

Low back pain and its association with the key lifestyle and anthropometric factors in adolescent females in Otago, New Zealand

Nidhi Mehta

School of Physiotherapy, University of Otago

Thesis submitted for Masters of Health Sciences

2014

Abstract

Background: Low back pain (LBP) is a common complaint in adolescents with prevalence rates in the teenage years reported to be as high as in adults and a wide range of lifestyle, socioeconomic, psychological and physical factors have been associated with LBP in the adolescent population. However, in New Zealand there has been only one study published to date, which has looked at the prevalence rates of LBP in the adolescent population (11-14 years). The Zealand study examining LBP in adolescents showed that psychological, social and emotional factors may play a stronger role than the physical factors. In yet another study on LBP in adolescents, investigators concluded that certain aspects of diet may influence on LBP in adolescents. Other investigators have linked physical factors to LBP in adolescents by demonstrating the association between increased physical activity and strong back flexor muscles with LBP. Overall the current literature suggests possible factors associated with LBP in the adolescent population are wide ranging and the issue is complex.

Aims: The primary aim of the current study was to determine the current and period prevalence's of LBP when categorized according to reporting period (LBP lifetime, LBP recurrent and LBP location confirmed (LC)) specifically in adolescent schoolgirls in Otago, aged between 13-18 years. The secondary aim was to examine the relationship between the three reporting periods of LBP and key lifestyle factors of physical activity, smoking habits, food and drink consumption levels along with anthropometric measurements and back extensor endurance (BEE) estimates.

Methods: This was a cross-sectional observational study. Consenting adolescent females (n=322) from six Otago schools completed a self-report questionnaire, the Otago Back Pain & Lifestyle Study Questionnaire (OBPLSQ). The questionnaire was designed and customized for the current study and comprised 48 items. The items were based on previously validated questionnaires and covered demographics, physical activity levels (PALs), LBP, smoking habits and food and drink consumption levels. The questionnaire was made available on-line to the participants in their respective school's computer suite. The anthropometric measurements of height (cm) and midpoint waist circumference (cm) were taken directly from the participants on the same day they completed the questionnaire. Bio-electrical impedance analysis was undertaken to gather information regarding the participants' body fat

percentage, fat mass (kg), fat-free/lean mass (kg), body mass index and body fat percentages and BE endurance score (seconds).

Data analysis: Descriptive statistics (mean, standard deviation and range) were used to describe the participants' characteristics. Uni-variate and multinomial logistic regression (MLR) analysis were undertaken on the three dependent variables of LBP self-report categories (LBP lifetime, LBP recurrent, LBP LC) to identify any significant lifestyle factors explaining the risk of LBP. The sixteen predictor variables used in this analysis were age, ethnicity, waist to height ratio (WtHR), body mass index standard deviation (BMI z score), BEE, fat percentage, PAL's (New Zealand physical activity questionnaire (NZPAQ), metabolic equivalents (METs), health behaviour in school children (HBSC), current smoking, fruit and vegetable intake along with food indices (fruit and vegetable (FV), fibre, calcium, variety, treat) derived from food and drink consumption section). Predictor variables demonstrating $p \leq 0.2$ at the uni-variate level analysis were entered into the MLR models for further analysis.

Results: Two hundred and ninety seven participants (92%) completed the entire questionnaire and had their physical measurements taken. The mean (SD) age of the participants in the current study was 14.3 (SD 1.2) years. Prevalence levels of LBP were LBP lifetime (57.6%), LBP recurrent (26.6%) and LBP LC (24.2%). From the uni-variate analysis the likelihood of LBP LC was found to be almost three times (OR=2.9 95% (confidence interval) CI 2.56, 3.01, $p=0.04$) greater in those participants who were current smokers. The predictor variables of WtHR, BMI z score, fat percentage, BEE and age were also found to be associated with different categories of LBP at various levels of significance. Five predictor variables (WtHR) (odds ratio) (OR=72.17, 95% CI 55.34, 93.79 $p=0.05$), (BMI z) score (OR=1.34, 95% CI 0.98, 3.33 $p=0.01$), fat percentage (OR=1.04, 95% CI 0.56, 1.87 $p=0.00$), BEE (OR=0.99, 95% CI 0.32, 1.24 $p=0.01$) and variety index (OR=1.11, 95% CI 1.01, 1.55 $p=0.09$) met the threshold criteria to be included in MLR models using the dependent variable of Lifetime LBP. Seven predictor variables: age (OR=1.28, 95% CI 1.03, 1.71 $p=0.01$), BMI z score (OR=1.24, 95% CI 0.64, 3.52 $p=0.08$), fat %age (OR=1.03, 95% CI 0.43 $p=0.02$), BEE (OR=0.99, 95% CI 0.46, 1.98 $p=0.00$), PAL's (OR=1.25, 95% CI 0.09, 1.66 $p=0.19$), current smokers (OR=2.5, 95% CI 1.19 $p=0.08$) and variety index (OR=1.13, 95% CI 0.77, 2.67 $p=0.11$) were analysed with the dependent variable of recurrent LBP. Four predictor variables: age (OR=1.26, 95% CI 1.01, 1.60 $p=0.02$), BEE (OR=0.99, 95% CI 0.77, 2.25 $p=0.01$), PAL's (OR=1.33, 95% CI 1.11, 1.43 $p=0.10$) and current smokers (OR=2.9, 95% CI 2.56, 3.01 $p=0.04$) were included in the MLR

analysis with the predictor variable of LBP (LC). No significant relationships were identified from any of the MLR analyses.

Conclusion: The LBP prevalence levels reported in the current study are in accordance with available literature. Of all the variables examined the anthropometric measurements showed the strongest associations with LBP when compared to the self-report lifestyle variables. In the preliminary analysis no consistent pattern emerged between the three self-report categories of LBP as although the factors of age, WtHR, BMI z score, fat percentage, BEE, current smoking were significantly related to LBP the level of risk varied between the three back pain categories. However, these significance levels were lost when these same factors were examined in the more robust models (MLR) and current smoking was found to be the most significant predictor of LBP and this was specifically evident in the adolescents categorized under the LC category. The emergence of only LC category LBP as most significant in relationship to smoking emphasizes the importance of using the body chart in studies of such kind and being able to relate the pain to specific body part which helps to improve the reliability of the responses. Finally, the results demonstrate that the reporting period is very important when factoring in risk factors associated with LBP in female adolescence, as it is clearly observed that there is difference in the significance levels of same risk factor for example smoking, WtHR within different categories of LBP in the same set of population.

Acknowledgements

I am using this opportunity to express my gratitude to everyone who supported me throughout the course of this thesis. I am thankful to my supervisors Dr Gillian Johnson, Dr Paula Skidmore, Dr Margot Skinner, and Prof Stephen Milosavljevic, for their aspiring guidance, constructive criticism and advice during the project work. I am sincerely grateful to them for sharing their truthful and illuminating views on a number of issues related to the project.

I express my warm thanks to administrative and technical staff at the School of Physiotherapy for their support. Also, I thank PhD colleagues at the School of Physiotherapy for your friendship and peer-support.

I would also like to thank my project participants and all the people who provided me with the facilities being required for data collection. I am sincerely grateful to you all.

I would like say special thanks to Aleksandra Macznik, PhD colleague and a dear friend who was a tremendous support at much needed time and I could not have finished my thesis without her support.

Last but not least I would like to thank my Parents and my Brother, my Husband Abhishek, and God for your love and continuous support.

Table of contents

Contents

Abstract	2
Acknowledgements.....	5
Table of contents.....	6
Chapter 1 Introduction.....	9
Chapter 2 Systematic review.....	11
2.1 Background.....	11
2.2 Study rationale	12
2.3 Literature Review	12
2.4 Risk factors	14
2.5.1 Research Question	15
2.5.2 Defining Inclusion and Exclusion Criteria	16
2.5.3 Methods for Identifying Research Studies.....	16
2.5.3.1 Database searching	17
2.5.3.2 Checking reference lists	17
2.5.3.3 Identifying unpublished studies.....	18
2.5.3.4 Study Selection.....	19
2.5.3.5 Screening.....	19
2.5.3.6 Methodological quality	21
2.6 Data Analysis and Findings.....	22
2.6.1 Physical Activities	22
2.6.2 Smoking.....	26
2.6.2 Alcohol.....	27
2.6.3 Food habits.....	27
2.7 Discussion and Conclusion	27
2.7.1 Physical activity and ALBP	28
2.7.2 Smoking and LBP	28
2.7.3 Alcohol and LBP.....	29
2.7.4 Food habits and LBP	29
2.8 Potential confounding variables	29
2.9 Limitations of the review	30
2.10 Implications of the study.....	30
Chapter 3 Methods	32
3.1 Study design & Set up	32

3.2 Development of the Otago Back Pain Lifestyle Questionnaire	32
3.3 Physical Measurements	46
3.4 Pilot Testing.....	51
3.4.1 Pilot test procedure.....	51
3.4.2 Pilot test results.....	51
3.5 Recruitment Processes.....	51
Fig 3.11 Recruitment process.....	53
3.6 Study Inclusion and Exclusion Criteria	53
3.7 Ethical approval.....	53
3.8 Token of Appreciation.....	53
3.9 Data Collection	54
3.10 Data Analysis	54
Chapter 4 Results	55
4.1 Demographic and Anthropometric descriptors	56
4.1.1 Recruitment.....	56
4.1.2 Lifestyle descriptors	58
4.1.2.1 Physical activity categorization of the participants:	58
4.1.2.2 Low Back Pain.....	60
4.1.2.3 Smoking.....	62
4.1.2.4 Food and Drink Consumption	63
Section 4.2.....	64
4.2.1 Demographics and anthropometric characteristics and low back pain.....	64
4.2.2 Physical activity levels and low back pain	67
4.2.3 Smoking and low back pain.....	68
4.2.4 Food and drink consumption and low back pain	69
4.2.5 Multinomial regression	71
Chapter 5 Discussion	80
References	85
<u>Appendix A</u>	99
Appendix B.....	98
Appendix C.....	101
Appendix D.....	108
Appendix E.....	118
Appendix F.....	120
Appendix G	122
Appendix H.....	126

Appendix I	130
Appendix J	132
Appendix K	134
Appendix L.....	136
Appendix M.....	166
Appendix N.....	167

Chapter 1 Introduction

Low back pain (LBP) is common disorder in adolescents, especially in females and the prevalence of LBP has been reported to be as high as in adults (12%-57%), in studies done in various parts of the world (Balague et al., 1999; Fairbank et al., 1984; Salminen, 1984; Kovacs et al., 2003; Roth-Isigkei et al., 2003; Watson et al., 2002). The literature reflects there is a dearth of research related to LBP in adolescent population in New Zealand, and there is only one published study related to LBP prevalence (35%) and factors associated (stomach ache, headache, sore throat, psychosocial factors, low desk height, carrying school bag on one shoulder) with LBP in male and female adolescents (11-14 years) (Trevelyan and Legg, 2011). The literature suggests that multiple factors such as psychological, socioeconomic, physical, ergonomic, and lifestyle are associated with LBP in adolescents to different extents and varied levels, and that the relationship between LBP and the associated factors remains ambiguous (Feldman et al., 2000; Shehab and Al-Jarallah, 2005; Lemos et al., 2013).

Also, the adolescent LBP is a strong precursor to adult LBP and the adolescents who report LBP in their teenage years are more likely to experience LBP in their adulthood (Harreby et al., (1995). The time taken off work and disability compensation costs associated with LBP are already known factors (Lidgren, 2003) hence pose a considerable socioeconomic burden on individual as well as societal level (Murray & Lopez, 1996; Lopez, 2006). In New Zealand, musculoskeletal pain, majority of which was comprised of LBP, was estimated to cost the country more than \$5.5 billion a year (MOH, NZ, 2012). Musculoskeletal pain including LBP is accountable for benefits for sickness or invalid purposes, and a major portion of claims to accident compensation commission (ACC). And with ageing NZ population, costs will grow as well. Therefore, the focused investigation of a prevalence of the LBP and factors associated with it in early ages, would give the opportunity to modify positively the possible outcomes in adulthood and later stages of life. In summary the present literature suggests that there are high prevalence rates of LBP in adolescents, especially in females, in different parts of the world, and established link of adolescent LBP with LBP in adulthood (Harreby et al., 1995, Brattberg 2004).

The current gap in the literature causes the need to investigate the prevalence rates of LBP in adolescents in the local population. As the existing body of research (Gunzburg et al., 1999, Blettner et al, 1999) demonstrates that there is complex relationship between the lifestyle

factors of physical activity, smoking, alcohol consumption, dietary habits (Balague et al., 1999, Manek and MacGregor 2005) and LBP in adolescents.

Based on the literature review carried by the primary author (NM) of the current study, among multiple lifestyle factors known to be related with the LBP in female adolescents, especially nutrition (food and drink consumption pattern) is the one which has not been explored previously in conjunction with the other lifestyle factors such as physical activity levels and smoking status and warrants further investigation.

Lifestyle factors are a big unit and include several entities. The current research concentrates on the physical activity levels (PAL's), smoking habits and food and drink consumption pattern and their relationship with LBP in adolescent females. Also, various anthropometric attributes of the individual such as endurance of the extensors muscles of the lower back, are thought to play an important role in LBP in female adolescents (Christopher S and Emma R. 2014; Johnson et al., 2009). However, there is lack of data available in regards to the lifestyle factors and their collective association with LBP, especially in local adolescent female population.

Therefore, the current study (OBPLS) is cross-sectional observational study primarily aimed to investigate the prevalence rates of LBP in the local female adolescent population aged 13-18 years. While the secondary aim is to examine the relationship between the three categories of LBP (lifetime, recurrent, LC) based on reporting period and key lifestyle factors of PAL's, smoking habits, food and drink consumption levels along with the anthropometric measurements and back extensor endurance (BEE).

Chapter 2 Systematic review

2.1 Background

Low back pain (LBP) is one of the most common musculoskeletal problems faced by an individual during their lifetime (Walker, 2000). Kemper & Tholen. (2011) defined LBP as “pain localized above the inferior gluteal folds and below the costal margin that can be associated with leg pain and discomfort.” The etiology of LBP is multi-factorial and influences the majority of the human population (Oliveria & Cabri 2005). Risk factors responsible for LBP are essentially unknown and are a nominated health concern for the World Health Organization (WHO) (Ehrlich, Khaltsev, & Management, 1999) acknowledge the high prevalence of LBP in most industrialized countries. Low back pain is also common among adolescents with a prevalence rate ranging between 12% to 57%, comparable to the prevalence of LBP in adults (Balague et al., 1999; Fairbank et al., 1984; Salminen, 1984; Kovacs et al., 2003; Roth-Isigkei et al., 2003; Watson et al., 2002).

Low back pain in adolescents can be classified as either specific or non-specific LBP. Specific LBP is associated with pathological conditions such as infection, fracture, cancer, osteoporosis, cauda equina syndrome or spondylo-arthritis (Ehrlich, 2003). Non-specific LBP is a medical condition which cannot be attributed to any specific pathology and according to international reports approximately 80% to 85% of LBP cases in adolescents and children are in this category (Gunzburg et al., 1999; Jones & Macfarlane, 2005).

There is a little agreement among researchers regarding risk factors for LBP experienced by adolescents irrespective of its increasing prevalence (Gunzburg et al., 1999). Blettner et al, (1999) consider LBP in adolescence is multi-factorial in origin.

Currently, there is a poor understanding regarding risk factors for LBP (Blettner et al, 1999), particularly related to physical activities and the growth and development of adolescent bone and muscle. A number of researchers consider that LBP in adolescence is associated with increased physical activity in sports or work (Kujala, Taimela, Erkintalo, Salminen, & Kaprio, 1996; Schmidt-Olsen, Jorgensen, Kaalund, & Sorensen, 1991). They argued evidence is based on the increased occurrence of LBP among adolescent competitive athletes compared to non-athletes (Balague, Dutoit, & Waldburger, 1988; Kujala, Salminen, Taimela, Oksanen, & Jaakkola, 1992; Sward, Eriksson, & Peterson, 1990). Alternatively Fairbank et al. (1984) argued that students with less participation in sports are more affected by back pain than their

counterparts and attribute this lack of sports involvement to hypo-mobility in their upper limb joints. In addition, Chen et al (2009) reported sedentary lifestyle to be a major risk factor for LBP. Lifestyle factors such as smoking (Feldman et al., 1999), alcohol consumption (Heaps et al., 2011; Hestbaek et al., 2006a) and food habits (Perry et al., 2010) are also considered to be potential factors related to LBP.

Even though there are number of risk factors for non-specific low back pain it is important to identify the modifiable lifestyle factors such as alcohol consumption, smoking, food habits and physical activities. Hence this study focuses on the relationship between modifiable lifestyle factors and LBP in adolescents.

2.2 Study rationale

The study by Harreby et al., (1995) has shown that students with existing LBP have a higher risk of developing back pain during adulthood than those without. As a reduction in LBP in adolescence may be associated with reduced risk of LBP in adulthood (Brattberg 2004) it is important to understand what modifiable lifestyle factors in adolescents are associated with LBP. Although a number of cross-sectional studies have been carried out on LBP in adolescence, the results are not adequate for determining an evidence-based intervention (Cardon & Balague, 2004) While several primary cross-sectional studies have been carried out the quality of these studies is poor (Kemper and Tholen, 2011). The European Guidelines for Prevention of LBP (ECSTR, 2004b) also criticises the lack of quality in existing studies. The aim of the current chapter is to undertake a systematic review of literature to identify modifiable life style risk factors for LBP in adolescents. The review particularly focuses on relationship of smoking, alcohol consumption, physical activities and food habits with LBP in adolescents.

2.3 Literature Review

Low back pain is a common health problem (Andersson, 1998; Deyo, Diehr, & Patrick, 1991; Dionne, Dunn, & Croft, 2006; Rapoport, Jacobs, Bell, & Klarenbach, 2004) and imposes a major burden to public health (Murray & Lopez, 1996; Lopez, 2006) including work absence and limitation of activity (Lidgren, 2003). In addition to discomfort, LBP also reduces quality of life and is a major factor for health care expense (Wynne-Jones, Dunn, & Main, 2008). Although LBP has been considered a problem limited to developed economies

(Chaiamnuay, Darmawan, Muirden, & Assawatanabodee, 1998), a number of recent studies now demonstrate that LBP is also a health issue in low and middle income countries (Chaiamnuay et al., 1998; Hoy, Toole, Morgan, & Morgan, 2003; Jin, Sorock, & Courtney, 2004; Ory, Rahman, Katagade, Shukla, & Burdorf, 1997).

Over the last two decades epidemiological studies from both America and Europe have shown that children in the nine to 18 year age group experience non-specific LBP (reference). Roth-Isigkeit et al. (2003) confirmed a 3-month prevalence (experience in last three months) of non-specific LBP back pain of 33% among 1077 children and adolescents in Germany. A similar study by Watson et al. (2002) demonstrated a prevalence level of 24% of LBP among 11-14 years school children in Northwest England. A review by Duggleby and Kumar (1997) identified a point prevalence of 13% (range 12 to 33%), a recurrent prevalence of 8% (range 3 to 15%) and a lifetime prevalence of non-specific LBP to be 29% (range 30 to 51%). Duggleby and Kumar (1997) and Hakala, Rimpela, Salminen, Virtanen, & Rimpela (2002) observed an increasing prevalence of non-specific LBP among adolescents in Finland from 1985 to 2001. Duggleby and Kumar (1997) concluded that non-specific LBP might lead to future degenerative musculoskeletal disorders in adults. In addition, Harreby, Kjer, Hesselsoe, & Neergaard, (1996); Salminen, Pentti, & Terho, 1992 and Watson et al., (2002) have indicated that certain groups of children also experience regular and severe non-specific LBP, and that this may lead to regular use of medication, and loss of participation in sports (Harreby et al., 1999; Kristjansdottir & Rhee, 2002; Salminen et al., 1992). Similarly, longitudinal studies by carried out by Harreby et al., 1999 and Salminen et al., 1999) indicate that recurrent non-specific LBP during adolescence continues into adulthood and consequently results in reduced work capacity.

