2012). When men are involved in household tasks, they tend to focus on "masculine" responsibilities, such as maintaining the home, yard, and automobiles. At the same time, women undertake the more time-intensive and routine "feminine" housework, including cooking and cleaning (Treas, 2008). An extensive study, encompassing a sample size of over one hundred thousand individuals, revealed that globally, women are consistently more involved in cooking lunch and dinner than men (Wolfson et al., 2021). In France, a cross-sectional analysis of 62,373 adults from the NutriNet-Santé cohort revealed gender differences in daily meal preparation time, with women averaging 42 minutes per day and men 27.9 minutes (Méjean et al., 2017). However, the extent of this disparity varies significantly across and within different regions of the world (Wolfson et al., 2021). Across most countries, men reported that they cook lunch very infrequently, with Chinese men leading

the way with the highest frequency (4 times/week) (Wolfson et al., 2021). Gallup and Cookpad conducted a global study to track how often people around the world cook (Gallup and Cookpad, 2023), highlighting that, on average, meals cooked by men globally were prepared four times a week. In contrast, it is 8.7 for women (Gallup and Cookpad, 2023), resulting in a cooking gender disparity of 4.7 (Gallup and Cookpad, 2023). However, there are notable variations among different nations, with this gap being wider in some countries than others (Gallup and Cookpad, 2023). For instance, in Ethiopia and Tajikistan, women prepare an average of 8.6 and 8.2 more meals per week than men, almost double the global average (Gallup and Cookpad, 2023). Conversely, in countries with a minimal gender gap, such as Spain and the United Kingdom, women still cook more meals than men, albeit slightly (Gallup and Cookpad, 2023). Identical findings were reported in a 2022 cross-sectional study in the US, where more than 80% of women stated that they took most of the household responsibility for planning/ preparing meals, and only 38.73% to 43.20% of men participated in meal preparation (Storz et al., 2022). Among opposite-gender couples, there can be a tendency towards gendered labor division with more of the foodwork being undertaken by women (Bianchi et al., 2000; Klünder and Meier-Grawe, 2017). But when the other partner works longer, both male and female partners take a higher portion of food-related work (Liu et al., 2022). Research on same-sex households showed that, compared to heterosexual couples, household labour is more equally shared, especially among lesbian couples, because of more liberal attitudes toward gender roles (Goldberg et al., 2012; Smart et al., 2017). Working parents' gendered strategies often result in women doing “the second shift” of housework and childcare (Hochschild, 1989). A 2022 study highlights that over 80% of women aged 25 and above not only take responsibility for preparing meals but also for food-related shopping and planning for their families, indicating that women continue to bear the majority of shopping and cooking responsibilities (Storz et al., 2022).

Previous studies have shown that having dependents is a key determinant of cooking frequency. Compared to those cooking less frequently (0–6 times/week), individuals who cooked daily were more likely to have children under 18 in the household (Saito et al., 2019). A 2014 review of studies further suggests that households with dependents tend to have more frequent family meals, which are linked to healthier dietary intake among children and adolescents (Fulkerson et al., 2014). A 2021 study revealed that 6.6% of college students with dependents reported cooking frequently, in stark contrast to only 0.6% of students with dependents who never cooked (Soldavini & Berner, 2021). Frequent home-cooked dinners are more common in larger households, particularly those with children under 12 years old. Participants from these households tended to belong to the highest cooking frequency group (Tiwari et al., 2017). Another study found that families with dependents cooked, on average, 5.2 dinners per week, compared to 4.6 dinners in households without dependents (Virudachalam et al., 2014). These findings highlight that individuals with dependents are more likely to engage in frequent cooking.

While household income did not show a significant direct relationship with cooking frequency in some studies (Saito et al., 2019), other research indicates that a higher socioeconomic status is associated with a greater likelihood of eating home-cooked meals at least once a week. Specifically, higher educational attainment and greater household income were linked to increased home cooking (S. Mills et al., 2018). Low-income households may face difficulty dedicating the time required to prepare nutritious and budget-friendly meals (Lisa Mancino & Constance Newman, 2007; Rose, 2007).

Ethnicity and culture also play a significant role in shaping cooking behaviors, however, the results are heterogeneous. Cultural influences on food choices are well-documented (Sealy, 2010), with immigrants (Virudachalam et al., 2014) and Asian Americans

(Larson, Story, et al., 2006) in the U.S. engaging in home cooking more frequently than other Americans. A study analysing data from the National Health and Nutrition Examination Survey (NHANES) 2007–2010 further found that Non-Hispanic Blacks reported lower home cooking frequency compared to other racial/ethnic groups (Farmer et al., 2019; Wolfson & Bleich, 2015). White ethnicity was associated with lower odds of consuming takeout more than twice per week, though no significant differences were observed for other meal types (S. Mills et al., 2018).

Personal relationships significantly influence cooking behaviours within the broader context of social dynamics. The community kitchen is an example of a structured environment where small groups gather regularly to prepare meals together (Iacovou et al., 2013). These spaces foster not only the development of practical cooking skills but also serve as vital hubs for emotional and social support (Iacovou et al., 2013). Furthermore, evidence suggests that marital status is a strong predictor of home meal preparation, with married individuals being more likely to cook at home (Blake et al., 2011; S. Mills et al., 2017). Women, particularly as wives, girlfriends, and mothers, often take responsibility to provide homemade meals for their households (Engler-Stringer, 2010). Intergenerational interactions and family communication dynamics profoundly shape how children select, prepare, and consume food (Kaplan et al., 2006). Specifically, parental modelling has a notable impact; individuals who observe their parents cooking during childhood are more likely to engage in home food preparation themselves (Jones et al., 2014b; Leech et al., 2014). Living arrangements refer to how individuals organise their household and the people they live with. In a sample of Greek university students, living away from home was associated with notable dietary changes (Papadaki et al., 2007).

2.1.4 Reduction in cooking frequency and duration

In the UK, home-cooked food represented more than half of the food budget in 1980, but less than a third in 2000 (Griffith et al., 2022). Correspondingly, the time spent eating at home decreased by 9 minutes over five years, and Spain experienced a more pronounced drop of 21 minutes during the same period (Díaz-Méndez & García-Espejo, 2014). Shifts in the amount of time spent eating at home have been linked to broader lifestyle changes, evolving patterns of time use, and the labour market participation of secondary earners (Griffith et al., 2022).

In France, there was a 15-minute daily decline in household cooking time, while in the USA, this decline was about 20 minutes (Plessz & Étilé, 2019). Between 1965–1966 and 2007–2008, all income groups experienced a 36-minute reduction in time spent cooking, with low-income groups also showing a significant decline in cooking prevalence, from 67% to 56% (Smith et al., 2013). On weekdays in Brazil, adults spent an average of 108–112 minutes per day preparing dinner. Of these, 24.2% dedicated up to an hour, 54.1% spent one to two hours, and 21.7% spent more than two hours cooking at home (Martins et al., 2024). Another aspect of cooking behaviour is the number of times people cook at home in a day, i.e. the frequency of cooking. From 2007 to 2010, 8% of American adults aged 20 years or older lived in a household where dinner was cooked only 0-1 time per week, and 44% lived in a household where dinner was cooked 2-5 times/week (Wolfson & Bleich, 2015). Globally, the average number of meals cooked at home reduced from 6.9 in 2019 to 6.4 in 2022 (Gallup and Cookpad, 2023). Despite a minor decline, Latin America and the Caribbean continue to be among the regions with the highest cooking frequency (Gallup and Cookpad, 2023).

In 2000, females spent 8.3 hours a week on food management as the main activity, while the male average (including zeros) is 3.3 hours. In 1974–75, the average time spent by

females on food management was higher at 13.3 hours (compared to 8.3 hours in 2000) (Griffith et al., 2022). These trends are also observed in the USA. Bianchi et al. (2000) document a 12.5 hours per week reduction in female housework hours between 1965 and 1995. Approximately two-thirds of the overall reduction in housework is attributed to cooking meals and meal cleanup (8.5 hours) (Griffith et al., 2022). This decrease is specifically associated with women's employment, resulting in 3.6 fewer minutes daily for grocery shopping and 17 fewer minutes cooking (Griffith et al., 2022). Other examples in which the reduction in activity time associated with employment is greater for those interviewed on weekdays than weekends include: cooking (20 versus 9 fewer minutes) (Cawley & Liu, 2012). In 1975 and 2006, the time spent on food preparation by American women declined substantially, whereas the time spent on these activities by American men remained relatively unchanged (Zick & Stevens, 2010). On average, respondents spent about 48 min on meal preparation activities and had slightly more than one meal preparation activity between 3:00 p.m. and 9:00 p.m. (Widener et al., 2021).

The impact of individual food-related time uses shows that knowledge of cooking and eating patterns affects the BMI of overweight individuals. Increases in cooking time are associated with a decrease in BMI (Kolodinsky & Goldstein, 2011). Higher cooking frequency helps in levelling up fruits and vegetable intake, for instance, people from households that cooked frequently (five or more times per week) consumed an average of 48.2 grams more fruits and vegetables per day compared to those from families that cooked less often (fewer than five times per week) (Baraldi et al., 2025). On the contrary, allocating less than an hour daily to food preparation has been linked to more frequent consumption of fast food, increased reliance on packaged and convenience foods such as frozen pizzas, and lower vegetable intake (Chu et al., 2012; Monsivais et al., 2014; Smith et al., 2013).

2.1.5 What is contributing to the upward trend in these eating-out practices?

Changes in food consumption patterns, such as the decrease in home cooking and increase in fast food consumption, are attributed to the feeling of not having enough time (Jabs & Devine, 2006; Widener et al., 2021; Kegler et al., 2023). Research indicates that the time allocated to meal preparation has a positive correlation with the perception of having limited disposable time available (Larson, Perry, et al., 2006; Widener et al., 2021). In the United States, 36% of young adults reported a lack of time as a major barrier to cooking (Larson et al., 2006). This reduction in time allocated to food preparation and consumption can be attributed to the myriad roles adults undertake in today's fast-paced society (Escoto et al., 2012; Jurado-Gonzalez et al., 2024). Individuals often turn to ready-made meals and fast-food options to optimise time management and alleviate the perception of time scarcity (Djupegot et al., 2017; Escoto et al., 2012). This preference towards pre-made meals presents a lucrative opportunity for the food industry to profit by offering inexpensive and convenient foods (Celnik et al., 2012). These quick meals cater to perceived time constraints by requiring minimal preparation (Celnik et al., 2012; Jabs & Devine, 2006). The experience of time scarcity has numerous downstream consequences, including adverse effects on mental and physical well-being (Rudd, 2019; Widener et al., 2021). Concerning mental health, heightened feelings of time shortage are associated with increased levels of depression, stress, emotional exhaustion, fatigue, rushing, negative mood, and decreased subjective well-being, including lower levels of happiness, life satisfaction, job satisfaction, and mindfulness (Rudd, 2019). Other barriers include a lack of adequate meal planning skills, no cooking skills, insufficient time to cook, and a lack of cooking utensils or a suitable place to cook, as well as limited knowledge of food terms, such as ingredient names and preparation terms in recipes (Asp, 1999; Jurado-Gonzalez et al., 2024).