Jones and Macfarlane (2005) reported that the prevalence of LBP during adolescence increases with their age and affects more adolescent females than males. An international health survey, Health Behaviour in School-Aged Children (HBSC) was conducted in 24 countries, among 11-year-old, 13-year-old and 15-year-old school children during 1997/1998. This study which was sponsored by the National Institute of Child Health and Human Development in collaboration with WHO revealed that back pain was more common among girls than boys (19.9% versus 17.1%). Moreover the findings indicated that back pain increases with age from 14% to 16% for 11-year-old boys and, from 22% to 25% for 15-year-old girls (Kemper & Tholen, 2011). In this survey, it was found that America had the highest incidence for adolescent LBP followed by Czech Republic and Slovakia. The distribution of

adolescent LBP ranged evenly from 13% to 27% between these countries. (Kemper & Tholen, 2011).

2.4 Risk factors

Epidemiological studies by Balague et al., (1999) and review by Duggleby & Kumar, (1997) observed that non-specific LBP has a multi-factorial etiology. Manek and MacGregor (2005) reported that non-specific LBP is most commonly influenced by posture and physical activities and also indicate that it is not possible to determine specific etiological factors for non-specific LBP. In addition, demographic features such as age, sex, occupational characteristics, use of vibrating equipment, repeated weight lifting, sedentary life style, smoking, obesity, increased lumbar lordosis, cardiovascular disorders, scoliosis and low socioeconomic background are some of the risk factors for LBP. (Manek & MacGregor, 2005). Kemper and Tholen (2011) suggested that non-specific LBP in adolescents should be accepted as a daily occurrence and should be managed by changing lifestyle.

Cardon and Balgué (2004) categorized the risk factors for non-specific LBP in school aged children under 18 years into lifestyle factors (obesity, alcohol intake, smoking, eating habits, sport participation, working, physical inactivity, sedentary activities, working), physical factors (physical fitness, flexibility, mobility, muscular strength) psychosocial factors (family, social environment, depressions, hyperactivity, sleeping problems, behavioural problems) and school-related factors (bag weight, school furniture).

Roth-Isigkeit et al. (2005) studied the association of psychosocial and lifestyle factors and non-specific LBP and indicated that working class school children with low income and education are more prone to non-specific LBP than other children. Balague et al. (1999) related load carrying and sitting positions with non-specific low LBP in children and adolescents (Harreby et al., 1995).

Although a number of reviews have been conducted on positive relationships between LBP and lifestyle factors, causal links have yet to be established (Leboeuf-Yde, Kyvik, & Bruun , 2000; Leboeuf-Yde, Kyvik, & Bruun, 1999). Kemper and Tholen (2011) indicated the lack of a scientific framework for an evidence-based intervention. It is thus necessary to study and understand the effect of lifestyle factors such as alcohol, smoking, physical activities and nutrition for preventive purposes that will result in prevention and management of LBP in adolescents in school children. This review focuses on the role of modifiable lifestyle factors

such as smoking, alcohol consumption, physical activities and food on non-specific LBP among adolescents. The findings of this review will describe the scope for preventing LBP and help future researchers to develop prevention programmes based on the identified modifiable lifestyle factors.

Research Methodology

2.5.1 Research Question

What associations exist between non-specific ALBP in adolescents and the modifiable lifestyle factors of smoking, alcohol consumption, physical activities and food habits?

The main objective of this review is to identify the role of modifiable risk factors (smoking, physical activities, alcohol consumption and food habits) on LBP in adolescents. In order to derive solution(s) for this research question, the studies are selected based on the following PICOD (Population, Intervention, Comparator, Outcome and Design) format (NHS Centre for Reviews and Dissemination, 2008).

Population The population of the present review comprised both male and female adolescents who reported LBP, excluding individuals with a history of other co-morbidities such as, congenital problems, infection, tumor, ankylosing spondylitis, fracture, deformities so as to prevent bias due to overlapping of complications.

Intervention Intervention is not applicable for this review.

Comparators Studies focusing on acute or sub-acute or chronic adolescent LBP with reference to lifestyle risk factors of physical activity, food practices, smoking, alcohol consumption or any combination of these factors (a minimum of two lifestyle factors) were included in this review.

Outcome In this review, outcome implies the relationship between non-specific LBP in adolescents and lifestyle factors of smoking, physical activities, alcohol consumption and food habits.

Study design

In this review, the study designs of cohort, cross-sectional, longitudinal, and prospective studies were included in order to analyze the relationship between lifestyle factors and adolescent LBP.

2.5.2 Defining Inclusion and Exclusion Criteria

Based on the PICOD elements the inclusion and exclusion criteria were framed to avoid bias while selecting studies and helping to achieve reliable results (NHS Centre for Reviews and Dissemination, 2008).

Inclusion criteria

- Studies employing cross-sectional, cohort, longitudinal and prospective designs are included in this systematic review.
- Studies of adolescent participants (10-19 Years)
- Studies comparing non-specific LBP in adolescents, with at least two of the selected lifestyle factors (smoking, alcohol, food habits, physical activities)
- Full length studies published in the English language

Exclusion Criteria

- Non-English language studies
- Animal studies
- Studies employing small sample size (< 20) were excluded as they affect reliability and validity evaluation of data
- Studies involving pathology specific LBP such as spondylolisthesis

2.5.3 Methods for Identifying Research Studies

Relevant studies were identified by a comprehensive search of available literature on adolescent LBP. Both published and unpublished studies including reports, book chapters, abstracts, conference papers and theses were reviewed in order to minimize loss of important data and also to limit the bias within the review (Finfgeld-Connett, 2008). Studies with multiple publications were treated as a single study to prevent publication bias. The present review only included studies published in the English language in order to minimize for error

due to translation (Atkins et al., 2008). Care was taken to ensure that all studies are in accordance with inclusion and exclusion criteria. The formulated research strategy reviewed all of the following databases in search of relevant material.

2.5.3.1 Database searching

The systematic review started in February 2012, with the last search performed in March 2014. Databases such as AMED, Cochrane Library, Wiley, Ovid Medline, Science Direct, DARE, Embase, Sport Discus, PubMed, CINAHL, ISI, Web of Knowledge, PsycInfo and Scopus were employed in this review. Moreover, rich site summary (RSS) feeds were employed to obtain latest additions for each database. There was no limit for date range and for every database a PICO format was applied. The primary author (NM) employed substitutes of key expressions. Hence, a synonyms list was prepared to prevent omission of any relevant data.

The search strategy comprised cross-sectional, longitudinal, and prospective trials in addition to MeSH terms such as: LBP, adolescents, smoking, alcohol, nutrition, food habits. This search strategy was utilised for all databases. In addition, hand searching of clinical guidelines and systematic reviews was done. , A list of synonyms was prepared to prevent omission of any relevant data. The following represents the Keyword strategies employing Boolean operators AND and OR.

(LBP) OR (Non-specific LBP) OR (Spinal pain) OR (NLBP) OR (Backache) OR (Back Pain) OR (Lumbago) AND (Adolescents) OR (School Children) OR (Students) OR (Teenagers) AND (Smoking) OR (Tobacco) AND (Alcohol) OR (drug use) OR (physical activity) OR (Exercise) OR (Lifestyle factors) OR (Food) OR (Diet) OR (Nutrition)). The range of Keywords employed in this review is given in Appendix A.

All studies with appropriate title and abstract were taken into consideration. All relevant full texts and intermediate articles were also reviewed, if they satisfied the inclusion criteria.

2.5.3.2 Checking reference lists

The reference lists of the selected studies were reviewed in order to search further for relevant articles. In addition, a related articles search feature was used to choose relevant articles within the databases. In addition to electronic search, manual search was performed in tandem to avoid duplication of studies.

2.5.3.3 Identifying unpublished studies

The identification and inclusion of unpublished studies helped to reduce publication bias. Databases such as National Technical Information Service, Abstracts from Theses and Conferences, Registries of Clinical trials and Health Management Information Consortium helped to identify unpublished studies.

Table 2.1 Articles screened in the various databases

S.No	Database	Keywords	NO. of Hits + screened	No. of Articles selected
1.	Embase	Non-specific LBP, adolescents, Smoking, Alcohol, physical activities, Food	30	10
2.	Ovid MEDLINE	Non-specific LBP, adolescents, Smoking, Alcohol, physical activities, Food	40	3
3.	PSYCHOINFO	Non-specific LBP, adolescents, Smoking, Alcohol, physical activities, Food	48	5
4.	PubMed	Non-specific LBP, adolescents, Smoking, Alcohol, physical activities, Food	71	6
5.	CINAHL	Non-specific LBP, adolescents, Smoking, Alcohol, physical activities, Food	150	3

6	Cochrane Library	Non-specific LBP, adolescents, Smoking, Alcohol, physical activities, Food	220	2
7	Scopus	Non-specific LBP, adolescents, Smoking, Alcohol, physical activities, Food	339	4
Total number of studies included				32

2.5.3.4 Study Selection

Each study title and its abstract were assessed by NM to check whether it met inclusion criteria. Studies investigating two or more risk factors were included in this review. The studies which did not focus on non-specific LBP or adolescents were excluded. Quality assessment of the selected studies utilized two independent researchers NM and PM. Any differences in opinion while selecting studies were solved by discussion and mutual consensus.

2.5.3.5 Screening

The selected articles were subjected to three types of screening procedures (Higgins & Green, 2009) beginning with the title, abstract and the entire text.

Title Screening

The initial screening identified studies with relevant titles and abstracts which met the exclusion and inclusion criteria. In order to minimize the chances of omitting relevant studies title screening also included studies which deviated from the inclusion criteria. A total of 11,279 articles were obtained using the above-mentioned keyword strategy and hand searching resulted in 10 more studies. Moreover, after the removal of duplicates and review

articles, the total number of available studies was restricted to 750 studies. Following the use of the title screening criteria only 102 studies remained.

Abstract Screening

Individual abstract screening was done for each of these 102 studies to check for eligibility criteria. The main purpose of this screening was to check whether the selected articles were in accordance with the aim of the review. Abstract screening reduced the number of relevant studies to 40. Most studies rejected did not provide information regarding age of the participants, failed to investigate the association of more than one lifestyle factor with LBP and/or failed to provide explicit descriptive and statistical inferences specifically for the adolescent population.

Full-text Screening

The 40 remaining studies were then screened by NM and PM using a modified Downs and Black (1998) checklist (Appendix B) to select relevant articles. This checklist primarily assessed quality of the selected studies. It involved 26 questions and each question was answered with a yes/no format and the final decision to either exclude or include in the review was based on overall information from the form. As a result of screening by NM and PM using Downs and Black checklist, a total of 32 studies were included for this systematic review (Appendix C). The initial search was last re-run and updated in July 2015.

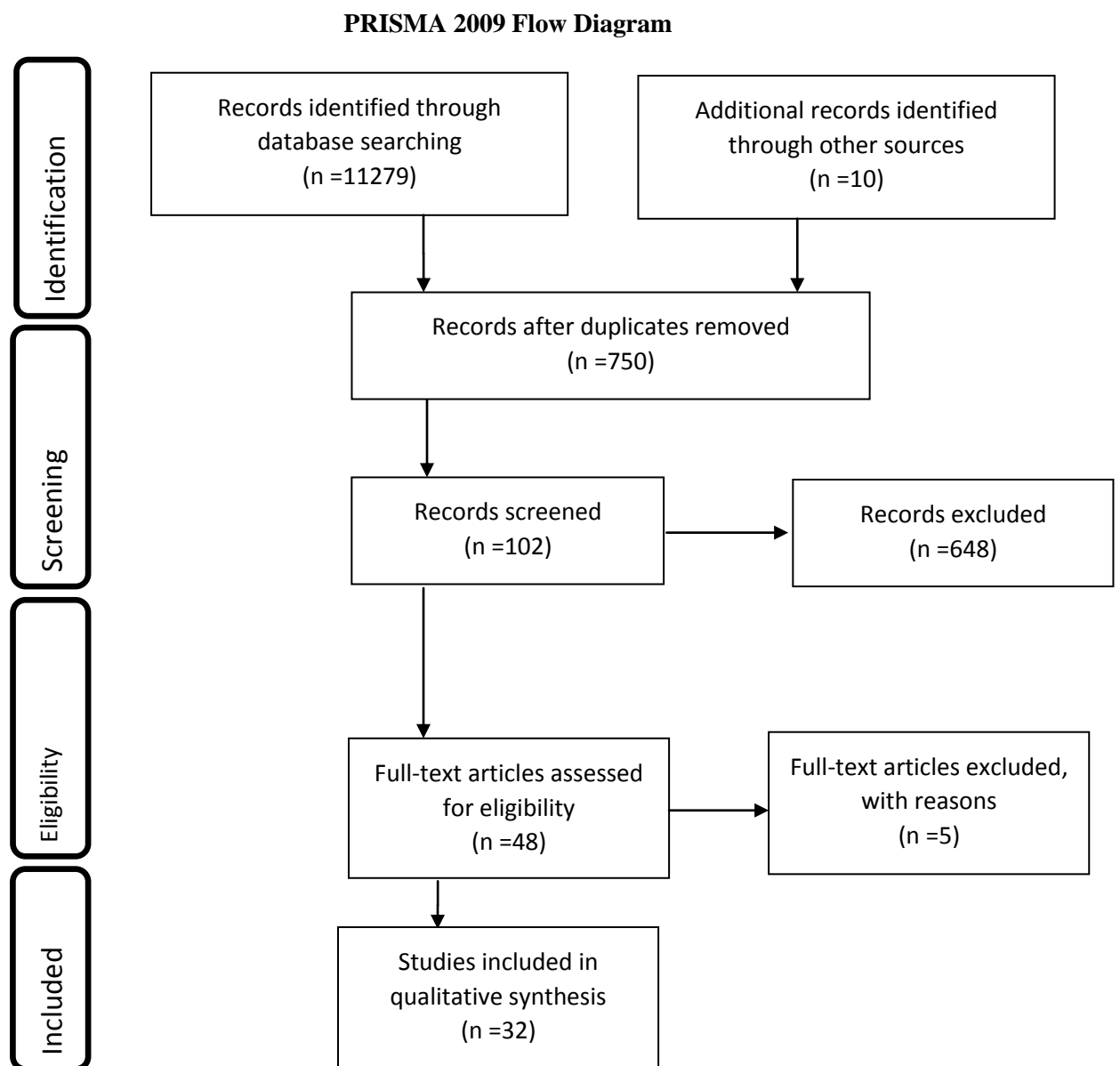


Figure 2.1: PRISMA 2009 Flow Diagram (Source: Moher et al., 2009)

2.5.3.6 Methodological quality

The use of the modified Downs and Black quality rating tool identified 15 studies as high quality with a score ≥ 50 . The most common reasons for scoring score < 50 were failure to clearly describe either the outcome measures, or the characteristics of participants, or failure to report actual probability values for the results.

2.6 Data Analysis and Findings

Of the 32 studies were included in this systematic review Twenty seven (27) studies dealt with physical activities, 12 studies dealt with smoking, 3 studies investigated alcohol consumption and only 1 study investigated dietary pattern with reference to ALBP. The major objective of all 32 studies was to investigate the association of LBP with lifestyle factors among adolescents. The age of the participants in the 32 studies ranged from 10 to 22 years, with the mean age of 14 years. Likewise, the sample size in the selected studies varied from 58 to as large as 9,600 twins.

2.6.1 Physical Activities

There were number of studies investigating the potential association of physical activity and LBP incidence in adolescents. The following studies based on inclusion criteria are selected for this review.

A cohort investigation of the natural history of back pain at adolescent stage, in participants of both sexes (n=216) was undertaken to determine the influence of sports participation and lumbar flexibility on BP (Burton, Clarke, McClune, and Tillotson (1996). The researchers undertaking this study concluded that back pain incidence is common in adolescents and was recurrent with some children requiring medical attention. The incidence of back pain was more predominant in males with a positive association with their sports when compared with females, at about 15 years of age. There was a negative correlation between severity and flexibility with sport, age and treatment.

A group of 116 children (10 to 19 years) were chosen by Newcomer and Sinaki (1996) to determine the incidence of adolescent LBP in students and its association with physical activity and back strength. The students were evaluated on their activity levels and their isometric back flexor and extensor strength were measured, without any intervention. The results showed an increase in the frequency of LBP incidence with previous history and previous year's history ($p= 0.02$ and 0.01 , respectively) of the problem. Further, there were significant associations between increased physical activity and history of back pain ($p=$

0.03), increased back flexor strength and history of back pain ($p= 0.03$) and rate of change in back flexor strength after 4 years with incidence of back pain ($p= 0.008$). The authors concluded, that LBP in adolescents increased with physical activity and that stronger back flexors were most likely to be associated with strains in musculotendinous and ligamentous sprains.

Harreby et al. (1996) conducted a cross sectional study with Danish school children aged between 13-16 years to identify risk factors of LBP. A group of 671 boys and 718 girls were recruited from 46 municipal schools. A two-part questionnaire was given to all students; the first section searched for a relationship between LBP and sports activities, computer use, watching television and smoking while the other section searched for a relationship of LBP with frequency and severity, influence on day-to-day life and use of the health system. The final outcome of the study indicated a positive relationship between LBP and smoking, poor life style, heavy work during leisure time, and excessive use of the health system in both female and male adolescents

Kristjansdottir and Rhee (2002) performed a study among 2173 Icelandic school children aged between 11-12 and 15-16 years to determine the relationship between physical, social and behavioural factors and LBP. The students were recruited on the basis of a self-administered survey questionnaire. The physical factors such as chronic health condition, physical fitness and tiredness were significantly linked with LBP. Similarly, behavioural factors such as eating, sports, watching television, computer use, and smoking had significant relation with LBP. Finally, students with low social supports were more likely to have LBP.

A population based study was conducted by Kovacs, Abaira, et al. (2003) among school children and their parents ($n=16,394$) to identify the incidence of ALBP and assess its presumed risk factor. Using self-administered questionnaires, information on smoking, alcohol, sports activities collected. The outcome of the study indicated a significant relationship between LBP and time of playing sports ($P<0.003$, $P<0.001$) in both students and their parents. However there was no relationship between smoking and LBP or, alcohol and LBP.

In a cross sectional study involving 1446 school children in North-West of England (11–14 years), Watson et al. (2003) found that neither mechanical factors such as weight of school bag or physical activity were associated with the LBP, but emotional and behavioral problems lead to an increased incidence of physical pain including LBP.

A cross sectional study was conducted by Sjolie (2004) among 88 students (mean age 14.7 years). Sixty-six percent of the students reported physical activities 3 times/week or more. Similarly, the median time spent on watching television or computer was around 15 hours. The findings revealed an inverse relationship between physical activities (walking, cycling) and LBP.

Among children and adolescent aged between 10 and 18 years, the prevalence of self-reported LBP was explored by Oliveira and Cabri (2006) in the Lisbon area of Portugal. Their sample contained 564 girls and 575 boys, and a cross sectional, descriptive; survey was used to collect data. No significant difference was found between sports and non-sports participation groups in terms of LBP ($P>0.5$). However, the LBP prevalence was significantly higher in children involved in sports activities beyond 14 hrs/week ($P<.05$). Tobacco consumption, watching TV, and computer use, was not significantly associated with self-reported LBP ($p>.05$).

A cross-sectional population of 400 Kuwaiti school children (10 to 18 years) was studied by Shehab and Al-Jarallah (2005) for factors associated with low-back pain linking with their performance in school and social activities. The findings reported that adolescent females involved in strenuous physical activities, watching TV for long hours, students who achieve academically and smokers were more likely to have LBP.

Diepenmaat, van der Wal, de Vet, and Hirasig (2006) recruited 3845 Dutch adolescents aged between 12 and 16 years and performed a questionnaire based survey and to determine the correlation of LBP, neck and shoulder pain with physical activity, computer use, stress and depression. Low back pain, shoulder and neck pain were significantly more prevalent among females and adolescent staying without parents. Psychosocial factors such as stress and depression were also significantly associated with LBP, neck and shoulder pain. However, no significant association was found between neck/shoulder, LBP and physical activities and computer use.

Mogensen et al (2007) carried out a cross sectional study with 439 Danish children aged between 12 and 13 years to investigate the link between specific sports activities and LBP and to identify the differences in pain among sports and non-sports participants. Data were collected by using questionnaires, semi-structured interviews, and physical examination. No significant associations were found between LBP and sports activities

A cross sectional study was conducted by Skoffer and Foldspang (2008) to identify types of physical activities associated with decreased occurrence of LBP among 546 participants aged

between 15 to 16 years. Physical activities such as swimming and number of hours participating in soccer were significantly associated with lower occurrence of LBP when compared to jogging, handball, general play and gymnastics.

The association between physical activity and sitting duration with LBP was studied in 5999 participants from a Northern Finland 1986 birth cohort by Auvinen et al (2008). Data analysis showed that increased physical activity was associated with increased "consultation for LBP" among both sexes and "reporting LBP" in the female group. Increased sitting hours resulted in "consultation for LBP" and "reporting LBP" only in female group. Overall, increased physical activity in both sexes, and prolonged sitting hours in females, was associated with the "reporting LBP" Factors associated with LBP were also studied by Szpalski, et al (2002) among 287 school children (aged 9 to 12 years) in Antwerp, Belgium using prospective, longitudinal study. The data collected included health perceptions, health issues, and sports, weight of satchel, habits and family history for LBP. Results indicated that LBP was predominant among children who reported lack of walking activity ($P < 0.0001$). However, children with initial LBP did not complain of its continued presence at the end of the study. Psychological factors and poor health perceptions seemed to play a significant role on reporting the experience in LBP similar to adults.

In a cross-sectional study by Hangai et al. (2010) the relationship between LBP with duration and type of sports in young age group was investigated. Information from 4667 student participants relating to LBP was analyzed relative to duration and type of sports activity. Results revealed that LBP was related to competitive sports and resulted in absenteeism, extreme pain and numbness in the extremities. Similarly, the severity of the LBP extending to the extremities was higher in volley ball.

The role of work characteristics on ALBP was evaluated by Mikkonen et al. (2012) among 1984 members, aged 18 years from the Northern Finland Birth Cohort (1986) for their association between work characteristics and LBP. This concluded that duration of work posed a risk for LBP among adolescent group of both sexes. A similar study by Jones et al. (2003) including 1046 school children in Northwest England concluding that children without any predisposition to LBP were under higher risk when psychosocial factors, similar to that of adults were noted. However, the use of mechanical weights did not establish any association.

Sato et al (2011) performed a cross sectional study to describe the relationship between sports activities and LBP using 43,630 Japanese school children comprising elementary school pupils from 4th to 6th grade (21,893 pupils) and junior high pupils from 1st to 3rd year (21,737

pupils) Out of these, only 26, 766 people provided a valid response. Among them, 2591 people had LBP at the time and 8588 people had history of LBP. Based on sports participation, the pupils were separated into two groups. Further, the severity of LBP was divided into three and compared with sports and non-sports group. Between these two groups, the prevalence of ALBP was significantly higher in sports group ($P < 0.001$) than non-sports. Moreover, the amount of time spent beyond 9.8 hr per week for sports activity was also positively related with LBP.

Yao et al (2012) investigated the risk factors associated with LBP among 1,214 Chinese adolescents who participated in a case control study. Participants were separated into two groups as cases (607, having a history of non-specific LBP) and control (607, without history of non specific LBP). Each participant was examined for family history of non-specific LBP, school bag weight, living condition, sedentary activities, and physical activities. Both football and basketball participation were positively associated with non-specific LBP.

2.6.2 Smoking

Feldman et al. (1999) performed a prospective, repeated-measures cohort design study on 502 students to identify if smoking was an associated causative agent for the development of LBP (LBP). In comparison to non-smokers, smokers experienced severe back pain. A dose-response relationship was found between LBP and smoking frequency but no differences in physical activity levels were found. Further, smokers experienced severe pain in upper and lower limbs compared to non-smokers. Following this, Feldman et al (2001) conducted a further cohort study to identify other risk factors for LBP development. A sample of 502 high school students was selected in this study. Risk factors such as smoking, tight hamstring, tight quadriceps femoris and working part-time were significantly associated with LBP (Feldman et al., 2001).

A cross sectional and prospective study was conducted by Hestbaek et al., (2006b) among 9,600 monozygotic twins spanning 12 to 22 years (age range) with the intention of analysing the association between smoking, overweight and alcohol consumption and to evaluate their present and future risk of LBP. A follow up survey ($n=6554$) was conducted after eight years to find out whether LBP was significantly correlated with life style factors at baseline. Factors associated with significant results were then tested in a twin-control study design. Results of this cross sectional study showed a positive correlation between life style factors and LBP.

However, the longitudinal study revealed a negative relationship between LBP and alcohol consumption. At baseline, smoking showed a monotonic dose-response relation with LBP. Finally, no statistically significant differences were found between all the three life style factors and LBP in this twin-cohort study.

Mikkonen et al. (2012) conducted a prospective cohort study among adolescents northern Finland in a 1986 cohort to identify smoking as a risk factor of LBP. The participants were examined at birth and at 16 years of age. The results indicated that regular smoking in adolescence was directly associated with LBP. Females were likely to be more susceptible to LBP than their male counterparts. Pack-years of smoking were correlated with high prevalence of LBP in females, a result only infrequently noted in males.

2.6.2 Alcohol

An independent association between neck/shoulder pain (NSP), back pain (BP) and adolescent drug use was tested by Heaps et al. (2011) among 1608 14 year old Australian adolescents. In order to evaluate the odd ratios of cigarette and alcohol use, multiple logistic regression was employed. The final outcome of the study indicated a positive relationship between alcohol and NSP and BP, but no significant association between cigarettes and NSP and BP.

2.6.3 Food habits

Perry et al. (2010) conducted an exploratory cross-sectional study to analyze the relationship between adolescent spinal pain and diet. A sample of 124 females and males aged below 14 years (696 girls, 728 boys) were recruited in Perth, Western Australia. Compared to males, females were likely to report and describe increased levels of spinal pain. Increased intake of eggs, meat, Vitamin B12, and cereals were significantly associated with development of spinal pain among girls.

2.7 Discussion and Conclusion

A total of 32 studies were included in this systematic review with 27 studies focusing on physical activities, 12 on smoking, three on alcohol and only one investigating the association of food and drink habits on LBP among adolescents. The following section discusses the findings obtained from this systematic review.

2.7.1 Physical activity and ALBP

Among other modifiable risk factors, physical activities gained much attention of several researchers (Auvinen et al., 2008; Diepenmaat et al., 2006; Fritz & Clifford, 2010; Grimmer & Williams, 2000; Hakala, Rimpela, Saarni, & Salminen, 2006; Hangai et al., 2010; Jones et al., 2003; Kovacs, Abaira, et al., 2003; Kujala et al., 1999; Mierau, Cassidy, & Yong-Hing, 1989; Mikkonen et al., 2012; Mogensen et al., 2007; Newcomer & Sinaki, 1996; Oliveira & Cabri, 2006; Rivinoja et al., 2011; Sato et al., 2011; Shehab & Al-Jarallah, 2005; Skoffer & Foldspang, 2008; Szpalski et al., 2002; Watson et al., 2003; Yao et al., 2012). A majority of the findings of the studies have indicated a positive relationship between physical activities and LBP among adolescents (Fritz & Clifford, 2010; Mikkonen et al., 2012; Sato et al., 2011; Yao et al., 2012). Harreby et al. (1999) indicated a direct relationship between degree of sporting activity and ALBP. However a few studies indicated a negative relationship between physical activities and ALBP (Diepenmaat et al., 2006; Mogensen et al., 2007; Oliveira & Cabri., 2006) or no difference (Feldman (1999). Moreover, Fritz and Clifford (2010) suggested the results of their research advocate for the use of physical activity to treat LBP among adolescents. The role of physical activities on ALBP was investigated by calculating the hours of playing per day and per week. In this review, the majority of the included studies focused on physical activities such as body building, volleyball, basketball, swimming, football and basketball, gymnastics (very light/ light/ moderate/ heavy/ very heavy) and revealed a positive relationship between various forms of physical activities and LBP except swimming, where a positive relationship was observed.

2.7.2 Smoking and LBP

In this review, there were ten studies included for review of the association between smoking and ALBP (Feldman, Harvey, Holowaty, & Shortt, 1999; Harreby et al., 1995; Heaps et al., 2011; Hestbaek & Leboeuf-Yde, 2000; Kovacs, Abaira, et al., 2003; Kristjansdottir & Rhee, 2002; Mikkonen et al., 2012; Oliveira & Cabri, 2006; Shehab & Al-Jarallah, 2005). Seven of these studies showed a positive association between smoking and ALBP while three studies indicated a negative relationship between the two variables (Oliveira & Cabri, 2006; Shehab & Al-Jarallah, 2005). The majority of the included studies

employed a cohort design and also investigated other lifestyle factors such as physical activities and alcohol. Moreover, most of the studies employed smoking as a dichotomous variable and classified participants as a smoker or a non/former smoker. However most of the studies did not report the smoking frequency of participants and this lack of quantification is a limitation of the findings.

2.7.3 Alcohol and LBP

Only three studies analysed alcohol as risk factor for LBP in adolescents (Hestbaek et al., 2006a). The studies by Hestbaek and Leboeuf-Yde (2000) and Kovacs, Abaira, et al. (2003) demonstrated a negative association between LBP and alcohol consumption, whereas Heaps observed a positive relationship between the two. Heaps employed a dichotomous variable to investigate the effect of alcohol. The results of these studies yielded inconsistent results. These studies did not consider the alcohol intake rate or quantity which limits the validity of the results. In addition not possible to derive a conclusion based on the results of two studies that identified an association between alcohol intake and the prevalence of ALBP.

2.7.4 Food habits and LBP

At the time of review there were only limited studies relating LBP to food habits. There is a lack of adequate diet characterization (specific nutrients, diet quality, food groups and dietary pattern) and hence only one study met the given inclusion criteria. Perry et al. (2010) indicated that high intake of eggs, meat, Vitamin B12, and cereals was related to increased rate of spinal pain. In this study, sex-specific multiple analyses were employed including education level, socioeconomic status, student's waist girth and smoking practices as potential confounders. The role of food and dietary habits as being associated with the prevalence of LBP among adolescents cannot be justified due to this paucity of research. Future studies should focus on the influence of food habits on LBP in adolescents.

2.8 Potential confounding variables

In the present study, the following primary confounding variables for ALBP have been identified; sitting in front of TV and computer, school bag weight, sex, hamstring flexibility, back extensor strength, emotional and behavioural disorders. Similarly, secondary confounding variables are socioeconomic factors, school furniture, BMI, age and ethnicity. BMI, back strength, body composition and waist circumference have been previously linked to LBP and hence they are also included as potential confounders. The presence and assessment of primary and secondary confounding variables were evaluated during quality assessment using the Downs and Black checklist.

2.9 Limitations of the review

Certain relevant studies may be less well represented in the databases and may have been excluded from our research. A few studies containing potentially useful data were excluded since few of these studies failed to provide statistical analysis and age group. Moreover, a number of studies did not control for possible confounders. Finally, the variety of scoring systems, and inadequate reporting of many of the trials may have led to some misunderstandings during our evaluation of risk factor association with LBP in the individual studies.

2.10 Implications of the study

The prevalence of LBP in adolescents appears to be increasing, however, there were only limited studies dealing with two or more modifiable lifestyle factors at the same time. We therefore recommend further research to assess the role of lifestyle factors on LBP in adolescents. Based on this systematic review, such future studies should focus on the association between dietary pattern, smoking and alcohol consumption with LBP in adolescents. These studies will likely play an important role in public health research as they will help to identify modifiable risk factors and enable development of more healthy life styles for adolescent school children. Currently, there is a lack of agreement among authors in terms of definitions of ALBP, associated risk factors and consequences of pain. Hence, a consensus is necessary for the above-mentioned variables and an approach to investigate outcomes among adolescent populations. In addition, further epidemiological studies are required to provide evidence for risk factors for ALBP among adolescents.

Summary

Although ALBP is a public health concern there are only limited studies focusing on the effects of lifestyle factors on the prevalence and severity of this condition. From this systematic review, it is clear that there is a positive relationship between smoking, physical activities and ALBP. Due to limited number of studies and inconsistent results, it is not possible to ascertain the relationship between dietary pattern, alcohol consumption on and ALBP. A number of studies have investigated the role of physical activities with respect to LBP utilizing one or two of the risk factors such as smoking and drinking as confounding variables. Moreover, variables have been adjusted to investigate the relationship of either of these risk factors with LBP. However, to the author's knowledge no studies have investigated the cumulative effect of various risk factors such as smoking, alcohol consumption, physical activities and food habits on LBP occurrence. More studies should focus on relationships between lifestyle factors and LBP among adolescents to provide the information that might support appropriate intervention and prevention strategies for this age group.

Chapter 3 Methods

3.1

Study design & Set up

A cross-sectional observational study, exploring the association between PALs, current smoking, food and drink consumption pattern and LBP, in adolescent females. Information was gathered using a customized self report questionnaire called the Otago Back Pain Questionnaire (OBPQ) and supplemented by a series of physical measurements which were gathered on same day that the questionnaire was administered.

3.2 Development of the Otago Back Pain Lifestyle Questionnaire

The Otago Back Pain Lifestyle Questionnaire

The OBPLSQ consisted of five different sections: demographics, low back pain, PAL, smoking and food and drink consumption. The sections were broken down into 48 multiple choice questions for which only one answer was permitted excepting for the ethnicity and Modified Hanover Low Back Pain Questionnaire, where multiple answers could be selected. . The individual questions were taken from validated instruments in similar populations to that of the current study (McLean, & Tobias, 2004; Currie et al., 2001; Kourinka et al., 1987; Papageorgiou et al., 1995; Watson et al.:2002; Adolescent Health Research Group, 2007; Vereecken & Maes., 2003; Mgarrey et al., 2009; Wong et al., 2012). A full copy of the questionnaire is detailed in Appendix H.

Administration of the Otago Back Pain Lifestyle Questionnaire

The OBPLSQ was administered on-line via the LimeService® platform (www.limeservice.com). As part of the questionnaire set-up each question was coded uniquely and the document was then converted and saved as an excel comma separated value file before uploading to the survey website. Technical issues associated with the development

of the on-line access were guided by an experienced professional from the Human Nutrition Department, University of Otago.

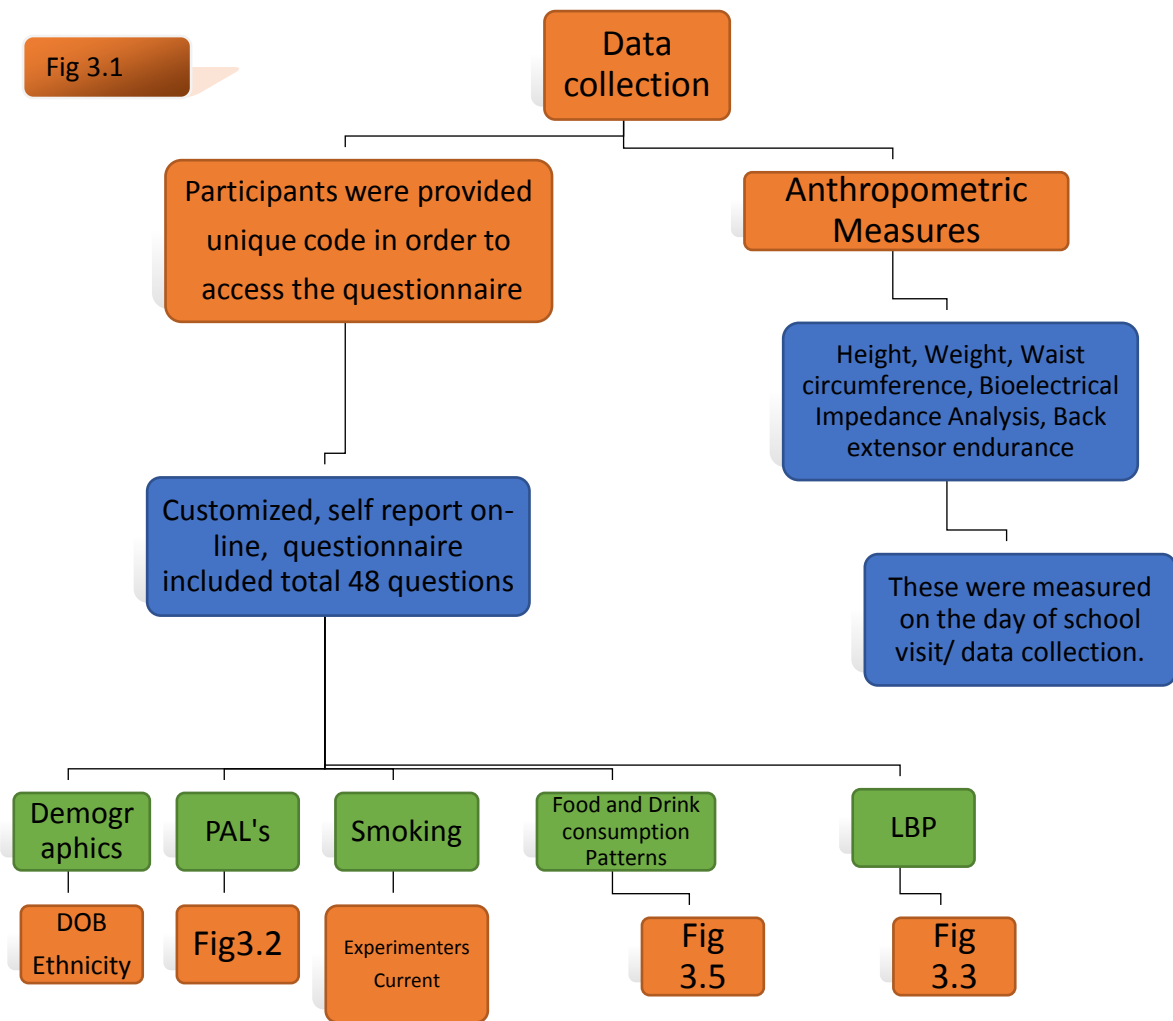


Figure 3.1 shows the process involved in collecting the data in the present study

Only successive access to the subsequent sections was permitted i.e. participants could not move to the next section before completing the current section they were working on in order to ensure all the questions were answered and so minimized missing data. The participants completed the questionnaire individually but were able to seek clarification from the

investigator who was always present in the computer room where the participants were accessing the on-line survey.

The Otago Back Pain and Lifestyle Questionnaire structure

The OBPLSQ data were categorized and organized as follows.

Section I-Demographics

Information regarding the participant's date of birth and ethnicity was gathered where age was calculated from the date of birth data. Ethnicity data were categorised into three groups; New Zealand European or Other (NZEO), Maori, or Pacific Island in accordance with other New Zealand surveys (University of Otago, MOH 2011). A prioritised system was used for ethnicity classification whereby a participant was categorised as 'Māori' if 'Māori' was one of the boxes selected, regardless of other selections and those selecting any Pacific Island ethnicity were classified as 'Pacific Islanders'. All other participants were classified as 'New Zealand Europeans' and 'Others'. (NZEO). The 'Other' group included 'Chinese', 'Japanese', 'Dutch', 'Tokelauan', and 'Indian' and were combined with 'Europeans' as these ethnicity numbers were very small.