2.1.6 Evolving food environment: Eating out practices

In recent decades, there has been an increase in the utilisation of out-of-home foods, such as fast food and highly processed foods (Smith et al., 2013). The Canadian food environment is characterised by a significant presence of fast food and other restaurant types, including full-service restaurants and cafés (Andrew C. Stevenson et al., 2022; Moghimi & Wiktorowicz, 2019). Over 27.1% of adults in the UK frequently use full-service or fast-food establishments on a weekly basis (Adams et al., 2015). In 2019, an average Canadian household spent over one-quarter (26.9%) of its food budget on meals and snacks purchased from restaurants (Statistics Canada, 2023b). In 2021, 55% of US households' food spending went toward meals outside the home, generating over $799 billion in revenue for the restaurant and food service industry (National Restaurant Association, 2025). Eating out is a widely enjoyed practice across populations; in 2018, half of American adults reported eating out three or more times per week (Saksena et al., 2018), and a few years later, 9 in 10 adults reported enjoying dining at restaurants (National Restaurant Association, 2025). In South Korea, 60% of adults eat out at least once per week (Kwon & Ju, 2014). Within the Canadian context, data from the 2019 Canadian Health Survey on Children and Youth reveal that children and adolescents in Canada ate meals outside the home an average of 2.2 times per week (Jane Y. Polsky & Didier Garriguet, 2023). Older youth demonstrate higher eating-out frequencies, with over 40% of adolescents aged 12 to 17 eating out at least twice in the previous week. One-third of children aged 6 to 11 and one-quarter of those aged 1 to 5 reported the same behavior (Jane Y. Polsky & Didier Garriguet, 2023). The frequency of eating out varies by sex, with males (27.7%) between the ages of 19 and 54 years leading the consumption (Jane Y. Polsky & Didier Garriguet, 2021). Furthermore, the rising sales in Canada's food service and drinking establishments underscore the growing prevalence of eating out as a routine practice (Statistics

Canada, 2022a). Despite a significant decline during the initial wave of the pandemic, sales have been on the upswing since then (Statistics Canada, 2022a).

2.1.7 Evolving food environment: Online food delivery

An alternative means of dining outside the home, a relatively recent phenomenon, involves using food delivery applications (Kabir Ahuja et al., 2021). Online food delivery apps are a critical part of the 'digital food environment' (Bennett et al., 2024). Since the onset of pandemic induced lockdowns in March 2020, the food delivery industry has witnessed remarkable growth, especially in well-established markets, with Canada emerging as a leader in this trend (Kabir Ahuja et al., 2021). The use of these platforms is substantial, making them a $26.8 billion industry that encompasses digital ordering services such as Grubhub, DoorDash, and Uber Eats, accessible through mobile phones, the internet, and text messaging (Stephens et al., 2020). Globally, DoorDash (an online food delivery platform) has more than 20 million monthly users and generated US$9.9 billion gross for the first quarter of 2021 (Backlinko Team, 2025). A recent market research report on the Australian Uber Eats online platform found that fast food delivery services doubled their customer base in the 18 months from mid-2018, with 19% of Australians now reporting that they have previously used the service (Roy Morgan, 2020).

These apps have become a significant component of the food industry, alongside traditional restaurants and fast-food businesses, often targeting young adults through social media advertisements of nutrient-poor food items (Lee et al., 2019). Among a sample of young adults in the United States, the average frequency of app usage is twice per week, with a positive association between this usage and sociodemographic factors such as being non-Hispanic Black or Hispanic/Latinx, experiencing food insecurity, living alone, being financially responsible, being a full-time college student, or being an older young adult

(Buettner et al., 2023). A 2024 systematic review encompassing 22 studies from Australia, the United Kingdom, Canada, the United States, Malaysia, Saudi Arabia, China, New Zealand, and Singapore examined patterns in the use of online food delivery services (Bennett et al., 2024). The review underscores how these platforms have significantly increased consumer access to energy-dense, yet nutrient-poor foods. Notably, with these apps, the concept of the 'neighbourhood food environment' has expanded beyond the traditional 1-kilometre radius surrounding a consumer's residence (Bennett et al., 2024). Approximately 90% of food deliveries originate from outside this immediate vicinity (Partridge et al., 2020), effectively broadening the geographic influence of food outlets.

Consequently, eating out or ordering takeout has become a persistent and defining feature of contemporary dietary behaviour (Jane Y. Polsky & Didier Garriguet, 2021).

2.1.8 Quality of food eaten away from home

Many people who regularly eat at fast food restaurants are often unaware of the nutritional content of what they consume, which can vary significantly depending on the restaurant and type of food (White et al., 2016). A comprehensive analysis of 57 studies encompassing over 400,000 participants highlights predominantly negative nutritional impacts of dining out (Gesteiro et al., 2022). Meals consumed away from home tend to be energy-dense, high in saturated fats, protein, cholesterol, sodium, and sugar-sweetened beverages, while lacking essential nutrients such as vitamin C, niacin, calcium, fibre, monounsaturated fats, potassium, fruits, and vegetables (Gesteiro et al., 2022). Furthermore, increased frequency of dining out correlates with elevated risks of metabolic syndrome and other health issues (Gesteiro et al., 2022). Eating away from home on a previous day meant fewer mean servings of whole fruit (about one-quarter serving less), dark green and orange vegetables, other vegetables (excluding potatoes), whole grains, legumes, nuts and seeds, milk and fortified soy-

based beverages on that day (Jane Y. Polsky & Didier Garriguet, 2021). Notably, men demonstrate a higher propensity to dine out, both in restaurant settings and at workplaces, than women (Escoto et al., 2012).

Food delivery apps offer unparalleled convenience, potentially leading individuals to make less health-conscious decisions and fostering dependency on high-calorie and less nutritious options (Willie et al., 2024). Studies analysing the nutritional quality of menus offered by online food delivery apps reveal that most menu items are energy-dense, high in sugar and fat, and low in overall nutritional value (Brar & Minaker, 2021; Jindarattanaporn et al., 2023). 41.7% of young adults in Singapore reported frequent use of food delivery apps, with 22.3% using them at least twice weekly (Tham et al., 2023). These apps have also made alcohol more accessible than ever (Duthie et al., 2023).

A food swamp refers to an environment where unhealthy food choices significantly outnumber healthy ones, making it easier for individuals to opt for poor nutritional options (Donald Rose et al., 2009). As discussed in sections 1.6 and 1.7, online food delivery apps and eating out restaurants increase the availability, accessibility and convenience of calorie-dense, low-nutrient meals, thereby contributing to the creation of food swamps.

2.2 Mental Health

2.2.1 The mental health epidemic

Mental health is best understood as a continuum in the Mental Health Continuum Model (MHCM)**,** ranging from optimal well-being to severe psychological distress (National Defence, 2023). This perspective acknowledges that emotional and psychological challenges are part of the human experience and vary in their intensity over time (National Defence, 2023). Rather than viewing mental illness as categorically distinct from normal behaviour, the continuum

model highlights that mental health concerns differ in degree (CAMH, 2025; Peter et al., 2021). At the severe end of this continuum lie clinical illnesses and disorders that necessitate intensive medical intervention (National Defence, 2023), and these cases are becoming increasingly prevalent.

It is estimated that one in four individuals globally is grappling with a mental health disorder (Dévora Kestel, 2022). Recent data up to 2022 reveal that over 5 million Canadians, representing 18% of those aged 15 and older, met the diagnostic criteria for mood, anxiety, or substance use disorders in the preceding 12 months (Statistics Canada, 2022b). The challenges of depression and anxiety result in an estimated loss of 12 billion working days annually, costing approximately US$1 trillion in productivity each year globally (WHO, 2022a). In 2019, mental disorders accounted for approximately 418 million disability-adjusted life years (DALYs), constituting over 16% of global DALYs, a more than three-fold increase compared to conventional estimates in America (Arias et al., 2022). At a regional level, these losses range from 4% of gross domestic product in Eastern sub-Saharan Africa to 8% in High-income North America (Arias et al., 2022). The five conditions with the highest burden include major depression, bipolar affective disorder, alcohol use disorders, social phobia, and schizophrenia in Ontario, Canada (Ratnasingham et al., 2013). Some countries are experiencing a treatment gap as high as 90% for mental health challenges (Dévora Kestel, 2022). In Swiss young adults in 2020, only 38% with symptoms indicating anxiety, depression, or ADHD had ever accessed treatment (Werlen et al., 2020). This gap may point to a shortage of mental health services; however, it could also reflect limited demand, potentially driven by stigma, poor awareness, and access barriers such as travel costs and service availability (Roberts et al., 2022)

Epidemiological research consistently shows that approximately 75% of all mental disorders begin before the age of 25 (Kessler et al., 2005; Solmi et al., 2022). The heightened

vulnerability is associated with critical developmental changes in neural and cognitive systems during adolescence and early adulthood, particularly in the regulation of fear and stress, executive functioning, social cognition, and reward processing (Uhlhaas et al., 2023). Among these, anxiety disorders frequently appear in early childhood, peak during mid-adolescence (around age 15) (Solmi et al., 2022), and often persist into adulthood, where they can severely impact daily functioning and quality of life (Essau et al., 2014). Thus, in 2005, Insel and Fenton aptly described mental disorders as the chronic diseases of youth (Insel & Fenton, 2005). For both depression and anxiety, the prevalence rates are highest in the age group of 20-24 years (Bie et al., 2024; Yang et al., 2024)

2.2.2 The burden of depression

Depression is a mood disorder characterised by a low mood or loss of pleasure or interest in activities for extended periods (World Health Organisation (WHO), 2023). Other behavioural alterations may include changes in appetite, sleep, psychomotor agitation, negative evaluation of events, feelings of helplessness, thoughts of death, reduced energy, and concentration (Belay et al., 2021; Henn et al., 2004).

Major Depressive Disorder (MDD) ranked third in terms of disease burden in 2018, according to the WHO, with projections indicating that it will ascend to the top spot by 2030 (WHO, 2011). In 2022, 9.3% of Canadian women experienced depression within the past 12 months. In comparison, the prevalence among Canadian men was 5.7% (Statistics Canada, 2024), highlighting the gendered nature of the disorder. In the US, among young adults aged between 18 and 23 years, the prevalence of depression increased from 4.13% to 6.88% over the span of 5 years from 2017 to 2021 (Xiang et al., 2024).

There is a multidimensional etiology of depression, including genetic, biological, psychosocial and environmental factors (Bains & Abdijadid, 2025). The three

neurotransmitters serotonin, dopamine, and noradrenaline affect brain areas linked to motivation, emotions, thinking, and stress in people with depression (Cui et al., 2024). A 2025 study reported 700 variations in the genetic code of individuals linked to the development of depression (Adams et al., 2025), which is associated with higher familial risk for major depression and several clinical/psychosocial vulnerabilities for depression (van Sprang et al., 2022). The presence of physical ailments is also a risk factor for depression; for example, the presence of head and neck cancer is related to an increased risk for depressive disorder (Fan et al., 2018). Negative self-concept, sensitivity to rejection, neuroticism, rumination, reduced positive thoughts, sociodemographic factors, and social support are among the psychosocial factors associated with depression (Bains & Abdijadid, 2025). Environmental stressors related to depression include acute life events, chronic stress, and childhood exposure to adversity (Bains & Abdijadid, 2025).

2.2.3 The burden of anxiety

Anxiety disorders are characterised by persistent and excessive fear and worry, often accompanied by a range of physical, cognitive, and behavioral symptoms (WHO, 2023). Individuals with these disorders commonly struggle to control their worries and may exhibit symptoms such as restlessness, fatigue, irritability, and heightened vigilance (Munir & Takov, 2025). These manifestations frequently occur in anticipation of situations perceived as threatening, reflecting an overactivation of preparatory responses to perceived future harm (Chand & Marwaha, 2025).

Based on the Global Burden of Disease (GBD) 2021 data from 204 countries, a 2024 study showcased that from 1990 to 2021, the global incidence of anxiety disorders among those aged 10-24 years increased by 52% (Bie et al., 2024). 5.2% of Canadians were diagnosed with Generalised Anxiety Disorder in 2022, which was only 2.6% in 2012 (Statistics Canada, 2024).