Section II-Physical Activity Levels (PAL)

The PAL section incorporated two previously validated questionnaires; a: the New Zealand Physical Activity Questionnaire – a) Short Form (NZPAQ-SF)' (McLean, & Martin Tobias, 2004) and b). the Health Behavior in School-aged Children (HBSC) (Currie et al., 2001).

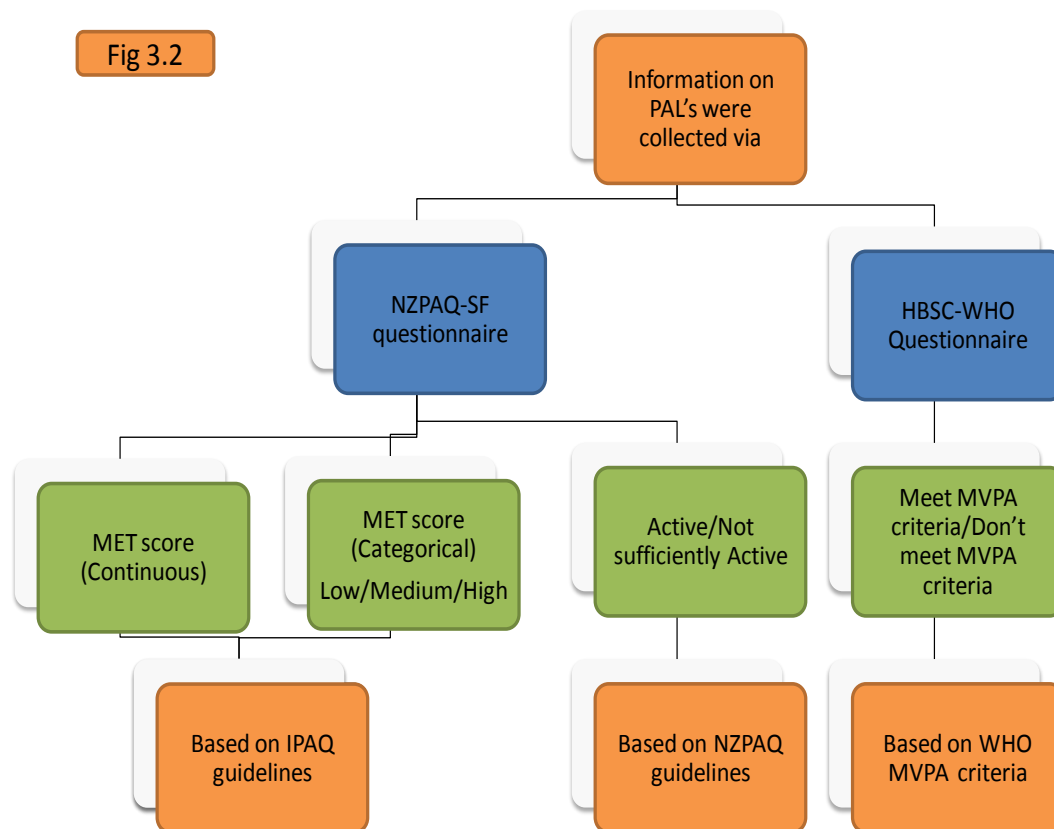


Figure 3.2 illustrates the scheme use to collect and categorize the information on PALs

The New Zealand Physical Activity Questionnaire-Short form

The NZPAQ-SF was developed by Sport and Recreation New Zealand (SPARC) and the Ministry of Health, with contribution from Statistics New Zealand and was designed to assess three dimensions of physical activity (frequency, duration and intensity). The questionnaire has eight questions and includes examples of different activities to assist with understanding different levels of activity. The NZPAQ-SF collects information on the participant's involvement in walking, moderate and vigorous physical activity in the last seven days. It is a modified version of the International Physical Activity Questionnaire Short-Form (IPAQ-Short) (McLean, & Martin Tobias, 2004).

The NZPAQ-SF has been validated against two self-report instruments (the NZPAQ-LF and IPAQ-Long) as well as heart rate monitoring, an objective measure of energy expenditure. Over all, both versions of these questionnaires were strongly correlated for walking and vigorous activity but poorly correlated for moderate intensity activity. When activity levels

were grouped into categories, both short and long form instruments yielded similar results, despite the comparatively modest Spearman correlation coefficients (not available) between the two questionnaires. (NZPAQ short and long form) (McLean, & Martin Tobias, 2004 & Moy et al., 2003). The test-retest reliability correlation co-efficient for the NZPAQ-SF questionnaire between days 8 and 15 was found to be 0.69, ($p < 0.0001$).

According to Maddison et al., (2007) both questionnaires underestimated the physical activity related energy expenditure compared to that of doubly labelled water. This was more evident at the high physical activity levels, and NZPAQ-SF underestimated more (59%) when compared with the IPAQ (27%). Similar results were reported by Mao et al., (2003), who worked with the development validation of the NZPAQ-SF, they found overestimation at low activity levels and underestimation at the higher activity levels. Overall, the findings of Moy et al., (2003) and Maddison et al., (2007) support the use of NZPAQ as a measure of physical activity for the purpose of epidemiological research and suggest the use of appropriate calibrated correcting factors (“equating one minute vigorous with two minutes moderate intensity activity”) when interpreting the PAL data for best results (McLean , & Tobias, 2004).

Health Behaviour in School-aged Children Questionnaire

The HBSC questionnaire was also incorporated into the current on-line questionnaire. The HBSC questionnaire was designed to evaluate PALs in children from 11-15 year and in collaboration with the World Health Organization, Europe (School Health: Health Behaviour in School-Aged Children) The HBSC questionnaire includes one question developed by Prochaska et al., (2001) asking participants about the involvement in *any physical activity of moderate intensity that lasted for at least 60 minutes per day in a week (number of days)* The definition of physical activity was modified in order to include PA performed in school time and it was this definition that was included the actual PA questions used in the current study.

PALs were determined by calculating the metabolic equivalents (METs) and classifying participants into three categories of PALs. The PALs were based on the criteria as follows:

- a. low/medium/high based on MET minutes
- b). active/not sufficiently active according to the criteria developed by the New Zealand PA guidelines; meeting the moderate to vigorous physical activity MVPA criteria that have been

established by WHO (Physical activity and young people) were derived from the two (NZPAQ-SF and WHO HBSC) questionnaires.

Categorization of Physical Activity Levels

The NZPAQ data was first cleaned according to the IPAQ 2005 guidelines in order to minimise the possibility of introducing variability into the data. The data was then double checked to make sure that there is no misclassification and that the highly active participants remain classified under 'high' category and less active participants were categorized 'low' thereby decreasing the chances of miss-categorization.

The MET values were based on those by Craig et al., (2003). In the present study the values used for the conversion to MET-minutes/week for the three intensity levels of PA were those according to Craig., et al (2003) as follows:

Walking MET-minutes/week = $3.3 * \text{walking minutes} * \text{walking days}$

Moderate MET-minutes/week = $4.0 * \text{moderate-intensity activity minutes} * \text{moderate days}$

Vigorous MET-minutes/week = $8.0 * \text{vigorous-intensity activity minutes} * \text{vigorous-intensity days}$

The total MET-minutes/week score was also calculated as the sum of walking + moderate + vigorous MET minutes/week scores

Finally three categories of PAL were based on the total MET-minutes/week score:

- a) Low-No activity reported/some activity reported but with a MET minutes/week score below total 60
- b) Moderate-Five or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of at least 600 MET- minutes/week
- c) High-Seven or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum Total physical activity of at least 3000 MET-minutes/week

Data from NZPAQ section in the on-line questionnaire were also categorized according to current New Zealand PA guidelines for children and young people (SPARC and the Ministries of Health and Education, 2007) where two sets of criteria were created. This

categorization was carried out using the conversion recommended by (McLean, & Tobias, 2004) where equating one minute vigorous activity with two minutes moderate activity.

Responses from the HBSC questionnaire were computed by taking the sum of the last and typical week (*number of days active for a total of at least 60 minutes*) (Prochaska et al., 2001) to provide the average number of days the participants were MVPA in last seven days for a total of at least 60 minutes. After calculating the average scores the participants were categorized as a) MVPA criteria met b) MVPA criteria not met. An average score of five or more meets the primary guideline of at least 60 minutes of MVPA on five or more days.

To summarize the PAL's were categorized using three different methods:

(a) NZPAQ (SPARC) guidelines, by equating one minute vigorous activity with two minutes of moderate activity; categorized into two groups-Active/Not sufficiently active

(b) Using International Physical Activity Questionnaire (IPAQ) guidelines (Categorized based on Metabolic Equivalent (MET) scores); further divided into two ways, categorical (low, medium, high) and continuous (based on continuous MET score) variables.

(c) Responses based on Health Behaviour in School Children Questionnaire-categorization of participants based on the Moderate-Vigorously Physically Active (MVPA)-World Health Organization (WHO) criteria

Following table shows the specific guidelines used for deriving categories of PAL's from NZPAQ and HBSC questionnaires

Table 3.1 shows the categorization of PAL's using specific guidelines

NZPA Questionnaire	Using NZPAQ/SPARC guidelines	Using IPAQ guidelines	
	Active/not sufficiently active	MET scores derived	
		Low/medium/high	Continuous MET score; Mean±SD
HBSC Questionnaire	Using MVPA-WHO criteria		
	Criteria met/Criteria not met		

In current study, two different questionnaires and three methods were used to derive the information from these questionnaires in order to gather data on PAL's of the participants. This was done to increase the reliability of the data collected. The NZPAQ used in this study is designed for population aged 15 years and above, but the age range of participants of current study was 13-18 years, hence this questionnaire by itself was not deemed sufficient to collect the data. Although this tool did not cover the entire age range of current study, this questionnaire is specifically designed for NZ population and allows collecting detailed information in regards to NZ scenario. The second questionnaire, HBSC, is age specific tool for adolescents and is recognised by WHO to gather information on PAL's for this population. Further, use of tool specific and international guidelines (NZPAQ and IPAQ respectively) to derive results from these questionnaires allows interpreting the data in most robust way.

Section III-Low Back Pain (LBP)

The Nordic Low Back Pain Questionnaire (NLBQ) (Kourinka et al., 1987) was modified in order to collect the information regarding period and point prevalence of LBP for the current OBPLS questionnaire. The participants were asked "*If you had experienced low back pain which has lasted for one day or longer at different point of times such as lifetime, in last three years, last year, past six months or if they currently had low back pain*" (Appendix L) This question was included in order to gain insight into the prevalence of LBP at different time intervals for this adolescent population. The NLBPQ questions had originally been designed for surveys, interviews and to assess the duration of the symptoms and to determine the effect of these on the work related/ergonomic activities (Kourinka et al., 1987). The test-retest reliability of the preliminary NBLBQ was trialled by administering the questionnaire twice over a 15-day interval to 25 nursing staff (Kourinka et al., 1987). The percentage of disagreeing answers on an average was 4-4, varied from 0 to 4% with exception of one question which was reformulated later on (Kourinka et al., 1987).

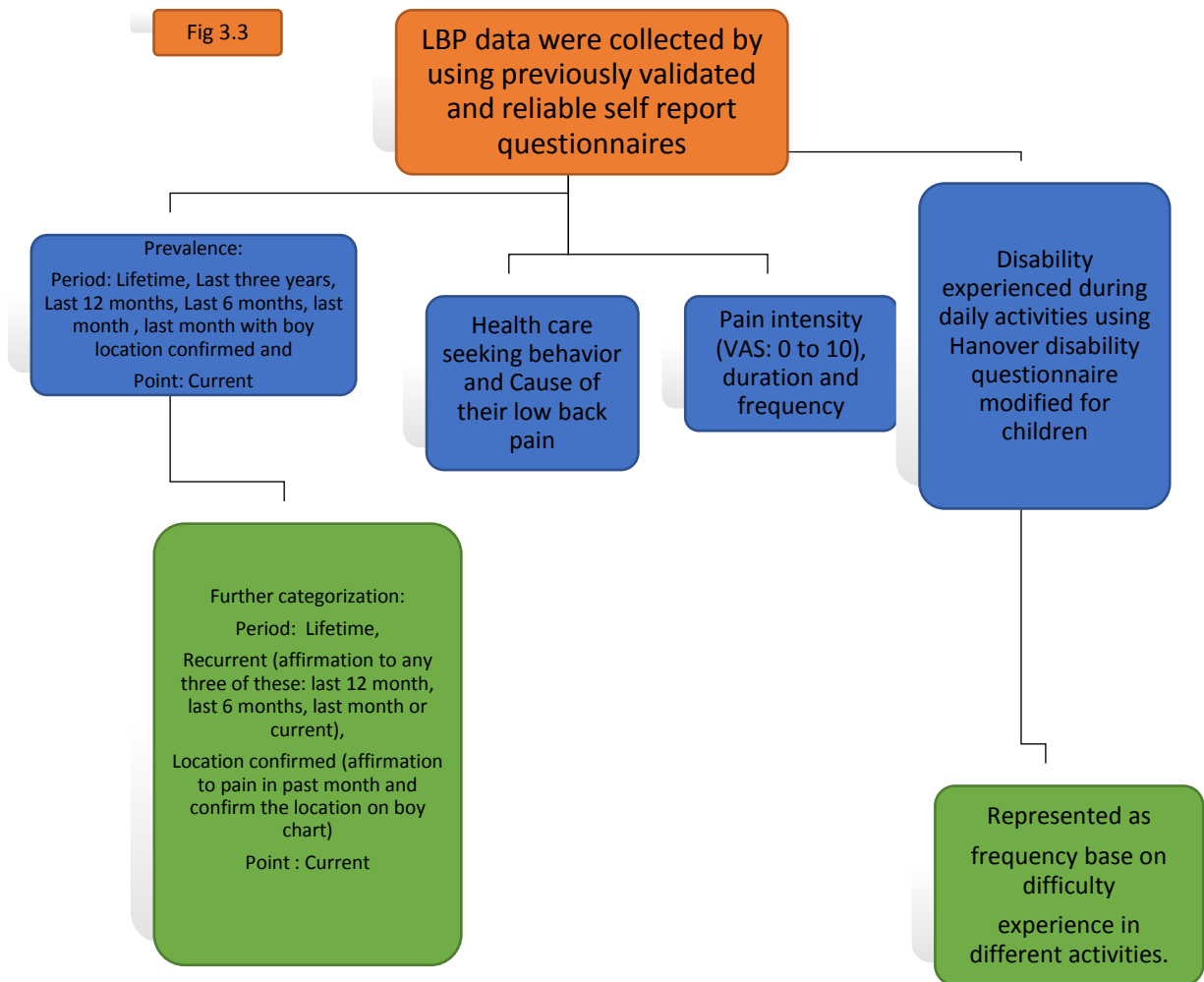


Figure 3.3 shows the information collected on LBP and further categorization of different prevalence's.

1)In the current OBPLS only the question relating to the period prevalence was modified “Have you ever had low back pain trouble (ache, pain or discomfort) for information on ‘lifetime, last three years, last year, past six month and current experience of low back pain”.Information regarding experience in the in past month was gathered using two questions,(“In the past month have you had low back pain which lasted for one day or longer?” and “In past month have you experienced pain in the shaded area which last for day or longer?”)taken from the South Manchester Low Back Pain Study (Papageorgiou et al., 1995)

An electronic body chart (fig 3.4) embedded into the questionnaire confirmed the location of the pain.

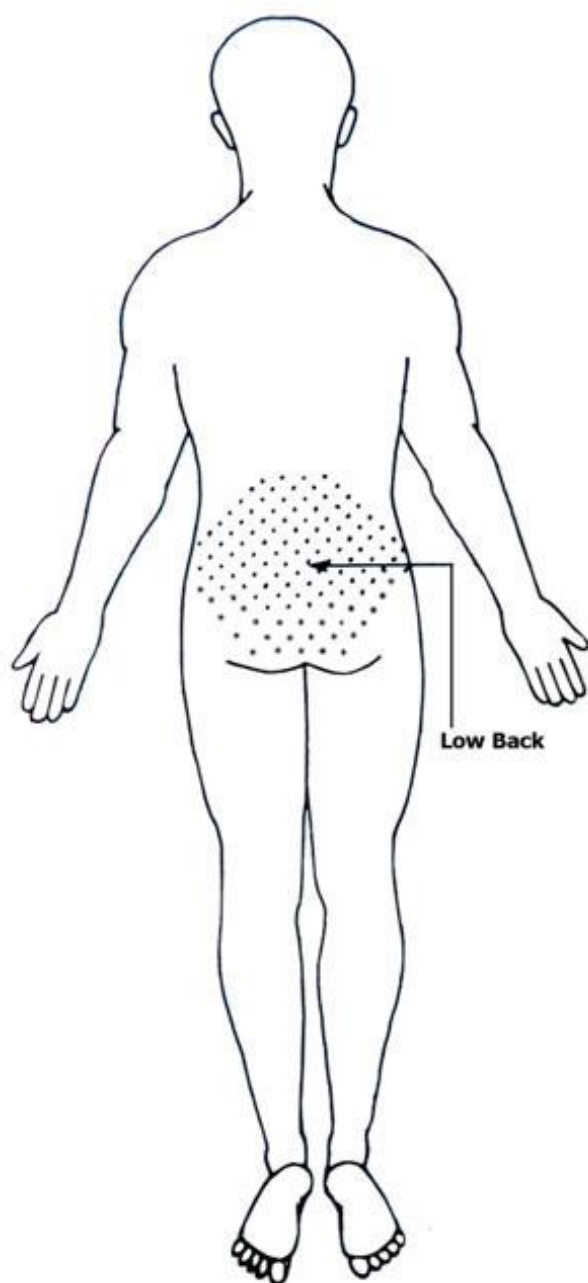


Fig 3.4 Body chart depicting shaded lower back area.

In order to be classified as having LBP participants had to respond positively to both questions (Papageorgiou et al., 1995), and low back pain was defined according to the South Manchester Study (Papageorgiou et al., 1995) as shaded area between the 12th rib and lower gluteal fold.

Participants who responded positively to having LBP within the Lifetime, Three years, Last year, Past six months, Past month or Current options were then permitted to assess the LBP section.

In order to avoid any confusion in the analysis, participants were categorized into “Lifetime LBP experience”, “Recurrent LBP”, “Past month LBP” and “Current LBP” based on their responses and separate analysis was carried out for each category. The period and point prevalence for the LBP data were categorized based on responses of the participants and termed accordingly. These terminologies of LBP as defined below have been previously used by investigators (Walsh et al, 1992; Smedley et al., 1995,). Separate analyses were performed for each of the three LBP experience categories.

1 Lifetime-participants who answered positively to the question *“Have you ever experienced low back pain in your lifetime that has lasted for day or longer?”* were categorized under this category (Walsh et al, 1992; Smedley et al., 1995; Papageorgiou et al 1995)

2 Recurrent-participants who answered positively to three or more of the following questions were categorized under recurrent LBP category i.e. those who had reported LBP three or more times in last 12 months. (Vonn K M. 1994)

1. *“Have you ever experienced low back pain in last 12 months that has lasted for day or longer?”*

2. *“Have you ever experienced low back pain in past 6 months that has lasted for day or longer?”*

3. *“Have you ever experienced low back pain in past month that has lasted for day or longer?”*

4. *“Do you currently have low back pain?”*

3 Past month-affirmation to both of the following questions was required in order to be categorized in the past month (Papageorgiou et al 1995)

“Have you experienced low back pain in past month that has lasted for day or longer?”

“Have you experienced low back pain in the area marked in the picture that has lasted for day or longer?”

The OBPLS participants who reported having the experience of LBP, were also asked questions regarding the duration of the symptoms, health care seeking behavior (if they had or were consulting any health professional for their LBP) and if they had any associated

radiating pain. Intensity of pain (at its worst during past month) was evaluated using the visual analogue scale ranging from 0 to 10, the participants were asked to type a number with 0 being no pain and 10 being worse.

All the items mentioned above regarding the duration and symptoms of LBP including the care seeking behavior have been previously assessed for comprehensibility, validity and reliability for school children aged between 11-14 years. The test-retest reliability of the items regarding symptoms and duration of pain with a two week interval was found to be 80%. 83% responses were ascertained to be valid when questionnaire was compared to the interview with the researcher. (Watson et al., 2002)

Participants were also asked if their LBP made daily activities difficult for them. The list of nine activities had been originally developed by Roesse et al., (1996) and modified for young adolescents (Watson et al., 2002) Watson et al., (2002) demonstrated a high level of internal consistency (Cronbach's alpha= 0.71) and satisfactory item vs. item total correlations (0.35 - 0.47) for adults and adolescents. Trevelyan & Legg (2011) used this tool to measure LBP related disability in New Zealand school children aged between 11-13 years old and reported similarities in patterns of daily activities effected due to low back pain with the adult patterns of LBP report.

Section IV-Smoking

Questions in the Smoking section of the OBPLS questionnaire sought information on smoking status and patterns (Appendix L). The questions used for this section have previously been derived from the 2006/07 New Zealand Health Survey (NZHS) adult questionnaire and the New Zealand Youth Health Survey 2007/Adolescent Health Research 2007. Participants were asked "*if you have ever tried smoking/smoked a whole cigarette/ smoked a total of more than 10 cigarettes/smoked a total of more than 100 cigarettes? How often you smoke and how many cigarettes/day?*" In addition to these they were asked "*how old were you when you started smoking in order to determine the chronicity of smoking.*" Based on their responses, the participants were classified as either "experimenter, current, non-smoker". Those who answered yes to the questions - "*Have you ever smoked cigarettes or tobacco at all, even just a few puffs?*" were categorized as "experimenters". "Current smokers" were those who were actively smoking at the time of the survey. Those who either reported that they have not smoked or they do not smoke now were recorded as "non-smokers".

Inferential analyses were performed for only for current smokers.

Section V-Food and Drink Consumption

Food and drink intake was assessed using questions from the Non-Quantitative New Zealand Adolescent Food Frequency Questionnaire (NZAFFQ) (Wong et al, 2012), which was adapted from the HBSC FFQ (Vereecken & Maes., 2003) and Children's Dietary Questionnaire (CDQ) (Magarey et al., 2009). The NZAFFQ is a useful tool in terms of its design being short and practical to use in time limited surveys and is considered to be suitable to be incorporated in larger surveys where detailed measure of food intake is not feasible (Wong et al., 2012)

According to Wong et al., (2012) as part of the development of the NZAFFQ, registered nutritionists and dieticians were consulted to review NZAFFQ, so as to improve its face validity, before they did formal pretesting. The questionnaire had been modified based on feedback from group interviews with students of a similar age to those in the target age range for the current study to ensure it was relevant and comprehensible to Otago adolescents. The repeatability and relative validity of the FFQ had also been assessed before use in this previous study (Wong et al., 2012). Further, the short-term reliability of NZAFFQ had also been established by comparing two administrations of the FFQ over a two-week period and the relative validity was established against a Four-day Estimated Food Record (4DFR) (Wong et al 2012). NZAFFQ yielded good test-retest reliability with the median ICC of 0.69 (range 0.26-0.92). Wong et al (2012) reported the median Spearman's correlation coefficient to be 0.71, with all food groups achieving Spearman's correlations above 0.46 which fell within a range considered good reliability for an FFQ (0.50–0.80) (Cade et al, 2002; Willett & Lenart, 1998). It is worthy of note that these values were similar to the reliability of the CNS02 FFQ, the only previous FFQ designed for New Zealand children (Metcalf et al, 2003). Details of the items (Appendix L) taken from the NZAFFQ (Wong et al., 2012) were used in the OBPLS are outlined below.

Food and drink consumption habits were assessed by asking “ *On average, how many times a week do you usually eat or drink any of the following foods?*” The wide variety of food items likely to be included in the New Zealand diet were included as options are detailed in the questionnaire (Appendix L) The response option of “*Never, less than a week, once a week, 2-4 days a week, 5-6 days a week, once a day, more than once a day*” was given for each food choice?

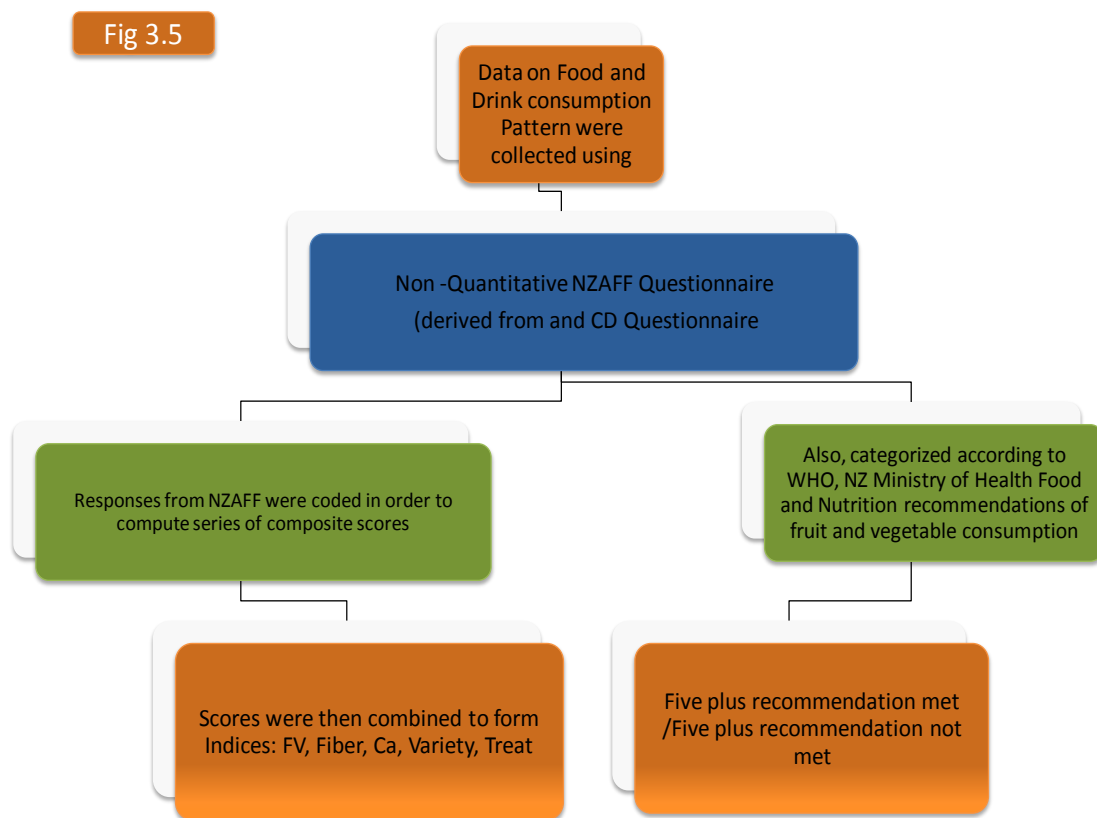


Figure 3.5 describes the organisation of food and drink consumption data

Coding of the dietary intake and construction of indices

The NZAFFQ response categories were re-coded in order to compute a series of composite scores and give them a form of *indices*. The following re-coding method was used:

“Never,=0, “less than once a week”=0.25“once a week”=1, “2–4 days a week”=3 (midpoint of the interval), “5–6 days a week”=5.5 (midpoint of the interval) and “once a day, every day” and “more than once a day, every day”=14 (Vereecken et al., 2008). The scores of food items were then combined together to form five indices. The indices were a) “fruit and vegetables (FV) index”, the FFQ consumption frequencies of fruit and vegetables were summed, b) “Fiber Index”, cumulated the consumption frequency of fruit, vegetables and brown bread, c)“Calcium-Index” (Ca Index), cumulated the FFQ consumption frequencies of whole fat milk, semi-skimmed milk, cheese and other milk products, d) “Variety index” summed up the consumption frequencies of fruits, vegetables, brown bread, whole fat milk, semi-skimmed milk, cheese and other milk products, e) “Treat Index”, Consumption frequency of carbonated sugared soft drinks, sweets, chips and crisps were summed up (Vereecken et al.,

2008). The continuous score obtained from these five indices were used in the subsequent linear regression model.

The participants were also categorized as a) Five plus recommendation met, b) Five plus recommendation not met. These categorizations were according to the WHO and the New Zealand Ministry of Health Food and Nutrition recommendations of consuming at least to eat five or more servings of colourful, fresh fruit and vegetables every day. The categorization was based on the responses from “*On average, how many servings of fruit (fresh, frozen, canned or stewed) do you eat PER DAY?*” and “*On average, how many servings of vegetables (fresh, frozen, canned) do you eat PER DAY?*”

In order to gain the information regarding the breakfast consumption two questions were asked 1) “*How often do you eat breakfast in weekdays?*” 2) “*How often do you consume breakfast in weekdays?*” The responses available were in *number of days* they consumed the breakfast.

3.3 Physical Measurements

A series of five physical measurements (including anthropometric data) were also gathered in order to provide objective data regarding the physical status of the participants.

Height was measured to the nearest 0.1 cm with shoes and socks removed with the head positioned in the Frankfurt plane (fig 3.6) (Marfell-J M., 2008) using a calibrated portable stadiometer (Invicta Plastics Ltd, Oadby, Leicester UK).



Figure 3.6 shows measuring height using calibrated stadiometer

Mid-point waist circumference (WC) was measured to the nearest 0.1 cm using a body composition non-elastic anthropometric tape measure (Seca, Germany) placed at the narrowest point between the lower costal border of last rib and the anterior superior iliac spine (Marfell-J M., 2008) (fig 3.7). The participants were asked to lift their shirts up and also instructed to breathe normally in order to get the exact measurement. The measurement was taken at the mid- expiration phase of the breathing cycle (Agarwal et al., 2009).



Figure 3.7 shows measurement of mid-point waist circumference using tape measure

Impedance, Body Fat Percentage, Fat Mass (kg), Fat-Free/Lean Mass (kg) and Body Mass Index were estimated with a calibrated foot-to-foot bio-electrical impedance analysis (BIA) scale (TBA-300A, Tanita Corporation, Japan), (fig. 3.8,3.9) which also measured body weight to the nearest 0.1 kilogram. Bioelectrical impedance analysis (BIA) is a non invasive, inexpensive, and portable method that has been used mainly for body-composition analysis (Barbosa-Silva et al., 2005)

Procedure Measurements were undertaken with the participants in their school uniforms in bare feet and a standard clothing weight of 0.5 kg was used to account for clothing. Participants were asked to remove all the metal accessories and to empty their pockets before stepping onto the scale. Investigators checked that participants' bare feet touched the metal plates and that no items of clothing were impeding this. Participants stood with feet on the metal plates and knees apart and with their arms down but slightly away from the body. Height was measured before BIA was undertaken so this information could be incorporated into the calculations.



Figure 3.8, 3.9 shows use of BIA scale to measure Impedance, Body Fat Percentage, Fat Mass (kg), Fat-Free/Lean Mass (kg)

Body Mass Index (BMI) was calculated as weight (in kilograms) divided by height squared (in meters). One Z score per person was calculated for BMI alone at 2 SD and followed the IOTF cut offs. The International Obesity Task Force (IOTF) cut off values were used to categorize the BMI values. Due to the small prevalence of obese individuals in the current sample, the overweight and obese groups were collapsed into one, hereafter referred to as overweight. Likewise, those with a low BMI-for-age (thinness) were collapsed in with the normal-weight category. BMI z scores were used in the regression analyses. Waist-to-height ratio (WHtR) was calculated as WC (in centimetres) divided by height (in centimetres) (reference).

Endurance of the Extensor Muscles of the Spine was measured using the modified Sorensen test known as “Ito test” (Ito et al., 1996). The ICC and test- retest correlation coefficients (after 72 hours) has been reported to be significantly high ($p < .01$), $r = 0.94$ for healthy females, and $r = 0.95$ for women with chronic LBP (average age 25.7 years, ranging

from 23 to 34 years). The ICC values exceeded 0.9 in both the cases ($P < .01$) (Ito et al., 1996). Performance time for controls and patients was reported as 128.4±53.0 and 70.1±51.8 seconds respectively (Ito et al., 1996).

Procedure The participants were asked to lie down in the prone position while holding the sternum off the floor. A small log roll was placed under their lower abdomen to decrease the lumbar lordosis (Shirado et al., 1995) (fig 3.10). Participants were instructed to hold their cervical spine in the maximum flexion position and to stabilize the pelvis while maintaining the horizontal position of the back against gravity. The test was terminated if either the participant was not able to maintain the position due to fatigue or after five minutes after starting of the test. The duration for which the subject was able to maintain the position was recorded using a digital stop watch (DSE-Mod. Y1299) and was measured in “seconds”.



Fig 3.10 Participant performing the Ito test.

3.4 Pilot Testing

3.4.1 Pilot test procedure

Before the actual commencement of the survey, the items of the questionnaire and the anthropometric techniques were tested for comprehensibility, achievability and feasibility.

For this process three female adolescents (14-15 years) were invited to complete the OBPLS questionnaire and after which, were asked to provide feedback on the clarity, comprehension and ease of completion of the questionnaire.

The physical measurements of height (cm), weight (kg), waist circumference (cm), body composition (fat percentage) and back extensor endurance (seconds) were also undertaken. The overall time taken to complete the OBPLS questionnaire physical measurements was computed for all participants.

3.4.2 Pilot test results

It was found that on an average it took the participants 20-25 minutes to complete the questionnaire and around seven minutes for the PI to do the measurements. All the females agreed that the questionnaire was easy to interpret, relevant what it was supposed to in order to gather the information on LBP and associated factors, demonstrating the face validity of the questionnaire. (Holden 2010., Gravatter & Forzano, 2012). No changes regarding the format of questionnaire were recommended by the participants. These participants were not included in the main study.

3.5 Recruitment Processes

Participants for the study were recruited with permission from the school principals located in rural Otago. A list of all the schools in the Otago region was accessed from Wikipedia (en.wikipedia.org) and the Ministry of Education website ([Te Kete Ipurangi](#)) in September 2011. Of the six schools for whom permission had been obtained to access selected classes from years 9 to 15 (based on the discretion of the school principal) female pupils were invited to take part in the study. The number of classes sampled at each school ranged from one per

year group to four per year group depending on the availability and number of students (size of the school) studying in the school. The data were collected over a period of two months (May-June 2012) which coincides with the term two of the New Zealand school year. The step-by- step recruitment process for this main study is outlined in Figure 3.11 below.

- Single sex girls and co-educational secondary school principals in Otago region invited to participate, *via preliminary email* , n=19 , Feb 2012

- Principals expressed interest, n=10

- Principals agreed, n=6, Wakatipu High school, Queenstown; Tokomairiro High School, Milton; Lawrence Area School, Lawrence; Cromwell College, Cromwell; Roxburgh Area School, Roxburgh; Maniototo Area School, Ranfurly. March- April 2012

- Digital copies of the information booklets for schools sent out to the school principals to reiew the details. April 2012

- The days for the school visits were fixed with the respective co-ordinators appointed by the principals for the study

- Hard copies of the information sheets for the students, parents, opt-out consent forms for parents and posters were sent out at least 15 days prior to the visit via post. April - May 2012, (appendix E, F, G, H, I, J, and K). Regular reminders via email about the study requirements were sent prior to the visit.

- On the day of the school visit, all the students who met the inclusion criteria and were present on the day, signed the consent forms. A brief explanation about the study was given before the start. Participants were given a unique token code in order to answer the questionnaire. This was followed by anthropometric measurements. May- June 2012

- After completing the data collection all the participants went in to the draw to win an IPod. The winner was chosen via random number generator software and they were sent out the prize via courier. November 2012.

Fig 3.11 Recruitment process

3.6 Study Inclusion and Exclusion Criteria

To be eligible the participants were required to be female and aged between 13-18 years (adolescent population) and to be physically present at the school on the day of the survey administration. Participants were also required to be able provide informed written ethical consent so as to ensure that all the participants could complete the questionnaires.

The exclusion criteria were a history of congenital or developmental spinal problems that had been diagnosed by a doctor and/or physiotherapist or, any spinal trauma or surgery in past year. Participants were also excluded if participants had a known neurological disease or pre-existing clinical conditions impacting on PA levels.

Information Sheets

Information sheets and consent forms were posted to the nominated school's contact person at least 15 days prior to the scheduled day of the data collection along with two posters designed to promote the study (Appendix E, F, G, H, I, J, K). The posters were displayed on the school's notice board for at least 10 days prior to the visit for data collection. On the day of data collection, the participants were required to sign a consent form in order to participate; parental consent was implied unless the parents did not wish their child to participate and provided the opt-out consent form.

3.7 Ethical approval

The study was approved by the University of Otago Human Ethics Committee (#11/223) (Appendix M), and Māori consultation was undertaken with the Ngāi Tahu Research Committee (Appendix N)

3.8 Token of Appreciation

All the participants went into a draw to win an iPod as a token of appreciation for participation. The draw was conducted using random number generator via the software 'Random Number Picker' accessed on 2nd November, 2012 (<http://www.thebestmoms.com/best/random>).

Fig 3.11 shows the stepwise recruitment process

3.9 Data Collection

On the day of data collection, the participants were required to sign a consent form in order to participate; parental consent was implied unless the parents did not wish their child to participate and provided opt-out consent. The study was designed to be completed during one class period and consisted of an online survey and collection of anthropometric measurements. Teams of two or more trained research assistants including the PI, conducted measurements at participating schools according to standard operating procedures.

After gaining consent each participant completed the on-line OBPSQ on a portal provided in the schools' computer suites. In every case the PI and research assistants were on hand to clarify any questions arising from the participants as they completed the questionnaire. The questionnaire took less than 30 minutes on average to complete.

3.10 Data Analysis

Descriptive data for LBP, PA, smoking, food and drink consumption were summarised as frequencies and percentages, means with standard deviations, or medians with inter-quartile ranges.

Three dependent variables of LBP categories (LBP lifetime, LBP recurrent, LBP location confirmed (LC)) were included in the multivariate regression analyses. Sixteen predictor variables: age; ethnicity; waist to height ratio (WtHR); body mass index standard deviation (BMI z score); BEE; fat percentage; PALs (New Zealand physical activity questionnaire (NZPAQ) and metabolic equivalents (METs); health behaviour in school children (HBSC); current smoking; and food indices (fruit and vegetable, fiber, calcium, variety, treat) derived from the food and drink consumption section, were each examined using univariate regression analysis with the three dependent variables. Only variables demonstrating $p \leq 0.2$ (purposeful selection of covariates, this is based on wald test from logistic regression) (Bursac et al., 2008) at the univariate level were entered into the multinomial logistic regressions (MLR) models.

A two-sided P -value of <0.05 was considered statistically significant. Statistical analyses were undertaken using STATA statistical software package version 10.0IC (StatCorp, College Station, TX, USA).

Chapter 4 Results

This chapter describes the results for the participants invited into the study, including response rate, distribution of the population, demographics and physical characteristics of the participants, description of their lifestyle habits.

The results are divided into two parts; section 4.1 descriptive statistics for recruitment of participants, basic demographic and anthropometric characteristics including age, ethnicity, height, weight, waist circumference, waist to height ratio (WHtR), back extensor endurance (BEE), BMI and percentage fat of the participants. This section also includes physical activity habits based on respective guidelines, and categorised for low back pain prevalence and characteristics, smoking habits and patterns of food and drink consumption.