Females have consistently shown higher rates of anxiety across all age groups, with Canadian women (6.8%) struggling with it more than men (3.6%) (Statistics Canada, 2024). The incidence and prevalence rates in the US were highest among young adults aged 18 to 23 (Xiang et al., 2024).

Low self-esteem, family history of depression, female sex, race, years of education, and disturbed family environment increase the risk of anxiety disorders (Blanco et al., 2014) At the chemical level, dysregulation in neurotransmitters such as serotonin, gamma-aminobutyric acid (GABA), and norepinephrine has been implicated in anxiety disorders (Martin et al., 2009). Exposure to trauma, abuse, or neglect during childhood predisposes an individual to developing anxiety disorders later in life (Green et al., 2010).

2.2.4 Interplay between nutrition and mental health

Poor diet quality is associated with many mental health challenges (Marx et al., 2017), mostly with depression (Li et al., 2017). A systematic review published in 2022, involving 385,541 participants, highlighted the higher odds (odds ratio: 1.53) of depressive symptoms associated with greater consumption of ultra-processed foods, which undergo significant industrial processing resulting in a final product that bears little resemblance to the raw ingredients (Lane et al., 2022). On the other hand, epidemiological studies have indicated that adherence to healthy or mediterranean dietary patterns are characterized by high consumption of fruits, vegetables, nuts, and legumes; moderate intake of poultry, eggs, and dairy products; and occasional consumption of red meat- is linked to a reduced risk of depression (Firth et al., 2020; Lassale et al., 2019).

Conversely, mood also plays a significant role in dietary choices and eating styles, with individuals often adjusting their food intake in response to their emotional state (Kennedy, 2008; Pecoraro et al., 2004). Loneliness has been linked to disordered and emotional eating

patterns (Cortés-García et al., 2022). A 2023 scoping review further highlights the association between loneliness or social isolation and multiple food-related behaviors that are typically detrimental to health. These include lower consumption of fruits and vegetables, increased intake of energy-dense, nutrient-poor foods, and a decline in overall diet quality (Hanna et al., 2023). Elevated anxiety symptoms have been linked to greater consumption of fat, insufficient intake of tryptophan and dietary protein, increased intake of sugar and refined carbohydrates, and generally poor dietary patterns (Aucoin et al., 2021). Depression is related to more unhealthy eating styles (Paans et al., 2018). Feelings of sadness or happiness can lead to alterations in dietary preferences, such as seeking out "comfort foods" during periods of low mood or experiencing appetite changes due to depression (Kennedy, 2008; Pecoraro et al., 2004). Moreover, barriers to maintaining a healthy diet exacerbate the relationship between nutrition and chronic mental illness, which encompasses financial and environmental factors, and the appetite-inducing effects of psychiatric medications (Firth et al., 2019).

2.2.5 Mental health and everyday activities

Negative affect is a defining feature of anxiety disorders (Amstadter, 2008), distinguishing them from depression, which is clinically characterised by reduced positive affect (Werner-Seidler et al., 2013). The impact of these conditions on daily life is profound, as both anxiety and depression contribute to significant functional impairments (Gunnarsson et al., 2023). Individuals with severe depression symptoms face a 3.2-fold higher likelihood of experiencing a subsequent decline in higher-level activities of daily living than in older adults (Kazama et al., 2011; Penninx et al., 1999).

Various domains of daily functioning that may be disrupted by depression symptomology for over 90% of the individuals can include work performance, social interactions, self-care, household responsibilities, recreational activities, and academic

performance. Self-care tasks such as grooming, hygiene, and nutrition often become neglected due to a lack of motivation, energy, or interest, while household responsibilities such as cleaning, cooking, and organising may feel overwhelming, leading to a disorganised living environment (Hirschfeld et al., 2002; Iliou et al., 2024a; Kennedy et al., 2007; Kessler et al., 2003). Symptoms of anxiety also independently contribute to social restrictions and impairments in activities of daily life, depending on the severity of symptoms (Norton et al., 2012). Daily chores with significant cognitive demands, such as cooking, shopping, driving, and caregiving, report the highest rates of negative affect, with individuals experiencing high anxiety finding even routine personal care tasks like dressing, eating, and bathing overwhelming (Hebert, 2024). Thus, ultimately, both anxiety and depression lead to disruptions in daily functioning and a marked reduction in engagement in everyday activities (Hebert, 2024; Iliou et al., 2024b).

Chapter 3. Rationale, Objectives and Hypothesis

3.1 Rationale

The previous chapter highlighted the evidence of the decreasing frequency and duration of cooking and the growing burden of depression and anxiety. The following gaps were identified while conducting the literature review:

Firstly, while there is some data on eating-out behaviours (Statistics Canada, 2019b, 2019a), there is less information available on cooking practices. Cooking is a vital food skill that supports healthy eating, as recommended by Health Canada (Government of Canada, 2022). Thus, having information on current cooking behaviours will help characterise the behaviour in Canadian young adults.

Secondly, the determinants of home cooking are more complex than simply possessing cooking skills. They include gender, time availability, and employment, which have already been studied (S. Mills et al., 2017b). However, there is little research on specific mental health factors such as depression and anxiety. The current study will help characterise whether symptoms of anxiety and depression are among the psychological determinants of cooking.

Thirdly, cooking and symptoms of depression and anxiety are more prevalent in women than men (Discussed in sections 2.1.3, 2.2.2 and 2.2.3). However, the influence of gender on the association between mental health and cooking practices remains unexplored. Understanding whether and how this association differs by gender will be crucial for developing targeted interventions and public health strategies that consider psychological and behavioural factors.

To address these gaps, this study aims to describe the cooking practices among young adults in Canada, including their psychological determinants (symptoms of anxiety and depression) and the role of gender in shaping this association.

3.2 Objectives

The research objectives of the study were to:

1. Describe the cooking practices of frequency, duration, eating out and food delivery in young Canadian adults (Describe in section 4.3)
2. Examine whether symptoms of anxiety and depression are associated with cooking intensity (Described in section 4.3.2.1)
3. Explore gender differences in associations between symptoms of depression and anxiety that are associated with cooking intensity (Described in section 4.3.2.1)

3.3 Hypothesis

The study hypothesised that there would be positive associations between 1) symptoms of depression and cooking intensity and 2) symptoms of anxiety and cooking intensity (objective 2).

Chapter 4. Methodology

4.1 Study Design

The study employed a web-based, descriptive, exploratory cross-sectional research design. This design was chosen to describe cooking practices and analyse associations in variables at a single point in time.

4.2 Participants and Sampling

Young adults aged 18 to 29 were selected as the study population for several reasons. This stage of life is marked by pivotal transitions which, if not handled adeptly, may precipitate mental health difficulties (Rasalingam et al., 2023). These transitions include establishing independence, navigating romantic relationships, managing friendships and familial dynamics, balancing educational pursuits with part-time employment, and exploring personal values and identity, among other factors (Halfon et al., 2018). Furthermore, in 2022, depression and anxiety were most prevalent within this age cohort (Statistics Canada, 2023). Additionally, cooking skills in this age group tend to be lower, and the usage of food delivery apps is higher (da Costa Pelonha et al., 2023; Saleh et al., 2024). The convergence of these factors made the young adult population suitable for this study.

A convenient non-probability sampling approach was employed to reach eligible participants and efficiently meet the required sample size. A sample size calculation was not possible given the lack of information about the distribution of the primary outcome variable and the exploratory nature of this study. The team estimated that at least 200 complete and valid responses would be needed to meet the primary research objective. Given the lab's available resources and project timeline, this estimate would be feasible. Based on previous experience with participant attrition and response quality (Fernandez et al., 2024), the initial

recruitment target was set at a minimum of 400 participants. This number accounted for the likelihood of incomplete, ineligible, or withdrawn responses.

4.2.1 Eligibility questions and consent

The inclusion criteria were adults aged 18 to 29, residing in Canada, possessing a valid postal code, and being fluent in either English or French. Exclusion criteria were individuals with invalid email or postal codes and those lacking proficiency in English or French. The interested participants were asked the following eligibility questions at the beginning of the survey: 1) Are you at least 18 years old? 2) Are you less than 30 years old? 3) Do you currently live in Canada? 4) Do you have a valid email address? 5) Is this your first time completing the survey for the Mental Health and Cooking Practices Study?. If participants were not eligible, the survey ended for them, and they could no longer access the survey. Eligible participants were provided with detailed information about the study and were required to review and provide informed consent before proceeding. All participants could withdraw from the study at any time.

This study received ethics approval from the University of Ottawa's Research Ethics Board (H-06-24-9935).

4.2.2 Recruitment

Data collection spanned from October 2024 to January 2025. The participants were asked to complete an online survey, which could take up to 25 minutes. The data collection took place online via Qualtrics (Qualtrics, 2025). Since it was an online survey, participants could access the survey link at their convenience to complete it. Participants were recruited via four pathways:

1) The INSPIRE laboratory, in collaboration with the University of Ottawa, operates a research participation program called the Integrated System of Participation in

Research (ISPR) Student Pool, designed for students enrolled in introductory courses that examine human behaviour and cognition (University of Ottawa, 2025c). The participants accessed the link via their ISPR (student pool) account.

2) ISPR Community Pool allowed the team to recruit a more diverse participant pool for this research. It helped invite young adults from diverse backgrounds to participate in research (University of Ottawa, 2025b). The participants accessed the study through the ISPR Community Pool platform.
3) Social media advertising: Paid and unpaid Meta (Facebook and Instagram) and TikTok ads were posted on the 'Digital Food Environments' social media accounts. From the ads, participants were directed to the 'Digital Food Environments' website (Digital Food Environments, 2025) to access the consent form and the survey link. These ads helped us reach participants throughout Canada, expanding the reach beyond Ottawa.
4) Posters: The University of Ottawa's 'Advertising on Campus'(University of Ottawa, 2025a) services were utilised to put up 15 posters about the study on bulletin boards in 6 university buildings. This strategy made the study accessible to students from various faculties, with a greater proportion of male participants.

4.2.3 Incentives

Participants recruited via the ISPR student pool were awarded 0.5 credits after completing the survey. All other participants were entered into a contest to win one of six $50 Amazon gift cards, contingent upon completing the survey 100%. Due to the nature of the study (web-based study with no face-to-face interaction), there was a high risk of fraudulent and malicious entries. Therefore, only participants who completed the survey were eligible to enter the draw.

4.3 Tools for Data Collection

The web-based survey was available in both English and French. It consisted of three parts.

1) Section 1 gathered participant demographics. These included questions about sex, gender, living situation, ethnicity, income, marital status, education level, immigration, money to afford food, and others described in the table below (Table 1).