Section 4.2 is focussed on the three models of LBP viz lifetime, recurrent and location confirmed on body diagram (LC) and provides results for regression modelling used to demonstrate the influence of lifestyle factors related on these different types of LBP. This was performed as a two step process as explained below:

First part, presents results derived using binary logistic regression (first step) to demonstrate the association between low back pain and sixteen predictor variables: age; ethnicity; waist to height ratio (WtHR); body mass index standard deviation (BMI z score); BEE; fat percentage; PALs (New Zealand physical activity questionnaire (NZPAQ) and metabolic equivalents (METs); health behaviour in school children (HBSC); current smoking; and food indices (fruit and vegetable, fiber, calcium, variety, treat) derived from the food and drink consumption section. Binary logistic regression was executed as a separate equation for each variable separately. “Control” was “0” or “no” or “low” in case of categorical variable being tested.

Second part, presents the results of multinomial logistic regression (second step) and includes all the independent variables; in step one, with p value ≤ 0.2 , in a single model, for all three categories of low back pain. The purpose of this model is to explore the lifestyle factors which influence the prevalence of low back pain when they are present collectively.

4.1 Demographic and Anthropometric descriptors

4.1.1 Recruitment

Data for the Otago Back Pain and Lifestyle study were collected between May-June 2012. At the time of recruitment there were 19 co-educational composite, secondary and single-sex schools in the Otago region with adolescent female students in Years 9-13. Letters of invitation were sent out to the principals of the 19 schools. Acceptances were received from six principals and declines from 13, including seven schools that were unable to participate because of other commitments. From the six schools, out of 848 students who agreed to participate, 468 were made available by the study co-ordinators on the day of data collection. Further, three students did not meet the inclusion criteria and were excluded from the study. Reasons for not completing the study were, to finish other tasks/shortage of time/test/lack of interest/other commitments. Finally, 322 eligible students completed the study-a participation rate of 69.2%

Complete data for the OBPLS questionnaire and physical measurements were available for 297 participants, making a completion rate of 92%.

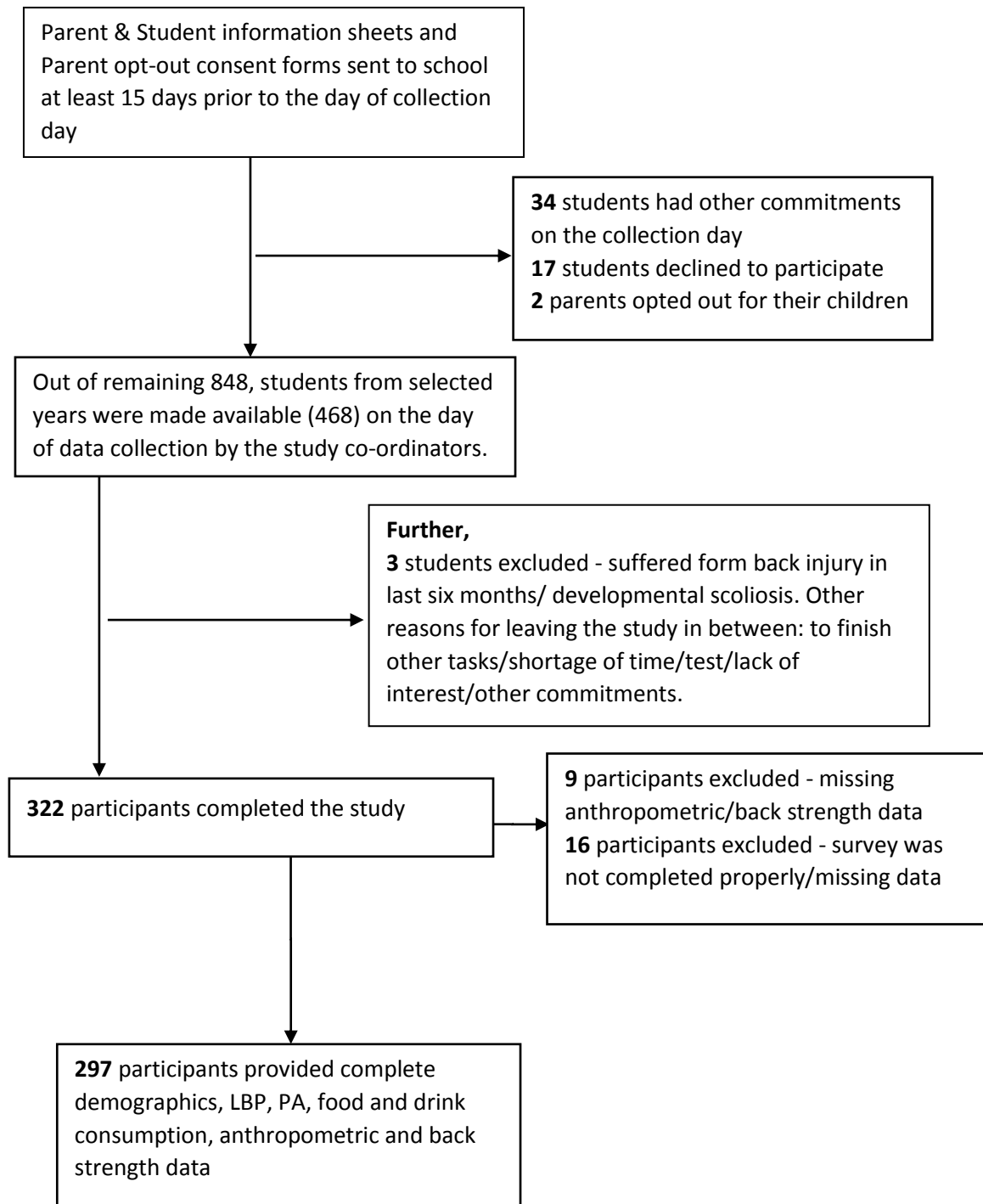


Figure 4.1: Flow chart to illustrate the recruitment of potential participants, reasons for not participating and exclusions and final numbers who participated in the OBPLS study.

Table 4.1 presents the demographics and the anthropometric characteristics of the study population. The majority of participants (62.2%) were aged between 13-14 years with

progressively smaller numbers in the older categories (Figure 4.1 result appendix), 76.4% were in normal BMI range (n=297)

	N(%) / Mean (SD)	Range
Age (years) mean (SD)	14.3(1.2)	13-18
Ethnicity n (%)		
Maori & Cook island Maori	18 (6.1)	
NZ European and Others	279 (93.1)	
Height (cm) mean (SD)	161.9 (6.6)	140 – 181
Weight (kg) mean (SD)	59.7 (12.3)	36 - 101.2
Waist Circumference (WC) (cm) mean (SD)	71.7 (9.2)	57 – 101
Waist to Height Ratio (WHtR) mean (SD)	0.4 (.0)	0.3 - 0.6
Ito Test (Back Extensor Endurance, (BEE))(sec)	136.9 (51.0)	14 -190
BMI n (%)		
Normal (Underweight & Normal BMI)	227 (76.4)	
Obese (Normal & Overweight BMI)	70 (23.6)	
BMI Standard Deviation (Z) Scores mean (SD)	0.00 (1.0)	-1.8 - 3.4
Fat (%)	29.28 (7.63)	5.2 - 52.4

4.1.2 Lifestyle descriptors

4.1.2.1 Physical activity categorization of the participants:

Responses from NZPAQ and WHO (HBSC) questionnaires are presented in table 1.2 below. The NZPAQ responses were calculated in accordance with the respective guidelines. These have been explained in detail in section 3.2.2.3 in methods.

The above table demonstrates that according to the NZPQ responses derived using SPARC guidelines 78.4% of participants were either relatively active or highly active, with the majority (43.4%) being highly active. Based on MET scores two thirds of the participants were moderately active and less than 5% reported to be involved in high levels of activity. The third category, focussed on the moderate to vigorous levels of activity and based on the responses, 33.3% of the participants met the criteria of being moderate-vigorously physically active and around two-thirds of them were not involved in any moderate- vigorous physically activity in seven days (over the last week & in an usual week) on an average.

Table 4.2 Categorization of participants physical activity levels (PAL's) based on New Zealand Physical Activity Questionnaire responses (New Zealand Physical Activity Questionnaire, SPARC guidelines), New Zealand Physical Activity Questionnaire response (International Physical Activity Questionnaire guidelines), Health Behaviour in School Children Questionnaire response (World Health Organization-Moderate to Vigorous Physically Active Criteria) (n= 297)

Categorization of PAL's					
(a)		(b)		(c)	
NZPAQ (SPARC guidelines), (total time equivalent to moderate activity over 7 days prior to the day of data collection)		NZPAQ (IPAQ guidelines), Based on MET score, (6212.23± 6830.73)		HBSC Based on WHO - MVPA Criteria	
	n (%)		n (%)		n (%)
Relatively inactive (<2.5 hrs)	(64) 21.5	Low (≤600)	(89) 30.0	MVPA Inactive	(198) 66.7
Relatively active (2.5 to 4.9 hours)	(104) 35.0	Medium (600 to 2999)	(195) 65.7	MVPA active	(99) 33.3
Highly active (5 or more hours)	(129) 43.4	High (3000 and above)	(13) 4.4		

Overall, it was observed that, when responses from NZPAQ (SPARC guidelines) and HBSC (WHO - MVPA) criteria were compared the percentage of the participants who reported to be moderately active, were similar, in both the categories. The figure below also demonstrates

the above observation as the blue line (NZPAQ) and the green line (HBSC) coincide at the moderate activity levels.

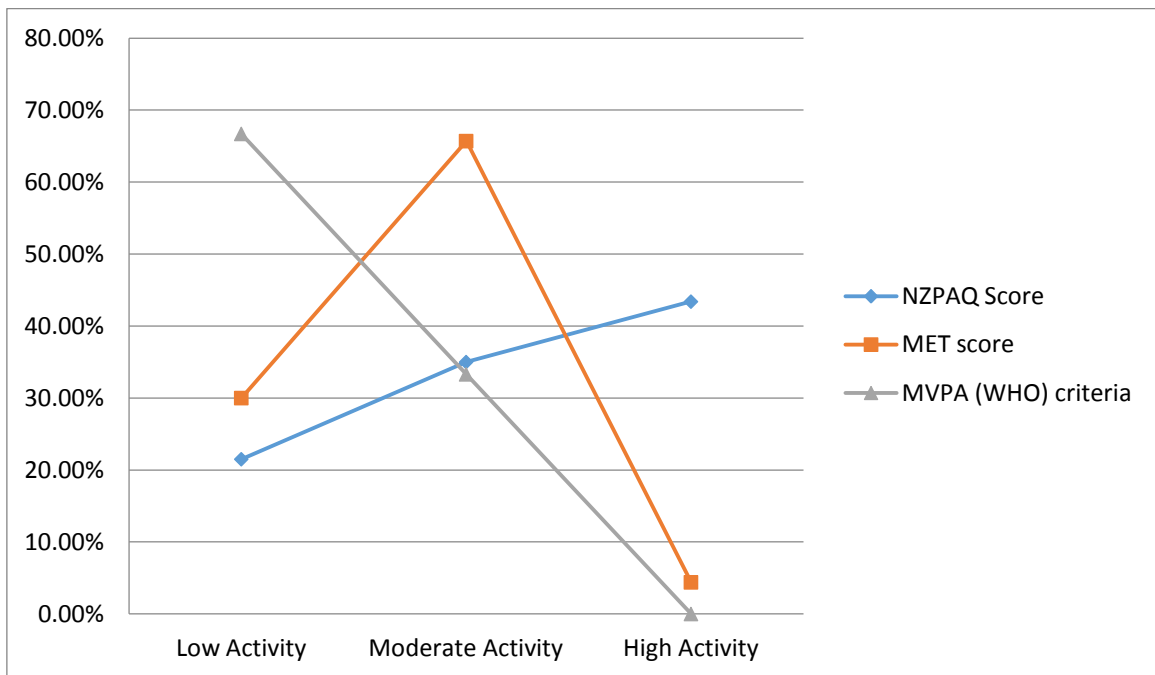


Figure 4.3: Comparison of number of participants n= 297 who were less, moderate or highly active based on the NZPAQ, MET and HBSC WHO -MVPA criteria.

4.1.2.2 Low Back Pain

This section presents the description of low back pain prevalence, described under three different categories derived from six low back pain categories, self reported-associated causes, pain associated characteristics and daily activities affected by low back pain (result appendix) in the cohort of participant n=297.

Based on their responses in Table 4.3 (result appendix) the LBP was categorized as: lifestyle, recurrent, confirmation with body diagram (location confirmed) low back pain. The table above shows the prevalence of LBP. The categorization included: participants who indicated experience at least once in lifetime were categorized as lifetime, those who answered yes on at least three of these occasions (current/past month/past six months/past 1 year) were categorized as recurrent, those who answered affirmatively to pain in past month and identified with the body diagram (confirmed the location) were labelled as location

confirmed. The definitions used to categorize are discussed in the method section (3.3.3.1) of the thesis.

Table 4.4 Categorization (derived from participant responses, appendix) of low back pain prevalence among the participants (n=297).

Derived categorization of low back pain	n (%)
Lifetime LBP prevalence	171 (57.6)
Recurrent LBP	79 (26.6)
Confirmation with body diagram and positive response to pain in last month /Location Confirmed (LC)	72 (24.2)

These categories have been further employed in inferential analysis by forming three models

4.1.2.3 Smoking

This section presents the smoking habits of the participants. They were initially categorized as smokers and non-smokers and smokers were further divided into experimenters (those who have even tried few puffs of cigarettes) and current smokers (those who answered affirmatively to presently smoking). To explore the association of smoking with low back pain, only current smokers have been taken into account, while performing inferential analysis.

Prevalence of smoking among participants is shown in the table below

Table 4.5: Classification of smokers and non-smokers based on their present smoking habits

Smokers/Non-smokers	n (%)
Smokers	59 (19.9)
Experimented with Smoking	44(14.8)
Current Smokers	15 (5.1)
Non- Smokers	238 (80.1)
Total	297 (100.0)

19.9% of the participants agreed they had tried smoking at least once in their lifetime and 5.1% of them reported they were current smokers.

4.1.2.4 Food and Drink Consumption

This section deals with the eating habits of the participants which reflect their food and drink intake behaviour or dietary pattern, an important predictor of lifestyle. Weekly meal consumption including weekdays and weekends, fruit and vegetable consumption, frequency of eating outside (result appendix) and food indices scores are summarised in Table 4.6.

In table 4.6 the scores for consumption of key food indices based on 25th and 75th percentiles are summarised. For the fruit and vegetable, fiber, calcium, variety indices, greater the percentile better and depicts more consumption of the respective food items whereas for the treat index, greater percentile meant indulging in more treat and junk food. The minimum and maximum columns for any given food indices depict the minimum and maximum score that could be achieved for that particular food index. For all of the indices the number of the participants trended towards the maximum score.

Table 4.6: This table shows the Fruit & Vegetable (FV), Fiber, Calcium, Balanced diet, Treat foods indices scores of the participants

Index	Percentiles		Mean	Standard Deviation	Median	Minimum	Maximum
	25th	75th					
Fruit Vegetable	8.50	21.00	16.00	8.43	14.00	.00	28.00
Fiber	11.50	28.00	19.85	10.31	18.00	.00	42.00
Calcium	7.75	18.75	13.91	8.48	13.00	.25	52.00
Variety	21.00	42.50	32.28	15.05	30.25	1.75	84.00
Treat	10.00	15.00	12.96	4.15	13.00	4.00	27.00

Section 4.2

Binary logistic regression was applied to each covariate initially and those variables with $p \leq 0.2$ were included in next model and then finally tested in a multinomial logistic regression model until the level of significance for the predictor variables was $p < .05$ for each time-related prevalence period (three models of LBP) .

4.2.1 Low Back Pain and its association with demographics and anthropometric characteristics in present cohort

Table 4.7: shows the results of binary logistic regression to predict the relationship between lifetime, recurrent, location confirmed low back pain and age

LBP and Age		B	S.E.	Wald	df	<i>p</i>	OR	95% CI
Lifetime	Age	0.046	0.092	0.254	1	0.614	1.04	1.01,1.06
Recurrent	Age	.253	.100	6.474	1	0.011	1.28*	1.03,1.71
Location confirmed	Age	0.23	0.10	5.192	1.00	0.023	1.26*	1.01,1.60

S.E.: standard error; Df: Degree of freedom; OR: Odds ratio; CI: Confidence interval

The table above demonstrates that the likelihood of recurrent and location confirmed low back pain slightly (OR = 1.28 and OR= 1.26, 95%CI 1.01, 1.60) increased with age in the present cohort and there is a significant association between them.

Table 4.8: presents the results of binary logistic regression to predict the relationship between lifetime, recurrent and location confirmed low back pain prevalence of and ethnicity

LBP and Ethnicity		B	S.E.	Wald	df	<i>p</i>	OR	95% CI
Lifetime	Ethnicity	-1.00	0.58	2.979	1	0.084	0.36	0.12,0.45
Recurrent	Ethnicity	-1.094	.491	4.959	1	0.026	0.33	0.11,0.33
Location confirmed	Ethnicity	-1.48	0.50	8.864	1	0.003	0.22	0.15,0.28

S.E.: standard error; Df: Degree of freedom; OR: Odds ratio; CI: Confidence interval

The results show there was no significant association between any of the LBP categories and ethnicity on the current cohort of participants.

Table 4.9: demonstrates the relationship between lifetime, recurrent and location confirmed prevalence of low back pain and waist to height ratio (WtHR) in the participants

LBP and WtHR		B	S.E.	Wald	df	<i>p</i>	OR	95%CI
Lifetime	WtHR	4.28	2.23	3.699	1	0.054	72.17*	55.34,93.79
Recurrent	WtHR	2.798	2.309	1.468	1	0.226	16.41	10.44,28.22
Location confirmed	WtHR	0.47	2.44	0.037	1	0.847	1.59	1.11,3.58

S.E.: standard error; Df: Degree of freedom; OR: Odds ratio; CI: Confidence interval

The numbers above show that WtHR was significantly associated with lifetime experience of low back pain but not with recurrence or location confirmed low back pain categories. Thus participants with a significantly higher WtHR had more likelihood of experiencing LBP.

Table 4.10: The relationship between lifetime, recurrent and location confirmed prevalence of low back pain and BMI z score depicted by odds ratio.

LBP and BMI z score		B	S.E.	Wald	df	<i>p</i>	OR	95%CI
Lifetime	BMI Z- score	0.29	0.12	5.595	1	0.018	1.34*	0.98,3.33
	BMI Z-	0.216	0.126	2.941	1	0.086	1.24	0.64,3.52

Recurrent	score							
Location confirmed	BMI Z-score	0.089	0.131	.463	1	0.496	1.09	0.05,1.23

S.E.: standard error; Df: Degree of freedom; OR: Odds ratio; CI: Confidence interval

The results show significant association between lifetime experience of low back pain and pain and BMI Z-score. The likelihood of reporting the low back pain experience at least once in lifetime increased 1.3 times with increasing BMI Z score.

Table 4.11: The results of binary Logistic Regression to predict the relationship between lifetime, recurrent and location confirmed prevalence of low back pain (LBP) and fat percentage (%) in the present cohort

LBP and Fat %		B	S.E.	Wald	df	<i>p</i>	OR	95%CI
Lifetime	Fat%	.043	.016	7.203	1	.007	1.04*	0.56,1.87
Recurrent	Fat %	.039	.018	4.879	1	.027	1.03*	0.43,1.66
Location confirmed	Fat%	.018	.018	1.053	1	.305	1.01	0.87,1.13

S.E.: standard error; Df: Degree of freedom; OR: Odds ratio; CI: Confidence interval

Fat% was only weakly associated with the lifetime and recurrent low back pain experience in the present cohort. Though the p values show a significant association between these two, the odds ratios (ORs) are close to one and thus do not demonstrate any strong relationship.