Table 1. Sociodemographic questions included in section 1 of the survey

Question	Categories
1.What year were you born?	Open text box
2.What was your sex assigned at birth?	Male; Female; Prefer not to say
3.What gender(s) do you identify with?	Man; Women; Agender; Bigender/ Multigender; Gender fluid; Genderqueer; Nonbinary; Transgender; Two-spirit; Another option not mentioned above; Prefer not to disclose
4.What is your marital status?	Married; Common law partner; Bachelor; Separated (not living common law); Divorced (not living common law); Widowed (not living common law); Prefer not to disclose
5.What is your highest level of education?	No certificate; diploma or degree; High (secondary) school diploma or equivalency certificate' Apprenticeship or trades certificate or diploma; College; CEGEP or other non-university certificate or diploma; University certificate or diploma below bachelor level; Bachelor's degree; University certificate or diploma above bachelor level; Master's degree; Earned doctorate; Other option not mentioned above (Please specify)
6. Are you currently a student?	Yes, full time; Yes, part time; No
7. What are the first three characters of your postal code?	Open text box
8. What is your employment status?	Full-time work; Part-time work; Self-employed; Unemployed (temporary layoff, searching for work; or not searching for work); Other (Please specify)
9. How many dependents do you have?	None; 1; 2; 3 or more
10. Which statement best describes your current living situation?	I live with roommates; I live alone; I live in university housing; I live with my parents; Other (Please specify)
11. For the year ending December 31, 2023, can you estimate which of the following groups your total personal income falls into (before taxes)?	Less than $10,000; $10,000 to $19,999; $20,000 to $29,999; $30,000 to $39,999; $40,000 to $49,999; $50,000 to $59,999; $60,000 to $69,999; $70,000 to $79,999; $80,000 to $89,999; $90,000 to $99,999; $100,000 and over; Prefer not to disclose
12. Are you having difficulty making ends meet?	Yes; No
13. In the past month, was there any day when you or anyone in your household	Yes; No

went hungry because you did not have enough money for food?	
14. Do you identify as a person belonging to a racialised group (e.g., Black, Indigenous, or a person of color)?	No; Black; Indigenous; Other racialized group (please specify); Multiple racialized groups (please specify); Prefer not to say
15. What is your current citizenship or immigration status?	Canadian citizen; Permanent Resident; Temporary Resident (e.g., work permit, student visa); Refugee; Other (Please specify)
16. Where did you hear about the survey?	TikTok; Facebook; Instagram; INSPR; A letter in the mail; WhatsApp; Other (Please specify)

2) Section 2 focused on the frequency and duration of home cooking and dining-out habits, the questions for which were adapted from the Home Cooking Frequency Questionnaire (HCFQ) (Goni et al., 2022). It comprised questions regarding home cooking, the percentage of home-cooked food, eating-out habits, cooking frequency, cooking time, and other related aspects. The usage of food delivery apps was also captured in this section. All questions adopted a multiple-choice format, facilitating the capture of diverse cooking practices. Two questions about cooking frequency and duration were of particular interest for this study (Table 2).

Table 2. Cooking practices questions included in section 2 of the survey (Goni et al., 2022)

Question	**Category**
1.a In the past 2 weeks, did you purchase prepared meals using mobile food delivery apps (for example: Uber, Skip, etc) or restaurant websites?	Yes; No
1.b In the past 2 weeks, how many times did you purchase prepared meals using food delivery apps or restaurant websites?	Open text box
2. Do you cook at home?	Yes; No
3. How many days a week do you usually cook (Number of days per week):	None; 1; 2; 3; 4; 5; 6; 7
4. How many hours do you spend on average each time you cook? (Number of hours):	None; Less than 1 hrs;1-2 hrs; 2-3 hrs; 3-4 hrs; 4-5 hrs; More than 5 hrs
5. Over the past week, how often eat in a restaurant or cafeteria for lunch?	None; 1; 2; 3; 4; 5; 6; 7
6. Over the past week, how often eat in a restaurant or cafeteria for dinner?	None; 1; 2; 3; 4; 5; 6; 7
7. Over the past week, how often do you buy takeout from a restaurant or a supermarket?	None; 1; 2; 3; 4; 5; 6; 7

3) Section 3 focused on two aspects of mental health: the Generalized Anxiety Disorder 7 (GAD-7) scale (Spitzer et al., 2006) and the Patient Health Questionnaire 9 (PHQ-9) (Kroenke et al., 2001) for evaluating anxiety and depression symptoms. Both surveys addressed the questions listed in Table 3 and provided answer options of 'Not at all,' 'Several days,' 'More than half the days,' and 'Nearly every day.'

Table 3. PHQ-9 and GAD-7 questions included in section 3 of the survey

Patient Health Questionnaire 9 (PHQ-9) (Kroenke et al., 2001)
Over the last 2 weeks, how often have you been bothered by any of the following problems?
1. Little interest or pleasure in doing things
2. Feeling down, depressed, or hopeless
3. Trouble falling or staying asleep, or sleeping too much
4. Feeling tired or having little energy
5. Poor appetite or overeating
6. Feeling bad about yourself – or that you are a failure or have let yourself or your family down
7. Trouble concentrating on things, such as reading the newspaper or watching television
8. Moving or speaking so slowly that other people could have noticed? Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual
9. Thoughts that you would be better off dead or of hurting yourself in some way
Generalized Anxiety Disorder 7 (GAD-7) (Spitzer et al., 2006)
Over the last 2 weeks, how often have you been bothered by any of the following problems?
1.Feeling nervous, anxious, or on edge
2. Not being able to stop or control worrying
3. Worrying too much about different things
4. Trouble relaxing
5. Being so restless that it's hard to sit still
6. Becoming easily annoyed or irritable
7. Feeling afraid as if something awful might happen

Some data validation questions were included throughout the survey to ensure the quality of the data collected. They were: 1) What year were you born? 2) What are the first three characters of your postal code? 3) Where did you hear about the survey? 4) How old are you? 5) What province do you live in?

4.3.1 Measures

4.3.1.1 Dependent variables

The variable of 'duration' included the categories of "no time," "<1 hour," "1–2 hours," "2–3 hours," "3–4 hours," "4–5 hours," and ">5 hours," and were coded ascendingly on a scale from 0 to 6. Frequency was already on a scale of 0-7. Initially, cooking frequency and cooking

duration were examined independently; however, analysing these variables separately did not capture the full scope of cooking practices. Thus, to address this, a composite variable named ‘Cooking Intensity’ was created by multiplying cooking frequency (0–7 days/week) with a coded version of cooking duration. This new variable generated an ordinal score ranging from 0 to 42. Certain numerical combinations were not possible (e.g., 11, 13, 19), resulting in 24 distinct response values. Furthermore, cooking intensity was categorised into four levels based on percentiles to create a categorical variable, facilitating the presentation of descriptive statistics: None (score = 0), Low intensity (1st to 33rd percentile), Medium intensity (34th to 66th percentile), and High intensity (67th to 100th percentile).

4.3.1.2 Independent variables

The independent variables were symptoms of depression and anxiety. Anxiety levels were assessed utilising the Generalised Anxiety Disorder 7 (GAD-7) scale (Spitzer et al., 2006), a user-friendly, self–report instrument comprising seven items. GAD-7 serves as a tool for identifying probable cases of Generalised Anxiety Disorder (GAD). By interpreting participants' responses, the scale delineated their position on a continuum of anxiety severity, ranging from mild to severe manifestations. The GAD-7's brevity and simplicity made it suitable for implementation in the purpose of the study. The depression symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9) (Kroenke et al., 2001), an instrument known for its efficacy in screening, evaluating, and monitoring depression symptoms. By gauging the total score of depressive symptoms, the PHQ-9 generates a 5-point severity index ranging from no symptoms to severe symptoms. The GAD-7 and PHQ-9 have been widely adopted in Canada, particularly in clinical settings. Thus, there were total ordinal scores and categorical severity for both anxiety and depression symptoms.

4.3.1.3 Covariates

The covariates for the study were selected based on prior literature mentioned in Section 2.1.3. These variables were evaluated individually and then collectively in regression models to build an initial fitted model. Non-significant variables were subsequently removed to arrive at the final fitted model.

Gender identity was defined as person's internal sense of being a woman, man, both, neither or somewhere along the gender spectrum (Canadian Institutes of Health Research, 2022) and was categorized into agender, bigender/multigender, gender fluid, genderqueer, man, nonbinary, transgender, two-spirit, woman, another option not mentioned above and prefer not to disclose. Analyses demonstrated no significant differences in cooking intensity when considering participants' biological sex or gender identity. Therefore, the final results were based only on an analysis of biological sex (male and female).

The question about marital status had the following options: married, living common-law, bachelor, separated (not living common-law), divorced (not living common-law), widowed (not living common-law), and prefer not to disclose (Statistics Canada, 2016). For analysis, 'married' and 'common-law partner' were merged into a single 'coupled' category, reflecting equivalent legal recognition. The category of 'other' was created to include individuals who were divorced, separated, widowed, or preferred not to disclose, as well as those in other categories (Table 4).

Educational attainment options included: No certificate, diploma or degree, high (secondary) school diploma or equivalency certificate, apprenticeship or trades certificate or diploma, college, CEGEP or other non-university certificate or diploma, university certificate or diploma below bachelor level, bachelor's degree, university certificate or diploma above bachelor level, master's degree, earned doctorate and other option not mentioned above (Statistics Canada, 2025) (Table 4). The 'university degree' category was created to include

bachelor's, master's, and doctoral degrees. 'College/diploma' category was created by merging college/CEGEP, university certificates below/above bachelor level, and trades/apprenticeships.

Yearly household income options were less than $10,000, $10,000 to $19,999, $20,000 to $29,999, $30,000 to $39,999, $40,000 to $49,999, $50,000 to $59,999, $60,000 to $69,999 to $70,000 to $79,999, $80,000 to $89,999, $90,000 to $99,999, $100,000 and over and prefer not to disclose (Statistics Canada, 2023a). For analysis, all income categories above $30,000 were consolidated into a single, broader category labelled "$30,000 and above" (Table 4).

Living situation options were: living alone, living with roommates, living in university housing, living with parent(s), and other (Table 4). 'Other' included answers such as cohabitation with friends, partners, siblings, extended family, or other shared living arrangements, and was therefore combined with 'I live with roommates'.

Participants were asked whether they identified as belonging to a racialised group. The answer options were: no, black, indigenous, other racialised group, multiple racialised groups, and prefer not to say. Two groups, 'racialised' and 'non-racialised', were created for analysis. The 'racialised' group combined black, indigenous, other racialised, and multiracial identities.

The participants were also asked whether they had any dependents to look after. The answer options ranged from none, 1, 2, 3 or more. However, for data analysis, categories 1, 2, and 3 or more were combined to form the '1 or more' category. Since the category of '1 or more' had 17 participants only (Table 4), it wasn't included in the final models.

The immigration status options were Canadian citizen, permanent resident, refugee, temporary resident, and others. 'Permanent resident', 'refugee', and 'other' immigration statuses were grouped into 'other' for analysis (Table 4).

Data was gathered using the following questions to understand the frequency of food delivery apps in the population: 1) Over the last 2 weeks, did you buy prepared meals using

food delivery apps, or restaurants' websites? (Yes/ No) and 2) Over the last 2 weeks, how many times did you use food delivery apps or websites in a week? (Table 5).

The 'Eating out' variable was created by summing responses to two items: frequency of eating out for lunch and dinner. Each item was rated on a scale from 0 to 7 days per week, resulting in a combined score ranging from 0 to 14 (Table 5).

Participants answered two questions: on the number of fruit servings and the number of vegetables consumed daily. Each was scored on a 0–10+ scale. These were combined into a single variable ranging from 0 to 10 or more servings per day (Table 5).

4.4 Data analysis

Data were analysed using Python version 3.12.4, packaged by Anaconda, Inc. Statistical significance was set at $p < 0.05$, ensuring robust comparisons across different variables.

4.4.1. Data preprocessing

The backend of Qualtrics was monitored daily to check for unusual activities as part of a quality check. A CAPTCHA verification was presented just before Section 1 of the survey to confirm that the respondent was human and to prevent any automated activity. Quality assurance questions were integrated throughout the survey to cross-validate the participants' responses and check for potential inattentive responses.