Table 4.12: The results of binary logistic regression used to predict the relationship between lifetime, recurrent and location confirmed prevalence of low back pain (LBP) and back extensor muscle endurance (BEE)

LBP and BEE		B	S.E.	Wald	df	<i>p</i>	OR	95%CI
Lifetime	BEE	-.006	.002	5.821	1	0.016	0.99*	0.32,1.24
Recurrent	BEE	-.007	.003	8.004	1	0.005	0.99*	0.46,1.98
Location confirmed	BEE	-.007	.003	6.605	1	0.010	0.99*	0.77,2.25

S.E.: standard error; Df: Degrees of freedom; OR: Odds ratio; CI: Confidence interval

The numbers above show that the endurance of back extensor muscles is marginally associated with lifetime (OR=0.99, 95%CI 0.32, 1.24), recurrent (OR=0.99, 95%CI 0.46, 1.98) as well as location confirmed (OR= 0.99, 95%CI 0.77, 2.25) low back pain. This association is marginal but highly significant with *p* value being at least <0.01 for any category of low back pain. Thus those reporting low back pain had less endurance of back muscles as demonstrated by decreased hold time compared to those who did not reported low back pain.

4.2.2 Physical activity levels and low back pain

This section presents the results of binary logistic regression employed to investigate the association between different categories of low back pain and physical activity levels of the participants. As described above in the description section (4.2.1), three different type of categorizations of physical activity levels have been used to explore the relationship.

Table 4.13: Predictions of the relationship between lifetime, recurrent and location confirmed low back pain prevalence and physical activity (PA) (NZPAQ), (MET score), (HBSC) in the present cohort

LBP and PA		B	S.E.	Wald	df	<i>p</i>	OR	95%CI
Lifetime	PA_NZPAQ	.105	.151	.479	1	.489	1.11	1.01,1.31
	PA_MET	.186	.223	.699	1	.403	1.20	0.04,3.56
	PA_HBSC	.250	.251	.991	1	.320	1.28	1.04,2.32
Recurrent	PA_NZPAQ	.226	.173	1.694	1	.193	1.25	0.09,1.66
	PA_MET	.076	.250	.092	1	.762	1.07	0.76,3.55
	PA_HBSC	-.026	.279	.009	1	.926	.97	0.33,1.55
LC	PA_NZPAQ	.291	.181	2.579	1	.108	1.33	1.11,1.43
	PA_MET	-.169	.256	.437	1	.509	.84	0.09,1.32
	PA_HBSC	.082	.285	.082	1	.774	1.08	0.03,5.78

S.E.: standard error; Df: Degree of freedom; OR: Odds ratio; CI: Confidence interval

No association was observed between physical activity categories derived using NZPAQ, MET score and HBSC based MVPA criteria and low back pain categories.

4.2.3 Smoking and Low back pain

The results for binary logistic regression between current smoking and low back pain showed that the likelihood of reporting low back pain (LC) was around three times more (OR =2.9, 95%CI 2.56, 3.01) in those who were currently smoking. The likelihood of experiencing recurrent low back pain also increased (OR =2.5, 95%CI 1.19, 3.62) in current smokers but was not statistically significant ($p=0.08$).

Table 4.14: relationship between lifetime, recurrent and location confirmed prevalence of low back pain and current smokers

LBP and Current Smokers		B	S.E.	Wald	df	<i>p</i>	OR	95%CI
Lifetime	Current smokers	.408	.561	.528	1	.467	1.50	1.11,1.89
Recurrent	Current smokers	.937	.535	3.064	1	.080	2.55*	1.19,3.62
Location confirmed	Current smokers	1.072	.537	3.992	1	.046	2.92*	2.56,3.01

S.E.: standard error; Df: Degree of freedom; OR: Odds ratio; CI: Confidence interval

4.2.4 Food and drink consumption and low back pain

Table 4.15: Binary Logistic Regression to predict the relationship between lifetime, recurrent and location confirmed prevalence of low back pain and fruit and vegetable consumption in the present cohort

LBP and Fruit and vegetable consumption		B	S.E.	Wald	df	<i>p</i>	OR	95%CI
Lifetime	F&V	-.458	.375	1.486	1	.223	.63	0.43,1.62
Recurrent	F&V	.221	.422	.274	1	.601	1.24	1.11,1.85
Location confirmed	F&V	.159	.435	.133	1	.715	1.17	0.09,4.32

S.E.: standard error; Df: Degree of freedom; OR: Odds ratio; CI: Confidence interval

No significant associations were observed between fruit and vegetable intake and any of the categories of low back pain in present cohort of participants.

Table 4.16: Binary Logistic Regression to predict the relationship between lifetime, recurrent, location confirmed prevalence of low back pain and fruit and vegetable, fiber, calcium, variety and treat indices

The table below shows that eating more fiber (OR= 0.84, 95%CI 0.04, 3.78, $p = 0.02$) and calcium rich food (OR= 0.89, 95%CI 0.66, 1.65, $p = 0.06$) were associated with reporting less lifetime low back pain. More fruits and vegetable consumption was very slightly associated with increase reporting of low back pain (OR = 1.08, 95%CI 1.00, 1.68, $p = 0.04$). No other food indices were significantly associated with any of the category of low back pain.

LBP category	Food indices	B	S.E	Wald	df	<i>p</i>	OR	95%CI
Lifetime	Fruit & Veg	.082	.041	3.917	1	.048	1.08*	1.00,1.68
	Fiber	-.173	.077	4.977	1	.026	.84*	0.04,3.78
	Calcium	-.116	.062	3.473	1	.062	.89*	0.66,1.65
	Variety	.110	.066	2.764	1	.096	1.11	1.01,1.55
	Treat	-.131	.106	1.524	1	.217	.87	0.50,3.22
	Constant	-.140	.512	.075	1	.784	.86	
Recurrent	Fruit & Veg	-.032	.046	.483	1	.487	.96	0.07,1.45
	Fiber	-.121	.091	1.769	1	.183	.88	0.65,1.57
	Calcium	-.084	.075	1.253	1	.263	.92	0.20,1.88
	Variety	.125	.079	2.461	1	.117	1.13	0.77,2.67

	Treat		-.055	.118	.219	1	.640	.94	0.88,1.98
	Constant		-1.360	.573	5.630	1	.018	.25	
Location confirmed	Fruit & Veg		-.049	.047	1.107	1	.293	.95	0.09,8.54
	Fiber		-.074	.091	.653	1	.419	.92	0.01,3.67
	Calcium		-.064	.075	.731	1	.392	.93	0.10,1.69
	Variety		.096	.080	1.465	1	.226	1.10	0.87,2.78
	Treat		-.095	.121	.619	1	.431	.90	0.78,3.33
	Constant		-1.485	.589	6.359	1	.012	.22	

S.E.: standard error; Df: Degree of freedom; OR: Odds ratio; CI: Confidence interval

4.2.5 Multinomial regression

Based on the binary logistic regression modelling the variables for which the values of p were ≤ 0.2 were carried forward in a multinomial logistic regression model. The variables for back extensor strength (BEE), waist to height ratio (WtHR), fat %age, current smokers, BMI Z-score, Variety Index, Physical activity (NZPAQ) were analysed to predict the relationship with the prevalence of low back pain. The results/variables from (tables 4.7, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.16) showed associations with low back pain and are presented in the table below.

Table 4.17 Multinomial logistic regression modelling undertaken to predict the relationship between prevalence of low back pain, in three different categories: lifetime, recurrent and location confirmed and respective associated independent variables (p value ≤ 0.2 in binary logistic)

LBP category	variables with $p \leq 0.2$	B	S.E	Wald	df	p	OR	95%CI
Lifetime	WtHR	3.174	5.055	.394	1	.530	23.89	3.56,67.75
	BMI z score	-.130	.352	.137	1	.711	.87	0.04,4.65
	Fat%	-.024	.030	.605	1	.437	.97	0.92,1.68
	BEE	.004	.003	2.838	1	.092	1.00	0.55,1.57
	Variety index	.004	.008	.249	1	.618	1.00	0.23,1.89
Recurrent	Age	-.160	.112	2.028	1	.154	.85	0.23,1.78
	BMI z score	.276	.242	1.303	1	.254	1.31	0.76,2.54
	Fat%	-.060	.033	3.368	1	.066	.94	0.66-4.66
	BEE	.005	.003	3.547	1	.060	1.00	0.66-1.99
	PA_NZPAQ	-.170	.189	.815	1	.367	.84	0.67,4.44
	Current smokers	-.945	.566	2.791	1	.095	.38	0.10,1.11
	Variety index	-.005	.010	.283	1	.595	.99	0.32,1.78
Location Confirmed	Age	-.049	.047	1.107	1	.293	.95	0.02-2.56
	BEE	-.074	.091	.653	1	.419	.92	0.56,3.45
	PA_NZPAQ	-.064	.075	.731	1	.392	.93	0.87,1.56
	Current smokers	.096	.080	1.465	1	.226	1.10	0.76,2.22

S.E.: standard error; Df: Degree of freedom; OR: Odds ratio; CI: Confidence interval

The table above demonstrated no significant relationship between any of the anthropometric or lifestyle variable with any category of low back pain in the present cohort.

The results show that though the anthropometric variables (BMI z score, WtHR, BEE, Fat % age) and lifestyle factors (physical activity levels_(NZPAQ), current smoking and eating certain food were associated at the uni-variate level, none of them were found to be related with low back pain in this cohort when combined in one model.

The LBP prevalence levels reported in the current study are in accordance with previous studies published. The individual physical measurements rather than the self-report lifestyle factors showed the strongest associations with LBP. The current study found that although several physical and lifestyle factors (age, WtHR, BMI z score, fat percentage, BEE, current smoking) were found to be related to LBP in the preliminary analysis when these factors were examined in combination using more robust modelling (MLR) the level of association was no longer of significance. Collectively these results serve to demonstrate the complexity of identifying explanatory lifestyle and physical factors that contribute to LBP in adolescent females.

Appendix of results

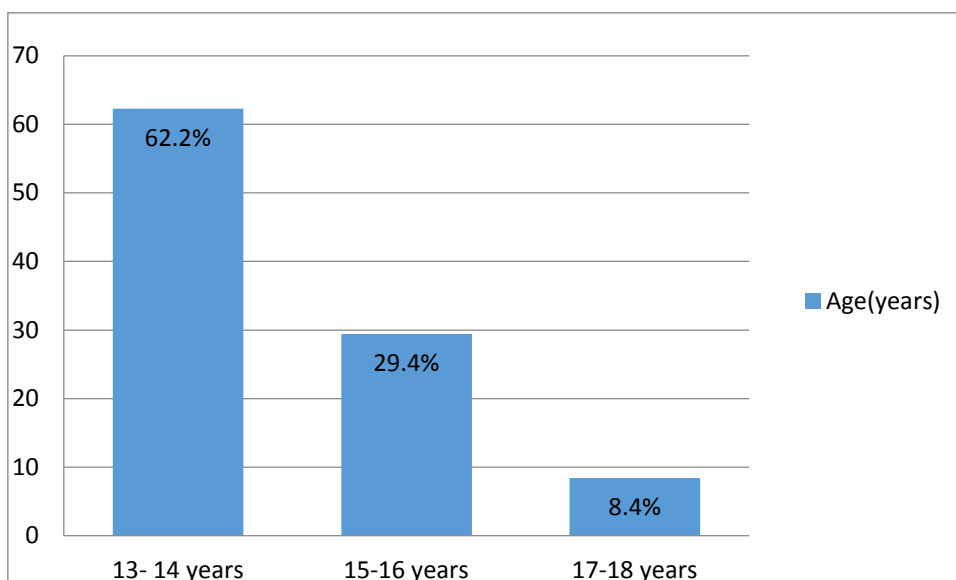


Figure 4.1: Participants (n=297) categorized into age groups and their distribution as a percentage of the age range 13-18 years.

The results in table 4.1 show that number of females who experienced LBP at least in their lifetime is more than half (57.6%) of the total participants. The table clearly demonstrates that, as the categories proceed towards more recent prevalence, the number of females experiencing LBP decreases, with minimum number in the current LBP category. The majority of the females who reported LBP, self reported they experienced pain which lasted on an average for 1-2 days. Most of them, 41.7%, related their pain to sporting activity and least to activities they performed at home.

Table 4.1 showing the low back pain duration, cause and its related characteristics in the participants reporting low back pain

Prevalence	n (%)	No. of Days Pain reported	Location	Cause
Lifetime Prevalence of LBP	171 (57.6)	A -9(7.1)	1-6 (31.5)	M – 3 (2.3)
		B- 6(4.7)	2 - 27(21.9)	N – 3 (2.3)
		C- 0(0)		O – 1(0.79)
		D -1(0.79)		P – 10 (7.9)
				Q – 4(3.1)
Last 3 year Prevalence	145(48.8)	A- 2(1.5)	1-1(5.2)	M – 2 (1.5)
		B - 5 (3.9)	2 -34(27.6)	N – 1(0.79)

		C - 0 (0)		O - 4(3.1)
		D - 0(0)		P - 4(3.1)
				Q - 0 (0)
Last 1 year Prevalence	141(47.5)	A - 8(6.3)	1 -2 (10.5)	M - 3 (2.3)
		B - 1(0.79)	2 -12(9.7)	N - 3 (2.3)
		C -0(0)		O -1(0.79)
		D -3(2.3)		P- 7 (5.5)
				Q - 2(1.5)
Last 6 months Prevalence	118(39.7)	A -15 (11.9)	1- 0 (0)	M -0 (0)
		B - 9(7.1)	2 - 6(4.8)	N- 5 (3.9)
		C-0 (0)		O- 3 (2.3)
		D -1(0.79)		P- 4(3.1)
				Q - 1(0.79)
Past month Prevalence	81(27.3)	A - 12(9.5)	1 - 5(26.3)	M - 8 (6.3)
		B - 5(3.9)	2 - 8(6.5)	N- 2 (1.5)
		C-3(2.3)		O - 3 (2.3)
		D - 2(1.5)		P -13(10.3)
				Q- 1(0.79)
Current/Point Prevalence	41(15.2)	A - 4 (3.1)	1 -3 (15.7)	M - 4(3.1)
		B - 10 (7.9)	2 -19(15.07)	N - 1(0.79)
		C - 4 (3.1)		O -5 (3.9)
		D - 7 (5.5)		P- 7 (5.5)
				Q - 3 (2.3)
Pain in area marked as Low Back	119 (40.1)	A-7 (5.5)	1-2 (10.5)	M- 2 (1.5)
		B - 2 (1.5)	2 -17(13.8)	N - 4(3.1)
		C -1 (0.79)		O - 1(0.79)
		D - 9 (7.14)		P - 8(6.3)
				Q - 3(2.3)

A=1-2 days B=3-4 days C=5-6 days D>= 7 days

1=Down leg 2=localised

M= Accident N= activity at home O= activity at school P=sporting activity Q=other

The Modified Hanover Disability Low Back Pain Questionnaire was used to collect the information summarised in Figure 4.2. The figure illustrates the difficulties the participants reported in their daily activities due to LBP. The majority (54.8%) reported sitting on a school chair for more than 45 minutes, the average time of a lesson, to be problematic and carrying the school bag to be second most difficult activity (47.6%). Participants who ticked more than one response most frequently chose a combination of either of these, “carrying your school bag to school, sitting on school chair for a 45-min lesson, bending down to put your socks on, sports activities at school”.

of LBP for each category.

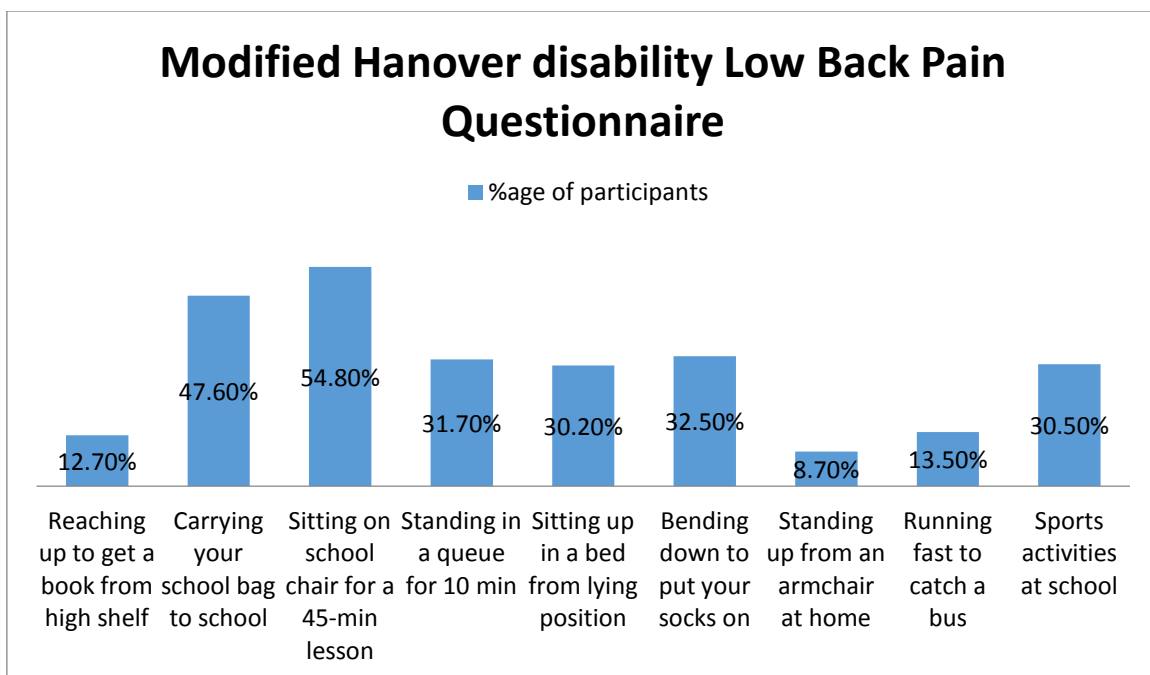


Figure 4.2 presents the percentage of participants with difficulties in daily life attributed to Low Back Pain in the present cohort

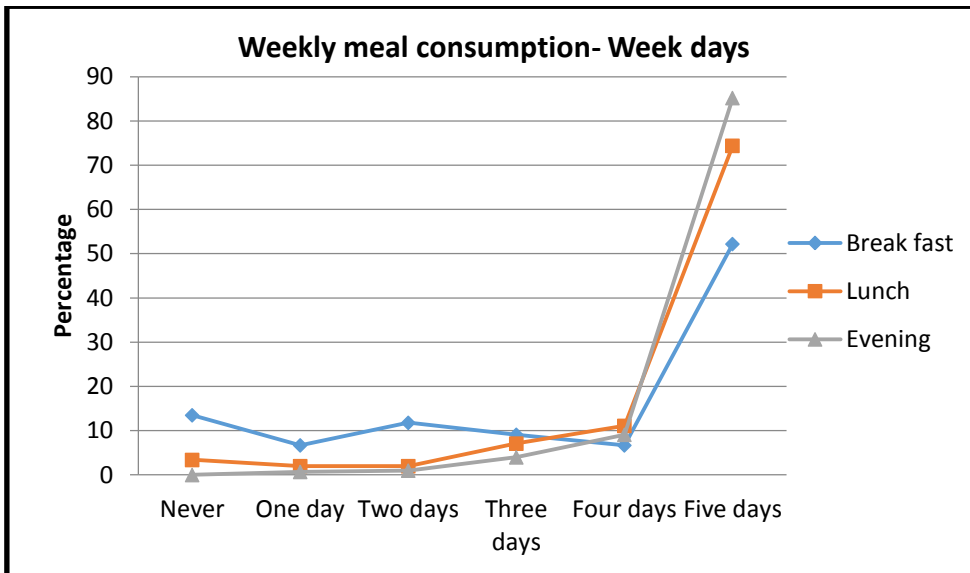


Figure 4.3: Breakfast, lunch and dinner consumption on weekdays (n=297)

The figure above demonstrates that just about half of the participants (52.3%) consumed breakfast on all five weekdays and those consuming evening meal were maximum (85.2%). 15.5% of the population never consumed the breakfast and about 10-20% of them had either of the above meals about three days in a week.