To make the data usable for the objectives of this study, multiple stages of filtering were applied to an initial sample of 1,847 participants. The preprocessing process began with eligibility and consent screening, during which participants were assessed for eligibility and provided informed consent, resulting in a sample of 1,749 participants. A duration check was

employed to filter responses based on survey completion time. Participants whose completion time fell below the 2.5th quintile of the total time distribution were excluded to eliminate rapid responders. This quality control measure resulted in a sample size of 1,656 participants. Survey source validation was conducted to verify the origin of responses (e.g., the platform used). Responses originating from unverifiable sources, such as LinkedIn, email, and WhatsApp, were excluded, resulting in a reduced sample size of 1,605 participants. Age screening was applied to ensure that only participants within the required age criteria remained, resulting in a dataset of 1,555 individuals (Quality assurance measure). A postal code verification step was then conducted, in which the first three digits of each participant's postal code were cross-checked against the province in which they reported living. This quality assurance measure validated the postal code–province match, resulting in 1,475 participants. Critical question completion ensured that only those who answered essential survey questions (pertaining to both dependent and independent variables) were retained, resulting in a dataset of 1,475 participants. Next, duplicate entries were identified using emails and ISPR IDs and removed, resulting in 1,339 responses. Finally, entries with missing sociodemographic data were excluded to prepare the dataset for final analysis, resulting in a refined dataset of 1,310 unique participants.

This systematic filtering process, based on consent, duplication removal, response duration, source validation, age verification, geographic data, and survey completeness, ensured data integrity and improved the quality of the final sample used for analysis.

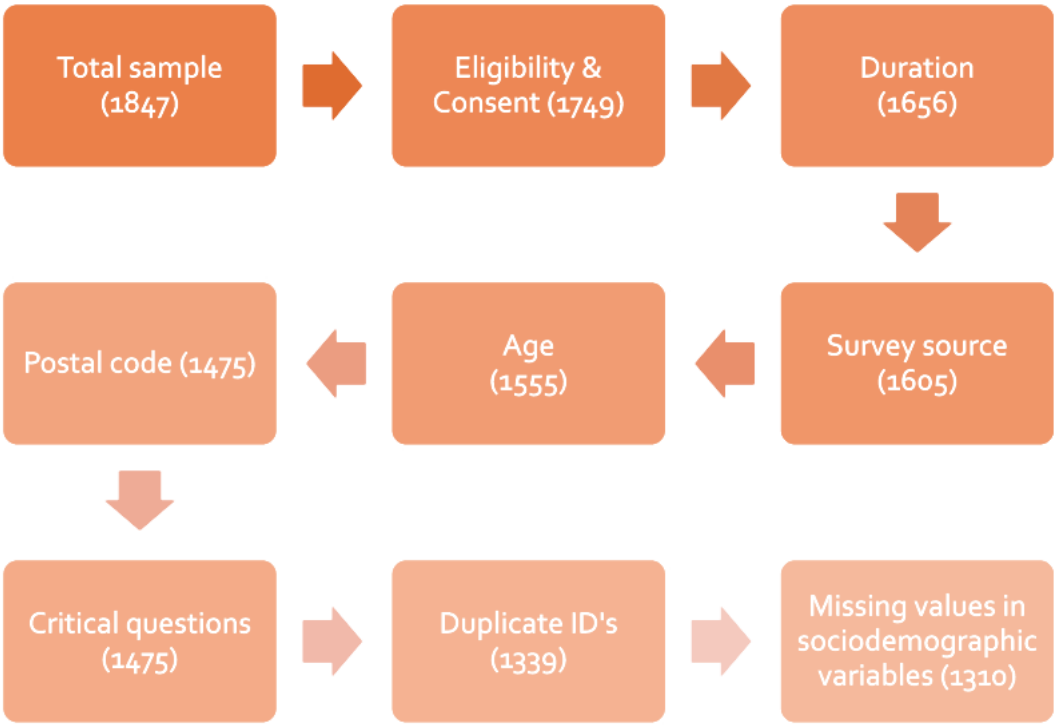


Figure 1. Preprocessing steps for data cleaning for analysis

4.4.2 Summary statistics

Discrete variables were summarised using means and standard deviations, while categorical variables were presented as frequencies and percentages. Participants' characteristics were compared across categories using Pearson's chi-square tests for categorical variables to compare sociodemographic characteristics between various levels of food intensity. Kruskal-Wallis was used to compare groups for ordinal variables.

4.4.3 Final variable type

Various combinations of the different formats of the dependent and independent variables were explored to optimise the statistical analysis. The best model fit was achieved when depressive and anxiety symptoms were used in their original raw form, as the sum of scores (Discrete, Ordinal). Cooking intensity was represented as a discrete (ordinal) variable, calculated as the product of cooking frequency and duration.

Non-parametric tests were used to analyse the data, as they do not rely on distributional assumptions (Liang et al., 2020). This approach was appropriate given the skewness observed in the dataset, as indicated by Q-Q plots.

4.4.4 Statistical analysis

Although the Wilcoxon test was considered suitable for group comparisons (F Wilcoxon, 1945), its limitation to binary independent variables reduced its applicability in this study. The ordinal logistic regression model (Liang et al., 2020), also known as the proportional odds model, was selected for analysis. This model is an advanced alternative to the Wilcoxon-Mann-Whitney test (Nahm, 2016), offering greater flexibility by allowing ordinal dependent and independent variables of any type (continuous or discrete).

The two key assumptions of the ordinal logistic model were met: (1) the dependent variable was ordinal, and (2) the independent variables were either continuous or discrete (UCLA, 2021). The statistical approach and interpretation of results were reviewed and validated in consultation with a statistician at the Ottawa Hospital Research Institute (OHRI).

4.4.5 Data visualisation

Bar charts were used to effectively illustrate percentage distributions across categories, providing a clear visual representation and comparisons among grouped data (He et al., 2017).

The scatter plot is a commonly used assessment for identifying patterns in a bivariate association (Kahng et al., 1998). Jittering was used in the scatterplot for better visualisation.

Heatmaps were employed to enable rapid visual comparison across multiple categories. Using colour gradients to represent values, heatmaps made it easier to identify patterns, trends, and areas of concentration without relying solely on numerical data tables.

Chapter 5. Results

A total of 1,847 participants were recruited for the study. After the data preprocessing steps (as described in Section 4.4.1), the analytical sample consisted of 1,310 participants, representing a completion rate of 70.9%. Of the participants, 90.8% were recruited from the ISPR student pool, with a small percentage coming from social media platforms (Instagram, Facebook, and TikTok) (6.6%), the ISPR community pool (1.8%), and posters at the University of Ottawa (0.8%).

English was preferred by 87.4% as the language to answer the survey. Ontario had the most significant representation in the province, with 83.5% of participants, followed by Quebec with 14.5%. The representation from other provinces was Alberta (0.8%), British Columbia (0.9%), New Brunswick (0.07%), and Saskatchewan (0.15%).

5.1 Characteristics of study participants

The characteristics of the sample, categorised by cooking intensity, are presented in Table 4. The sample was predominantly composed of individuals assigned female at birth (70.5%). However, 27 participants did not self-identify their gender as women. Seven males also didn't identify as the same sex as their assigned sex. A majority of the participants were Canadian citizens (79.6%), single (64.1%), identified as bachelor, non-racialised (49.7%), and living with their parents (44.5%). The majority (96.9%) of the participants were currently full-time/part-time students, and 75.4% had a high school degree/ diploma as their highest level of education.

Table 4 also identifies differences in sociodemographic characteristics between categories of cooking intensity. Significant differences were observed across cooking intensity categories for the variables of age ($p<0.05$), immigration ($p< 0.05$), income ($p< 0.05$), living situation ($p< 0.05$), difficulty making ends meet ($p< 0.05$), ethnicity ($p<0.05$) and employment ($p<0.05$). No statistically significant differences were found for the variables of sex ($p = 0.24$),

highest education (p = 0.15), and student status (p = 0.15) across the cooking intensity categories.

Table 4. Characteristics of the analytical sample by cooking intensity group (n=1310)

Variable	None	Low	Moderate	High	Total	P-value
Age (x̄/ SD) years*	19.4 (2.4)	19.6 (1.9)	20.2 (2.4)	20.2 (2.4)	19.9 (2.3)	0.01
Sex[1]						0.24
Female	87 (6.6)	317 (24.2)	252 (19.2)	268 (20.5)	924	
Male	26 (2)	136 (10.4)	120 (9.2)	104 (7.9)	386	
Marital Status[2]						NA
Bachelor	69 (5.3)	289 (22.1)	250 (19.1)	233 (17.8)	841	
Coupled	4 (0.3)	18 (1.4)	24 (1.8)	27 (2.1)	73	
Other	40 (3.1)	146 (11.1)	98 (7.5)	112 (8.5)	396	
Ethnicity[3]						0.01
Non Racialised	55 (4.2)	226 (17.3)	192 (14.7)	179 (13.7)	652	
Racialised	45 (3.4)	197 (15)	169 (12.9)	178 (13.6)	589	
Prefer not to say	13 (1)	30 (2.3)	11 (0.8)	15 (1.1)	69	
Immigration[4]						0.01
Canadian citizen	96 (7.3)	388 (29.6)	296 (22.6)	263 (20.1)	1043	
Temporary	8 (0.6)	41 (3.1)	57 (4.4)	72 (5.5)	178	
Other	9 (0.7)	24 (1.8)	19 (1.5)	37 (2.8)	89	
Highest Education [5]						0.15
High School	89 (6.9)	352 (27.3)	283 (21.9)	265 (20.5)	989	
College/ Diploma	11 (0.9)	58 (4.5)	39 (3)	48 (3.7)	156	
University degree	10 (0.8)	38 (2.9)	46 (3.6)	52 (4)	146	
Student Status						0.15
Yes	108 (8.2)	444 (33.9)	356 (27.2)	362 (27.6)	1270	
No	5 (0.4)	9 (0.7)	16 (1.2)	10 (0.8)	40	
Dependents						NA
0	112 (8.5)	451 (34.4)	370 (28.2)	360 (27.5)	1293	
1 or more	1 (0.1)	2 (0.2)	2 (0.2)	12 (0.9)	17	
Employment Status[6]						0.01
Employed	54 (4.1)	256 (19.5)	202 (15.4)	196 (15)	708	
Not employed	59 (4.5)	197 (15)	170 (13)	176 (13.4)	602	
Income[7]						0.01
Less than $10,000	20 (1.5)	63 (4.8)	34 (2.6)	63 (4.8)	180	
$10,000 to $19,999	64 (4.9)	220 (16.8)	176 (13.4)	164 (12.5)	624	
$20,000 to $29,999	13 (1)	107 (8.2)	87 (6.6)	87 (6.6)	294	
$30,000 and more	8 (0.6)	24 (1.8)	35 (2.7)	20 (1.5)	87	
Prefer not to disclose	7 (0.5)	39 (3)	40 (3.1)	38 (2.9)	124	
Living Situation[8]						0.01
I live with my parents	108 (8.2)	285 (21.8)	135 (10.3)	56 (4.3)	584	

I live with roommates	187 (14.3)	93 (7.1)	167 (12.7)	10 (0.8)	457	
I live in university housing	35 (2.7)	55 (4.2)	33 (2.5)	41 (3.1)	164	
I live alone	42 (3.2)	20 (1.5)	37 (2.8)	6 (0.5)	105	
Difficulty meeting ends						0.01
No	92 (7)	355 (27.1)	283 (21.6)	263 (20.1)	993	
Yes	21 (1.6)	98 (7.5)	89 (6.8)	109 (8.3)	317	
Not having enough money for food						NA
No	110 (8.4)	423 (32.3)	334 (25.5)	329 (25.1)	1196	
Yes	3 (0.2)	30 (2.3)	38 (2.9)	43 (3.3)	114	

*For the variable of age, the reported numbers are means and standard deviations. Chi-square tests were used to assess group independence for categorical variables, while the Kruskal-Wallis test was used for ordinal variables. Statistical significance was set at $p < 0.05$; 1. The response 'prefer not to disclose' was excluded due to small sample size ($n < 5$); 2. 'Married' and 'common-law partner' were merged into a single 'coupled' category, reflecting equivalent legal recognition. 'Other' included divorced, separated, widowed, prefer not to disclose, and other; 3.The 'racialised' group combined black, indigenous, other racialised, and multiracial identities; 4.'Permanent resident', 'refugee', and 'other' immigration statuses were grouped into 'other'; 5. 'University degree' includes bachelor's, master's, and doctoral degrees. 'College/diploma' includes college/CEGEP, university certificates below/above bachelor level, and trades/apprenticeships. 'No certificate' was excluded ($n < 5$); 6. 'Employed' includes full-time, part-time, and self-employed participants; 7. Income categories of $30,000 and above were merged for analysis; 8. 'Other' had answers such as cohabitation with friends, partners, siblings, extended family, or other shared living arrangements and thus, was combined with 'I live with roommates'.

5.2. Objective 1: Describing cooking practices in young adults in Canada

As shown in Table 4, 88.2% of participants reported cooking weekly, with a mean cooking frequency of 3.2 times per week (SD = 2.0). Females (62.4%) cook more than males (25.8%). Most participants spent 1–2 hours cooking weekly (37.0%), while 6.0% reported not spending any time on cooking.

Cooking intensity was a product of cooking duration and frequency, indicating the occurrence and time spent on cooking in a week. The average intensity was 6.4 (SD = 5.1). It was distributed across low (34.6%), moderate (28.4%), and high (28.4%) cooking intensity groups, with 8.6% reporting no cooking (Table 5).

Participants ate out for lunch and dinner an average of 1.9 times (SD = 2.0) and 1.8 times (SD = 1.9) per week, respectively. Over half (55.4%) used online food delivery, with an average frequency of 3.1 times per week (SD = 2.8) (Table 5).

Table 5. Description of the cooking practices of young Canadian adults (n=1310).

Variable	N (%) / $\bar{x}$ (SD)
Cooks weekly	
Yes	1155 (88.2%)
Women	720 (62.4%)
Men	435 (25.8%)
No	155 (11.8%)
Mean cooking frequency (times per week)	3.2 (SD=2.0)
Cooking duration (Each episode)	
No Hours	79 (6.0%)
Less than 1 hr	425 (32.4%)
1-2 hrs	486 (37.1%)
2-3 hrs	190 (14.5%)
3-4 hrs	65 (4.9%)
4-5 hrs	45 (3.4%)
More than 5 hrs	20 (1.5%)
Cooking intensity (Product of frequency and duration)	
None	113 (8.6%)
Low	453 (34.6%)
Moderate	372 (28.4%)
High	372 (28.4%)
Ate lunch out (times per week)	1.9 (SD= 2.0)
Ate dinner out (times per week)	1.8 (SD= 1.9)
Fruits and vegetables (servings per day)	2.2 (SD= 1.3)
Online food delivery usage	
Yes	726 (55.4%)
No	584 **(**44.6%)
Online food delivery frequency (times per week)	3.1 (SD=2.8)

Categorical variables were described with frequencies and percentages. Continuous variables were described with mean and standard deviation. Cooking Intensity was categorised into four levels based on percentiles to create a categorical variable to facilitate presenting descriptive statistics: None (score = 0), low intensity (1st to 33rd percentile), moderate intensity (34th to 66th percentile) and high intensity (67th to 100th percentile).

5.3. Objective 2: Examining the association between mental health symptoms of depression and anxiety and cooking intensity

5.3.1 Mental health characteristics of the sample

The average PHQ-9 score among participants was 9.9 (SD = 6.4), indicating overall mild to moderate depressive symptoms in the sample (Kroenke et al., 2001). Of the participants, 30.5% (n= 400) reported no symptoms of depression, and 7.1% met the threshold for severe depression symptoms (n= 94) (Fig. 2).

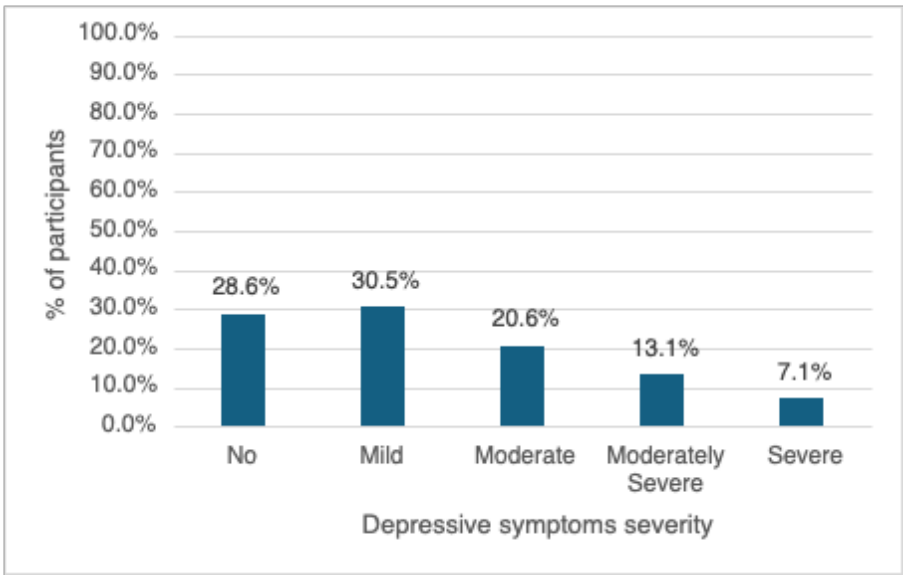


Figure 2. Distribution of depression symptom severity based on PHQ-9 scores among Canadian young adults (n = 1310).

On average, participants had mild to moderate anxiety symptoms (Spitzer et al., 2006), with a mean GAD-7 score of 9.2 (SD=5.7). Of the participants, 28.0% (n= 367) reported minimal anxiety symptoms, and 16.5% met the threshold for severe anxiety symptoms (n= 216) (Fig. 3).

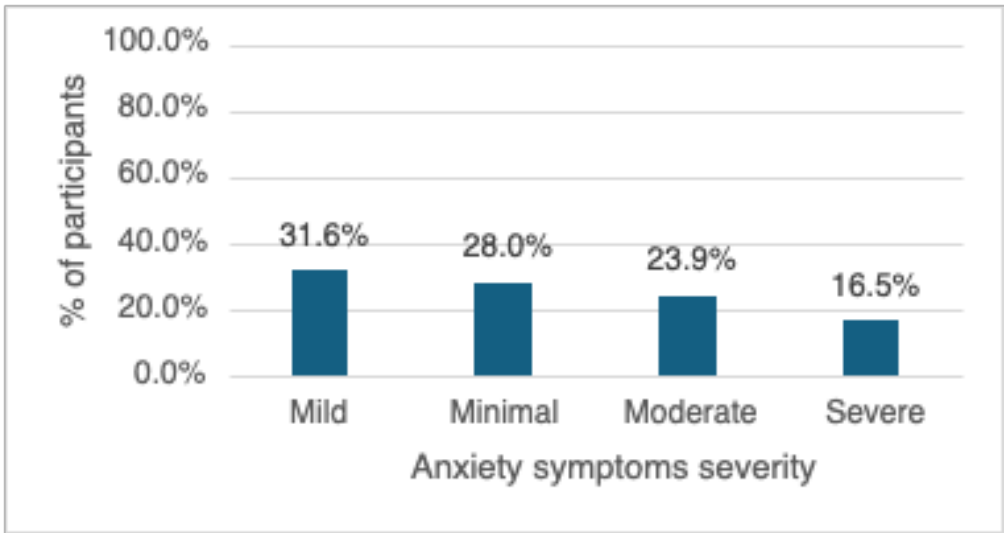


Figure 3. Distribution of anxiety symptom severity based on GAD-7 scores among young Canadian adults (n =1310).

5.3.2 Cooking intensity across severity levels of depression and anxiety

Figure 4 illustrates the distribution of cooking intensity across depression severity levels based on PHQ-9, where darker shades represent higher proportions of participants. No patterns were observed. The highest concentration of participants who did not cook (i.e., no intensity) was in the mild depression symptoms group, but only represented 2.9% of participants. The highest concentration of participants who reported high intensity cooking was in the no symptoms group, representing only 8.2% of participants.

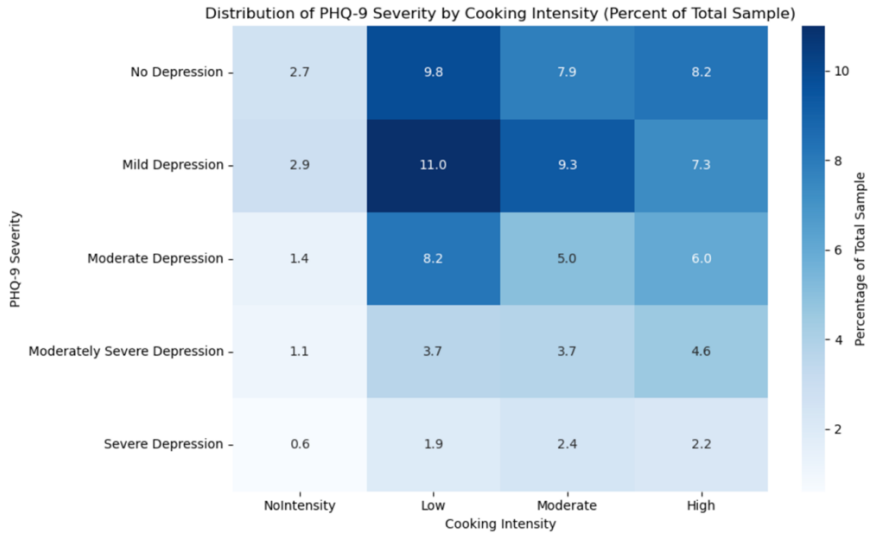


Figure 4. Distribution of depression severity by cooking intensity based on PHQ-9 (Patient Health Questionnaire) scores (n =1310) (Kroenke et al., 2001)**.**

Figure 5 illustrates the distribution of cooking intensity across anxiety severity levels, as measured by the GAD-7. No patterns were observed. The highest concentration of participants who did not cook (i.e., no intensity) was in the minimal anxiety group, representing only 2.8% of participants. The highest concentration of participants who reported high intensity cooking was also in the mild anxiety group, representing 8.8% of participants.

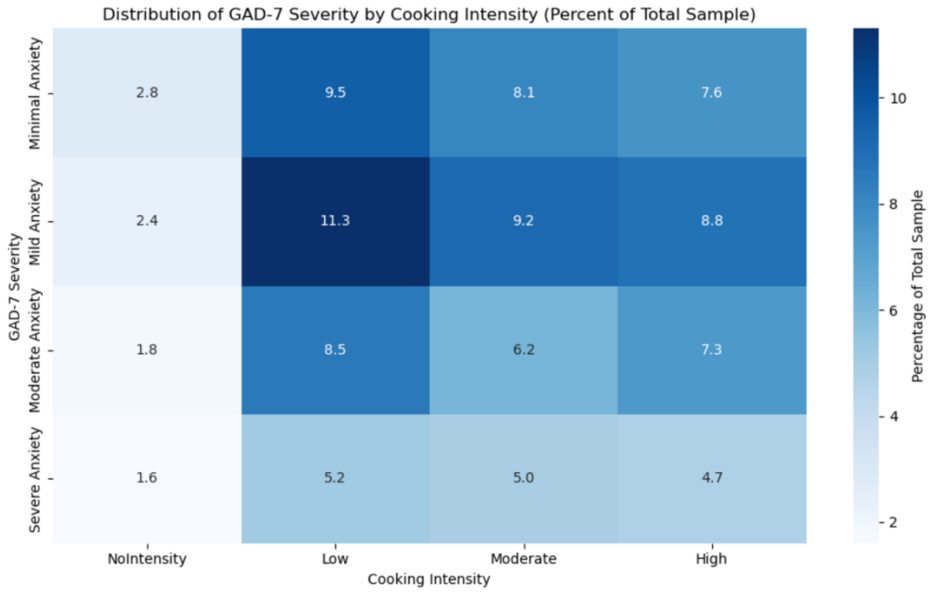
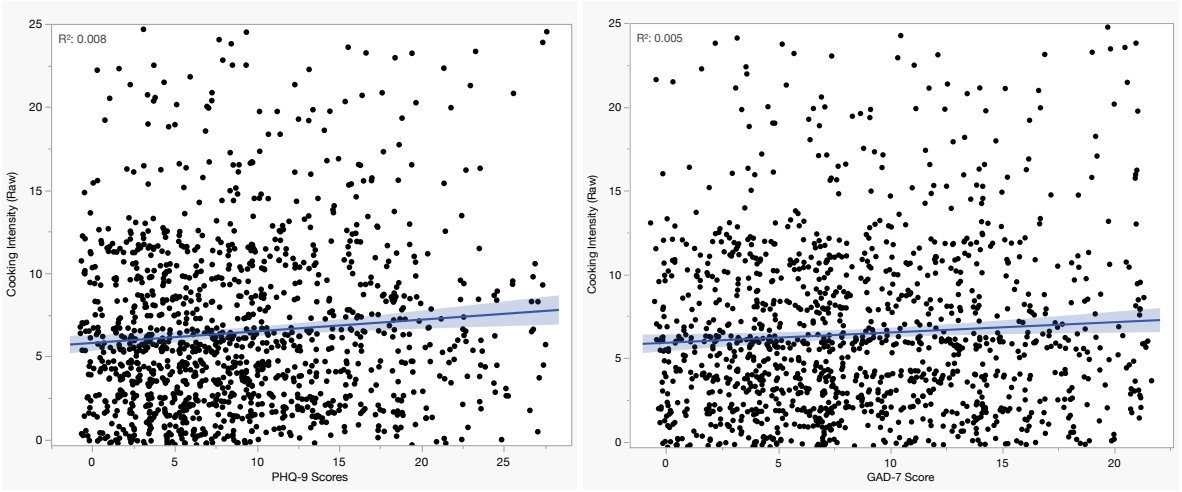


Figure 5. Distribution of Anxiety Severity by Cooking Intensity Based on GAD-7 (Generalised Anxiety Disorder) scores (n =1310) (Spitzer et al., 2006)**.**

5.3.3. Ordinal logistic regression analysis

Regression results representing the association between the dependent and independent variables were significant for PHQ-9 (R^2 = 0.008, P = 0.01) but not for GAD-7 (R^2 = 0.005, P = 0.09) (Table 6).



(A) **(B)**

Figure 6. Jitter plots depicting the association between cooking intensity and mental health symptoms (n = 1310).

(A) shows the distribution of cooking intensity in association with PHQ-9 (Patient Health Questionnaire) scores, and (B) shows cooking intensity in association with GAD-7 (Generalised Anxiety Disorder) scores (Kroenke et al., 2001; Spitzer et al., 2006)**.**

In fitted models, cooking intensity also showed a weak but significant association with PHQ-9 scores (β = 0.01, P = 0.03), but not with GAD-7 scores (β = 0.01, P = 0.06). Directly associated (positive) covariates were fruits and vegetable intake and not having enough money for food. Eating out, online food delivery, and living situation were significantly and inversely associated (negative) with cooking intensity ($p<0.05$). Specifically, among the different living situations, residing with parents and living in university housing were both significantly and inversely associated with cooking intensity ($p < 0.05$). Model fit improved after adjustment (Table 6).

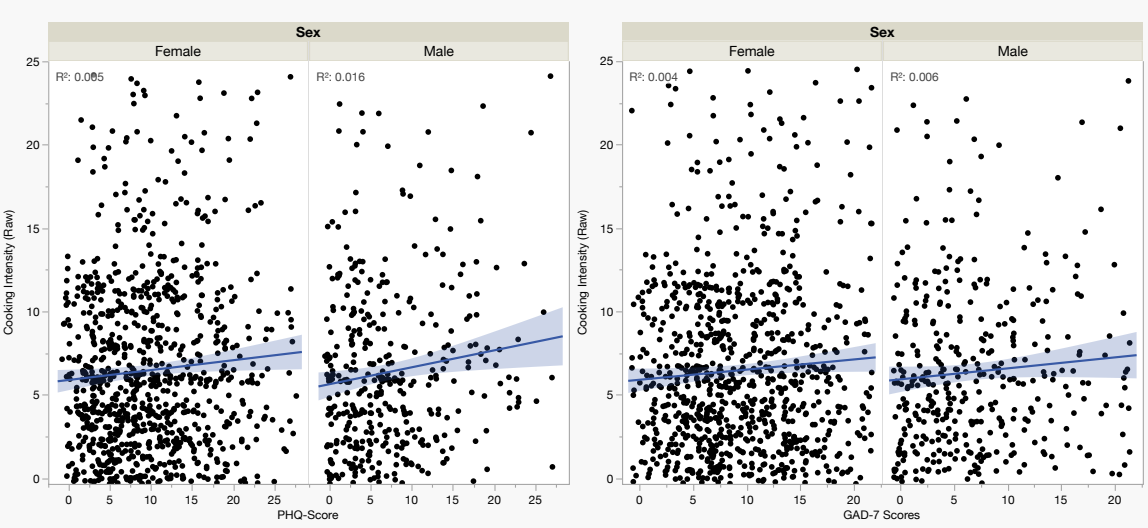
Table 6. Ordinal logistic regression analysis of the association between cooking intensity and mental health symptoms of anxiety (GAD-7) and depression (PHQ-9).

Category	R^2	β	P-value
Crude model			
GAD-7	0.005	0.01	0.09
PHQ-9	0.008	0.01	0.01
Fitted model			
GAD-7	NA	0.01	0.06
PHQ-9	NA	0.01	0.03

1. GAD-7 = Generalized Anxiety Disorder 7-item scale; 2. PHQ-9 = Patient Health Questionnaire 9-item scale; 3. β= Beta coefficient; 4. The fitted model adjusts for relevant covariates (e.g., fruit and vegetable intake, the number of dependents, eating out, online food delivery, and living situation); 5. R^2 indicates the proportion of variance explained by the model, 6. P-values indicate statistical significance ($p<0.05$).

5.4. Objective 3: Sex differences in associations between cooking intensity and symptoms of depression and anxiety

As shown in Fig. 7, the coefficient of determination (R^2) was higher for males in both models: anxiety ($R^2 = 0.006$) and depression ($R^2 = 0.016$), compared to females (Anxiety: $R^2 = 0.004$; Depression: $R^2 = 0.005$).



(A) **(B)**

Figure 7. Gender differences in the association between symptoms of anxiety and depression and cooking intensity.
(A) Compares males and females to the distribution of cooking intensity in association with PHQ-9 (Patient Health Questionnaire) scores, and (B) does the same for GAD-7 (Generalised Anxiety Disorder) scores (Kroenke et al., 2001; Spitzer et al., 2006)**.**

Table 7 presents the results of ordinal logistic regression models examining the association between cooking intensity and GAD-7 (anxiety) and PHQ-9 (depression) scores, separately for males and females. Among males, there is a significant association (p> 0.05) between cooking intensity and depression (PHQ-9) scores, but not with anxiety (p=0.08). Among females**,** no significant associations were observed with either anxiety (p=0.36) or depression (p=0.16).

Table 7. Association between mental health symptoms (Anxiety and Depression) and cooking intensity, stratified by sex.

Category	**β**	**P-value**
Males		
GAD-7	0.02	0.08
PHQ-9	0.03	0.01
Females		
GAD-7	0.01	0.36
PHQ-9	0.01	0.16

1. GAD-7 = Generalized Anxiety Disorder 7-item scale; 2. PHQ-9 = Patient Health Questionnaire 9-item scale; 3. β= Beta coefficient; 4. R^2 indicates the proportion of variance explained by the model; 5. P-values indicate statistical significance (p<0.05).

Chapter 6. Discussion

This study aimed to explore cooking practices among young adults in Canada. Specifically, it examined the association between symptoms of depression and anxiety and cooking intensity. Additionally, the study compared these associations across genders to identify potential differences between males and females.

6.1 Variables significantly associated with cooking intensity

6.1.1 Sex

Cooking intensity is associated with a range of demographic and social factors. As outlined in Section 2.1.3, the literature has documented that women cook more than men, highlighting the gendered nature of cooking. The present study also reflects this pattern, with a higher proportion of young women (62.3%) reporting engagement in cooking activities than young men (25.8%). These findings align with 2022 national statistics from the United States, which indicate that over 80% of young women aged 25 and older assume primary responsibility for meal planning and preparation, compared to approximately 39–43% of men (Storz et al., 2022).

The current study also examined the relationship between cooking intensity and sex. Among males, depressive scores were weakly but significantly associated with cooking intensity, while anxiety showed no significant association. For females, it did not reach statistical significance. However, due to the sex imbalance observed within the study cohort, the results should be interpreted with caution.

6.1.2 Living situation

The results of this study show that when individuals reside in settings where home-cooked meals are readily available, such as living with parents or in university residences, cooking intensity tends to be lower, as meals are often prepared by others (Table 4). Consistent

with this pattern, living arrangements have a significant influence on the cooking behaviour and dietary habits of young adults across various cultural contexts. An Australian study found that young adults living away from home were significantly more likely to prepare their own meals than those living with their families, with no significant differences observed across nationalities (Riddell et al., 2011). Among Japanese young women, those living independently reported higher cooking frequency, with none abstaining from cooking, in contrast to peers residing with their families (48.4%) (Hamade et al., 2023). Motivational differences further illuminate this pattern (Hamade et al., 2023). Spontaneous motivation to cook was also significantly lower among non-cooking women in family households (median = 2, IQR: 0–6) compared to those who cooked while living with family (median = 8, IQR: 6.5–10; $p < 0.001$), underscoring the role of intrinsic drive in food preparation (Hamade et al., 2023). Similarly, students living independently consumed fewer home-cooked meals (4.17 vs. 6.52 meals/week). They reported higher intake of convenience (2.08 vs. 1.22 meals/week) and takeaway foods (3.12 vs. 2.23 meals/week) compared to those living at home (Papadaki et al., 2007). These findings suggest that while living with parents or in university housing may provide access to homemade meals, it may also limit the opportunity and necessity to engage in cooking, potentially affecting the development of cooking skills and autonomy in food preparation.

6.1.3 Eating out practices and online food delivery

The practices of eating out and using online food delivery apps are negatively associated with cooking intensity. This finding suggests that as the consumption of food prepared away from home increased, there was a corresponding decline in the frequency of home-cooked meals (Table 5). Online food delivery apps represent a modern extension of eating out (Jack Collison∗, 2020). The growing popularity of online food delivery services appears to be substituting, at least in part, traditional methods of obtaining food away from home (Gupta et al., 2024a). This trend aligns with intuitive expectations: as individuals

increasingly rely on externally prepared meals, the frequency and intensity of home cooking naturally decline (Babar et al., 2021). In 2020, sociodemographic correlates of online food delivery service reported greater odds of usage amongst respondents who were male (OR: 1.50), that identified with an ethnic minority (OR: 1.57), those who lived with children aged under 18 years (OR: 2.71), or had high (versus low) levels of education (OR: 1.66) (Keeble et al., 2020). The current study's findings reveal a markedly high level of engagement with food delivery platforms among young adults in this sample, with 55% of the young individuals reporting the use of food delivery apps. This figure represents more than double the national usage rate reported in the 2021 International Food Policy Study (IFPS), which found that only 19.5% of Canadians used such services (Gupta et al., 2024b). Moreover, these platforms are primarily dominated by unhealthy food options (Gupta et al., 2024b; Poelman et al., 2020), reinforcing an unhealthy food environment (Jia et al., 2024). Conversely, these apps are associated with less fruit and vegetable intake (Tham et al., 2023). The participants in the current study reported a consumption below (Table 5) the recommended WHO guidelines of five portions (WHO, 2020). These findings align with broader global trends: a systematic review of survey data from 113 countries, including the United States, found that adults worldwide consume an average of only 81.3 grams of fruit and vegetables daily (Micha et al., 2015). Moreover, a 2022 review indicated that vegetable intake in 88% of countries falls below recommended levels (Kalmpourtzidou et al., 2020).

Thus, ease of access to calorie-dense, nutrient-poor meals through these apps may further contribute to the decline in home cooking and reduce the consumption of fruits and vegetables, amplifying public health concerns related to dietary quality and nutrition.

6.2 The association between mental health symptoms of depression and anxiety and cooking intensity

Results indicated that depressive symptoms were positively associated with cooking intensity, while anxiety symptoms were not. This result suggests that individuals reporting higher scores on PHQ-9 tended to engage in cooking more frequently and for longer durations. Although these associations were statistically significant for symptoms of depression, they were weak and accounted for only a minimal proportion of the variability in cooking intensity. Several covariates emerged as significant predictors: fruit and vegetable intake was positively (directly) associated with greater cooking intensity, whereas eating out, reliance on online food delivery services, and certain living situations were negatively (inversely) associated. To the best of available knowledge, this is the first study to specifically examine the association between symptoms of depression and anxiety and cooking intensity operationalised through frequency and duration of cooking activities.

These results rejected the null hypothesis and may be explained by various interrelated psychological and behavioral reasons. First, symptoms of depression and anxiety are well-established mental health concerns that are frequently associated with problematic eating behaviors, as seen in obesity and eating disorders such as anorexia nervosa and bulimia nervosa (Dakanalis et al., 2023; Mischoulon et al., 2011; Sander et al., 2021). Research consistently shows that individuals experiencing depressive symptoms tend to exhibit dysregulated eating habits, such as emotional or binge eating, along with increased caloric intake, lower diet quality, and higher body mass index (BMI) (Gold & Chrousos, 2002; Keck et al., 2020). For instance, the association between depressive symptoms and self-efficacy for healthy eating behaviors suggests that individuals experiencing persistent depressive symptoms tend to have reduced confidence in their ability to maintain healthy eating habits (Opie et al., 2021). From

a diagnostic standpoint, the DSM-5 recognises appetite and weight changes, either increases or decreases, as core symptoms of major depressive disorder (Simmons et al., 2016). Moreover, individuals with depression often show a preference for carbohydrate-rich foods, potentially due to altered reward pathways and the role of tryptophan in serotonin regulation, which may explain their increased cravings for such foods (Fernstrom et al., 1987; Markus, 2007; Thurn et al., 2025). In this context, the positive association between symptoms of depression and cooking intensity may reflect attempts to cope with these psychological and physiological needs. Home-prepared meals might be used to meet heightened caloric or emotional demands, particularly when individuals seek comfort structure through food preparation.

It is essential to note that, although these associations were statistically significant, they were weak, with symptoms of depression accounting for only a small proportion of the variance in cooking intensity. These relationships may be influenced by unmeasured factors. Moreover, existing literature suggests that depression disrupts daily functioning, leading to reduced engagement in everyday activities, including cooking (as detailed in section 2.3), which contrasts with the current results. Thus, there is a need for further investigation into the association between mental health symptoms and cooking intensity, as well as to explore other psychological factors that influence cooking intensity.

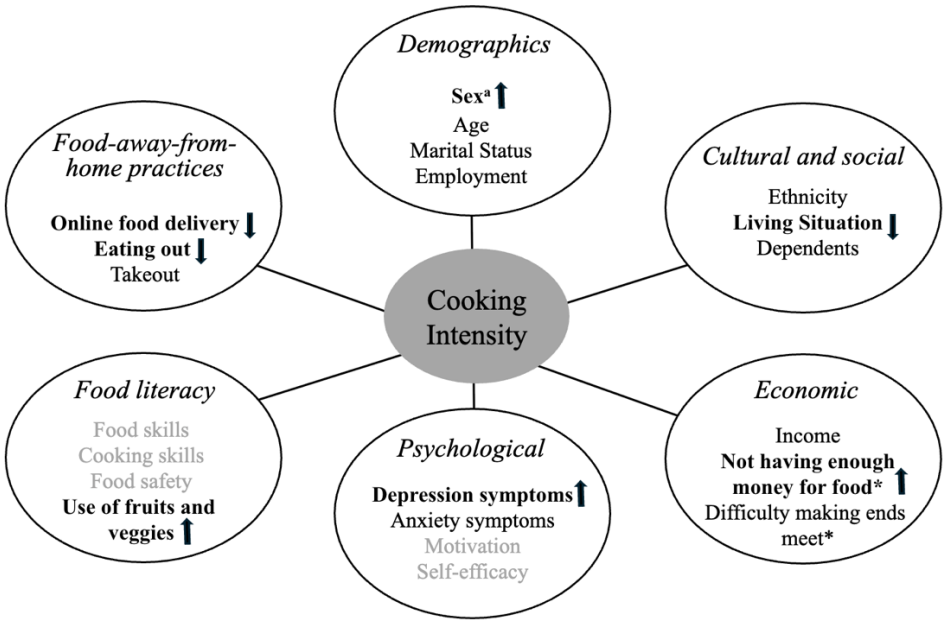


Figure 8: Conceptualisation of factors influencing cooking intensity.

Bolded variables represent those that were significantly associated with cooking intensity in this study, with arrows indicating the direction of association. Non-bolded variables were examined but showed no significant relationship. Greyed-out variables denote potential determinants but have not been assessed in this study. Variables marked with an asterisk (*) indicate indicators of food insecurity. (a) Only the results for males were statistically significant.

6.3 Strengths

This study has several notable strengths that contribute to the growing literature on nutrition and mental health. First, the study presents novel findings by exploring the association between cooking intensity and mental health symptoms, specifically depression and anxiety. It contributes to the knowledge of the psychological determinants of cooking practices, offering critical new insights to an underexplored area of public health research.

Second, this study adds to the current body of knowledge by focusing on the young adult population. Mental disorders are chronic diseases of the young, and most mental disorders have a typical onset between 12 and 25 years of age (Uhlhaas et al., 2023). Additionally, the young adult population is particularly susceptible to suboptimal dietary habits (Ravi et al., 2025;Cowan-Pyle et al., 2024). By examining the association between mental health symptoms

and cooking during this transitional stage, the study contributes to a better understanding of the psychological determinants of cooking in young adults.

Third, the large sample size is a strength of the study, as it increases the reliability of the findings and supports more confident interpretations. A larger sample helps to ensure that the results are less likely to be influenced by random variation and provides a stronger foundation for identifying meaningful patterns and associations. Additionally, the study had a completion rate of 70.9%.

6.4 Limitations

Several limitations should be considered when interpreting the findings of this study. First, the convenience sampling method primarily drew most participants from the ISPR student pool, resulting in a large proportion of female students from introductory courses in human behavior and cognition. Attempts were made to increase the number of male students by posting posters on bulletin boards in various faculties, aiming to achieve a more balanced proportion of male and female students. Advertisements on Instagram, TikTok, and Facebook were also aimed at including young adults who were not students. Thus, the sampling approach limits the generalizability of the findings, as the sample does not accurately reflect the broader demographic or cooking practices of young adults in Canada. Additionally, the underrepresentation of men within the sample may have influenced the observed associations, particularly given that cooking behaviors, dietary habits, and mental health symptoms can differ across genders.

Second, the study relied on self-reported data for cooking practices and psychological symptoms, introducing several potential sources of bias (Paans et al., 2019). Participants may have over or underreported their cooking frequency or mental health symptoms due to social desirability, memory errors, or lack of self-awareness. Moreover, responses on self-report

questionnaires are often shaped by retrospective recall and self-perception, making them vulnerable to recall bias and self-report bias (Fadnes & Taube, 2009). To manage this limitation, several quality assurance strategies were employed (Sections 4.2.2 and 4.3), including the use of eligibility screening questions and embedded quality assurance items to improve data accuracy. Additionally, extensive preprocessing steps were undertaken to ensure the final dataset was suitable for the study's objectives (Section 4.4.1).

Third, the cooking practice's questionnaire used in the study was not standardised or validated for the Canadian context. The absence of a culturally adapted and psychometrically sound measurement tool may have affected the accuracy and comparability of responses. However, there are currently no tools available in Canada for this purpose; therefore, future studies should focus on developing one.

Fourth, cooking does not have a universal definition and can vary widely across individuals, households, and cultural contexts (Section 1.2). Participants may interpret cooking differently, which may have introduced variability in how participants understood and reported their cooking behaviours. For example, perceptions of what constitutes cooking may differ depending on whether heat is applied, whether meals are made from scratch, or whether convenience foods are used. While many participants reported using convenience foods, there was general agreement in prior literature that cooking from scratch is considered more desirable (Mills et al., 2017b; Wolfson et al., 2016b). Future research should strive toward a standardised, operational definition of cooking that takes into account the nutritional quality of meals, the complexity of preparation, and the level of engagement required. Including both quantitative and qualitative methods may help capture these dimensions more accurately.

Fifth, the weak associations observed may be partly due to limited variability in cooking behaviors within our sample. Over 88% of participants reported cooking three or more times

per week, with an average frequency of three times per week. Similarly, cooking duration data may have lacked granularity, as many respondents selected similar time ranges, limiting precision. This clustering of responses, combined with the broad or categorical response options used to measure cooking frequency and duration, may have reduced the ability to detect stronger associations with mental health outcomes (Saito et al., 2019). These findings suggest that improvements in the design of measurement tools, particularly with more refined or continuous response options, may be necessary to capture subtle differences in cooking behaviors and their potential links to mental health.

Chapter 7. Conclusion

Cooking is a prevalent practice among young adults in Canada, with women reporting higher engagement in cooking activities than men. Several factors were associated with cooking intensity: fruit and vegetable intake, and not having enough money were positively related, while eating out, online food delivery, and certain living situations were negatively (inversely) related. These findings underscore the multifaceted nature of cooking behaviours and the broader lifestyle and environmental factors that shape them. The associations between symptoms of depression and cooking intensity accounted for only a small proportion of the observed variability, suggesting that other unmeasured factors may play a more significant role in influencing cooking engagement. Future research should broaden the scope to explore additional psychological constructs likely relevant to cooking and nutrition. These may include emotional eating tendencies, self-efficacy in cooking, executive functioning skills, and time management abilities. Understanding how these factors interact with cooking intensity could help identify key psychological barriers and promote healthier cooking behaviors among young adults.

Chapter 8. References

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