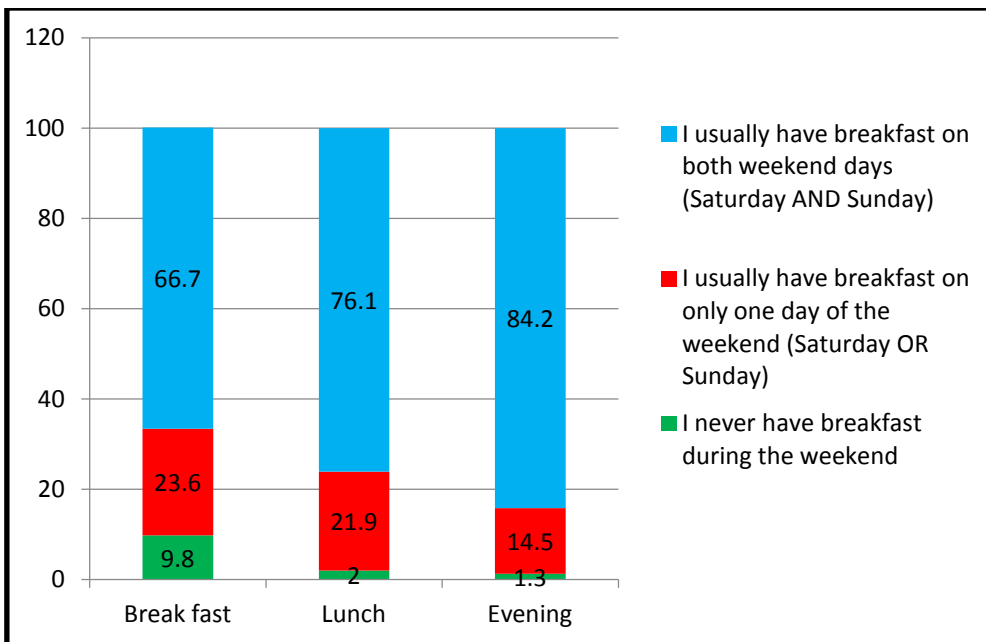


Figure 4.4: Breakfast, lunch and dinner consumption on weekends in current cohort (n=297)

This figure 4.4 above shows the meal eating pattern over the weekends. Breakfast was the most missed meal of the day with as much as around 10% of participants reporting so, whereas evening meal was the most consumed meal and only 1.3% participant's not consuming dinner during the weekends. On comparing the figure 1.5 and 1.6, it is noted that,

the percentage of dinner consumption is similar both during the weekdays and over the weekend whereas, the consumption of breakfast rises during the weekends.

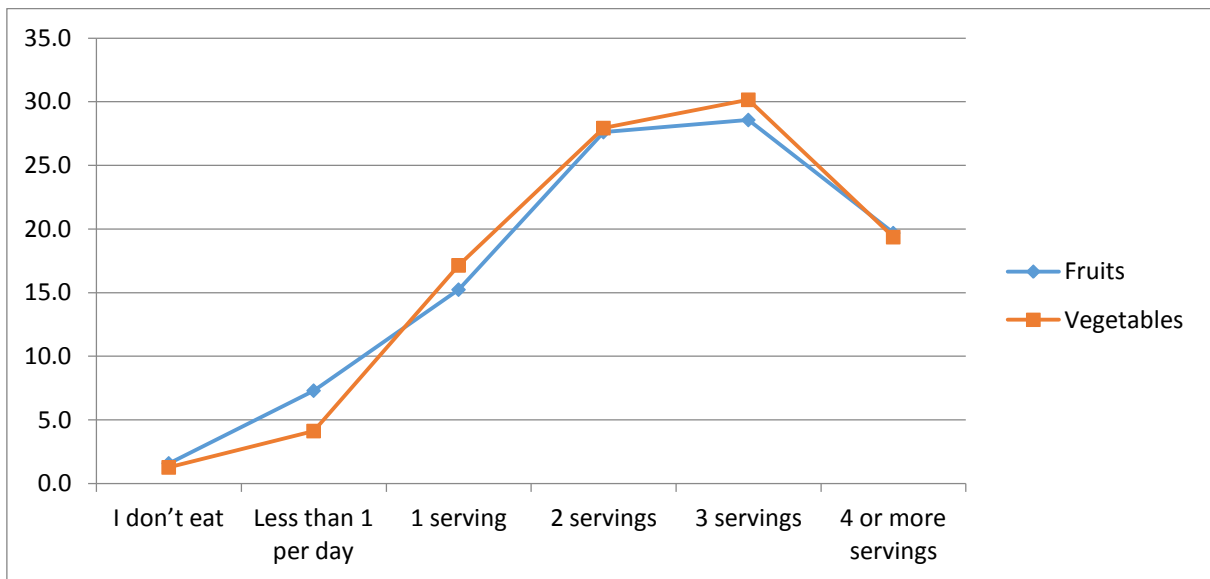


Figure 4.5: Average Fruit & Vegetable consumption/day based on WHO fruit and vegetable consumption criteria.

Figure 4.5 shows that 19.8% participants met the World Health Organization criteria of consuming five plus fruits/vegetables per day. Approximately one-third of them had three servings of fruits/vegetables per day and about 5% consumed less than one serving.

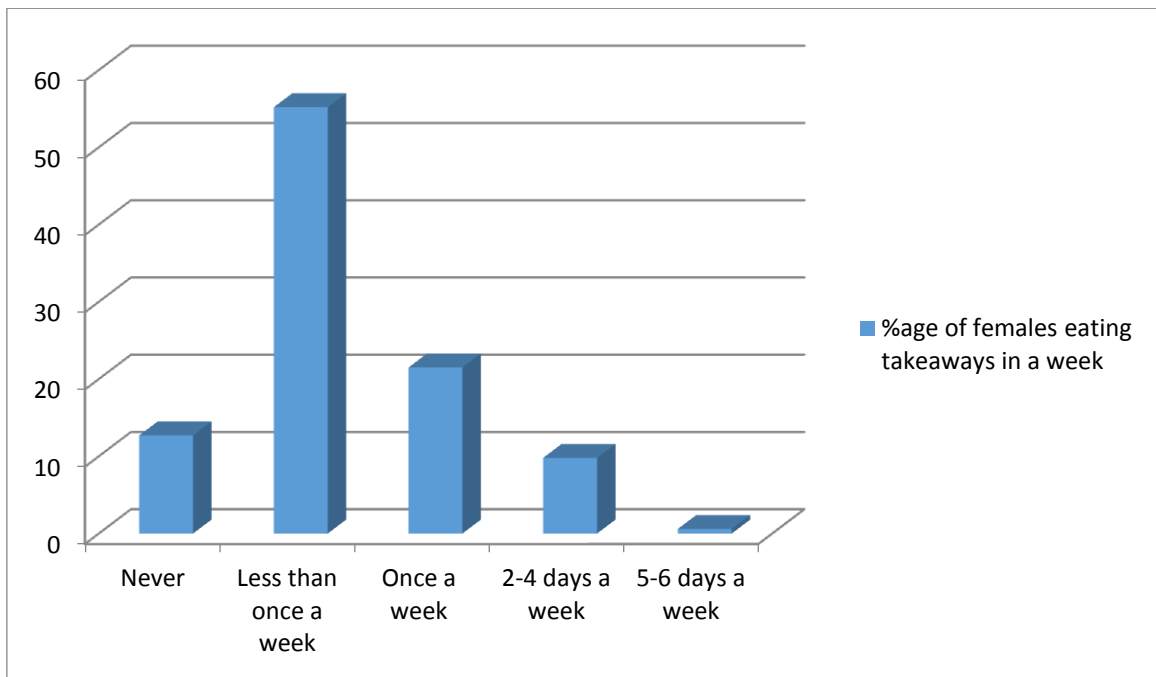


Figure 4.6 shows the percentage of participants eating takeaways/ junk food in a week.

Chapter 5 Discussion

The current study was designed to investigate the current and period prevalence's of LBP when categorized based on the reporting period, specifically in local female adolescent population aged between 13-18 years. The results show that in present cohort the LBP prevalence's ranges between 15.2% to 57.6%, with the lifetime prevalence 57.6%, recurrent 26.6%, LC LBP 24.2% and point prevalence 15.2%. The prevalence rates found in the present study are in accordance with the previous studies, where prevalence rates as high as 71% have been reported, and at least half of these patients have reported LBP at least once by the age of 18 years. (Anderson et al., 2006; Balague et al., 1994; Burton et al., 1996; Harreby et al., 1999; Lebueuf and Kyvik 1998).

The second aim of the present study was to examine the relationship between the three categories of LBP (lifetime, recurrent, LC) and key lifestyle factors of physical activity, smoking habits, food and drink consumption levels along with the anthropometric measurements and back extensor endurance (BEE). Uni-variate analysis demonstrated that the likelihood of experiencing LBP (LC) was almost three times (OR= 2.9, 95%CI 2.56, 3.01 $p = 0.04$) greater in those participants who were current smokers. The increase in the likelihood of experiencing LBP (OR= 2.9, 95%CI 2.56, 3.01 $p = 0.04$) in current smokers is consistent with previous studies done by Feldmen et al., 1999; Hestbaek et al., 2006b; Mikkonen et al., 2012. The results from all the three studies also reflected that smoking cigarettes is associated with LBP in male and female adolescents and demonstrated dose-response relationship with the amount of cigarettes smoked.

It is interesting to note that Hestbaek et al's (2006b) showed that the significant association between smoking and LBP was no longer statistically significant after a longitudinal follow-up period of eight years. Hestbaek et al., (2006b) used persistent/recurrent LBP (LBP for more than 30 days during previous year) accompanied by a body chart (showing the lower back area) as the outcome variable. However, unlike the results of Hestbaek et al., 2006b the current study did not show any statistically significant association with recurrent nature of LBP. Whereas, similarity between the results of the current research and Hestbaek et al. (2006b) was observed with the inclusion of body chart in the questionnaire. This highlights the importance of clear understanding of the location of the pain and being able to differentiate the low back from other areas by the adolescents.

Uni-variate analysis shows that in addition to the current smoking, PAL's, and variety index (food and drink consumption predictor) are also related with the different categories of LBP but the associations are not statistically significant. These initial analyses also demonstrated that the anthropometric variables such as WtHR body fat percentage, BMI z score, and BEE are significantly associated with all three categories of LBP at different significance levels.

Following the uni-variate analysis, further multiple logistic regression (MLR) models were employed to understand the more complex relationships between the predictor and the dependent variables. Five predictor variables WtHR (OR= 72.17, 95%CI 55.34, 93.79 $p = 0.05$), BMI z score (OR=1.34, 95%CI 0.98, 3.33 $p = 0.01$), fat percentage (OR = 1.04, 95%CI 0.56, 1.87 $p = 0.00$), BEE (OR = 0.99, 95%CI 0.32, 1.24 $p = 0.01$) and variety index (OR= 1.11, 95%CI 1.01, 1.55 $p = 0.09$) met the threshold criteria. These were included in MLR models using the dependent variable of Lifetime LBP. Seven predictor variables: age (OR= 1.28, 95%CI 1.03,1.71 $p = 0.01$), BMI z score (OR=1.24, 95%CI 0.64, 3.52 $p = 0.08$), fat percentage (OR = 1.03, 95%CI 0.43, 1.66 $p = 0.02$), BEE (OR = 0.99, 95%CI 0.46, 1.98 $p = 0.00$), PAL's (OR =1.25, 95%CI 0.09,1.66 $p =0.19$), current smokers (OR= 2.5, 95%CI 1.19, 3.62 $p = 0.08$) and variety index (OR= 1.13, 95%CI 0.77, 2.67 $p = 0.11$) were analysed with the dependent variable of recurrent LBP. Four predictor variables: age (OR= 1.26, 95%CI 1.01, 1.60 $p = 0.02$), BEE (OR = 0.99, 95%CI 0.77, 2.25 $p = 0.01$), PAL's (OR =1.33, 95%CI 1.11, 1.43 $p =0.10$) and current smokers (OR= 2.9, 95%CI 2.56, 3.01 $p = 0.04$) were included in the MLR analysis with the predictor variable of LBP (LC). MLR analyses showed no significant relationships between any of the predictors and three categories of LBP.

Overall, in the preliminary analysis no consistent pattern emerged between the three self-report categories of LBP and the factors of age, WtHR, BMI z score, fat percentage, BEE, current smoking and the level of risk with each factor varied between the three back pain categories.

However, these significance levels between the factors of age, WtHR, BMI z score, fat percentage and BEE with any of the three categories of LBP were no longer significant when these same factors are examined in the more robust models (MLR) and only current smoking is found to be significant predictor of LBP and this is specifically evident in the adolescents categorized under the LC category. Also, the logistic regression analysis demonstrates that of all the examined anthropometric measurements showed strong associations with LBP.

The current study presents a number of strengths. All the data were collected physically by the trained researchers using reliable equipments and validated method of collection. The

literature suggests that this approach to data collection eliminates the chances of over and under reporting of the height and weight respectively. A study done by (Wagner et al., 2013) states that there might be significant differences between the self reports versus actual measures and demonstrates that the participants in their study over reported the height and under reported the weight significantly. Hence, being able to collect all the anthropometric data on the day of data collection by trained researchers is strength of the current study. Additionally, the presence of the researchers during the entire duration of data collection ensured that all the issues raised were attended immediately. Also, the use of Ito test to measure the endurance of the back extensor is another positive aspect of the current study, as the Ito test uses the most optimal posture for activating trunk extensors (Shirado et al., 1995), doing so by simultaneous cervical and pelvic alignment. The participants showed no difficulty in understanding the test procedure and were shown how to perform the test in case the participant asked, which ensured the participants performed the test correctly.

This study has to be considered under its limitations. While the researchers were available to answer the questions of the participants on the venue, some of them might not have been comfortable asking any query or filling in the questionnaire in the school environment (using the school computers) and this might have influenced their responses. However, the research team created a safe and friendly atmosphere to build rapport with the participants and so that they felt comfortable. Additional limitation may be related to the possibility of peer pressure. This is one of the most important factors to be considered in these kind of set ups (Rihtaric and Kamenov, 2013) where participants are allowed to sit next to each other while completing the questionnaires which could possibly influence their responses. Although in the present study, the efforts were made to control this kind of behavior by continuous watch by the researchers who were present on the time of data collection.

Present cross-sectional design of the study might not be optimal to collect data on LBP as it limits the ability of the researcher to detect developments in the pain prevalence and characteristics of the target population beyond a single moment of time. While the author acknowledges the importance of longitudinal design, the current study collects the information on LBP over different occasions by asking the questions on experience of LBP on specified occurrences spread over three years retrospectively. Collecting the data over different occasions, gives the opportunity to collect the data over a period of time which is highly relevant in case of disorders such as LBP where single occurrences very common and rarely influence the professional or the social life of the patient to any large extent (Hestbaek et al., 2006).

The findings of this study may serve as base for a number of clinical recommendations. Firstly, the current smoking is highly correlated with occurrence of LBP in adolescence females, and therefore should be screened for and addressed within the LBP treatment plan in regular physiotherapy and other clinical setups. This could be done by education, referral to special cessation programs and regular follow ups to facilitate the patients' compliance to the programs. Secondly, it was observed in the initial analysis that the adolescents who were more active and took part in high levels of physical activity reported more LBP. Adolescents, especially females are prone to over indulge in to certain habits, physical activity being one of them, also known as compulsive exercise (White and Halliwell, 2010). Therefore, it is suggested that there should be certain guidelines, such as, guided minimum and maximum limits on the level of physical activity performed by the adolescents on daily/weekly basis, which should be followed stringently in the schools and during outside school training, regarding the levels of physical activity.

Future research could address the problem of not answering the questions to the best of participants' abilities, hiding the facts or influence of peer pressure. This could be done by verifying and correlating the participant's responses with their parents and carrying out the research in non-school environment will help as well.

As stated in the methods, the responses from the NZPAQ were analyzed using different sets of guidelines, given by SPARC, MOH and IPAQ. The results obtained using these sets of guidelines were highly contrasting. When the SPARC, MOH guidelines were used to analyze the responses, it was found that majority of the participants fell under the category of being highly active whereas when the response from the same questionnaire were analyzed using the IPAQ guidelines less than 5% of participants were found to be highly active. This is a big contrast, bearing in mind that responses from the same questionnaire (NZPAQ) were analyzed, with only difference being the guidelines used to obtain the results. Therefore, it is suggested that future studies involving physical activity should try to use objective physical activity measures such as accelerometer to gather the information on physical activity levels and compare the data with the results obtained using at least two self-report questionnaires in the same population or results obtained using two sets of guidelines for the same questionnaire, as done in the current study.

Although in current research, the nutritional aspect of the lifestyle did not show significant associations with LBP, it is suggested to be explored further and long follow up would help to understand the role of food and drink consumption pattern even better.

In summary, the LBP prevalence levels reported in the current study are in accordance with available literature. Of all the variables examined, the anthropometric measurements showed the strongest associations with LBP when compared to the self-report lifestyle variables. In the preliminary analysis no consistent pattern emerged between the three self-report categories of LBP. Although, the factors of age, WtHR, BMI z score, fat percentage, BEE, current smoking were significantly related to LBP, the level of risk varied between the three back pain categories. These significance levels were lost when these same factors were examined in the more robust models (MLR) and current smoking was found to be the most significant predictor (OR= 2.9, 95%CI 2.56, 3.01 $p = 0.04$) of LBP, and this was specifically evident in the adolescents categorized under the LC category. The emergence of only LC category LBP as most significant in relationship to smoking emphasizes the importance of using the body chart in studies of such kind and being able to relate the pain to specific body part which helps to improve the reliability of the responses. Finally, the results demonstrate that the reporting period is very important when factoring in risk factors associated with LBP in female adolescence, as it is clearly observed that there is difference in the significance levels of same risk factor for example smoking, WtHR within different categories of LBP in the same set of population.

Future research could focus on the space where the person usually smokes i.e. outdoor or indoor, as this would affect the amount of smoke they inhale with every puff and hence altering the amount of nicotine absorbed in their blood. Collecting information regarding use of nicotine in any other forms i.e. gum or patches would help to understand the association of nicotine with LBP to greater extent. Also, smoking in combination with tea/coffee/liquor, at the same time they smoke, might have different/increased affect on LBP. All of these would help to understand association of smoking/nicotine on LBP in adolescents in a better way.

Putting smoking cessation programs in practice, practicing back extensor strengthening programs in physiotherapy clinics and performing high intensity exercise under supervision of an expert is suggested for prevention of LBP in adolescents in future.

References

- A Focus on Nutrition: Key Findings of the 2008/09 New Zealand Adult Nutrition Survey, http://www.health.govt.nz/system/files/documents/publications/a-focus-on-nutrition-ch2_0.pdf , last accessed on 29/01/2014
- A.C Papageorgiou, P.R Croft, S Ferry, M.I.V Jayson, A.J Silman Estimating the prevalence of low back pain in the general population: evidence from the South Manchester Back Pain Survey *Spine*, 20 (17) (1995), pp. 1889–1894
- Adolescent Health Research Group, Youth07 Student Health and Wellbeing Questionnaire Auckland: The University of Auckland.
- Ainsworth BE., William L. Haskell, Melicia C. Whitt, Melinda L. Irwin, Ann M. Swartz, Scott J. Strath, William L. O'Brien, David R. Bassett, Jr., Kathryn H. Schmitz, Patricia O. Emplain court, David R. Jacobs, Jr.. And Arthur S. Leon, Compendium Of Physical Activities: An Update Of Activity Codes And Met Intensities, *Med. Sci. Sports Exerc.*, Vol. 32, No. 9, Suppl., Pp. S498-S516, 2000.
- Ainsworth BE., Haskell WL, Herrmann SD, Meckes N, Bassett DR Jr, Tudor-Locke C, Greer JL, Vezina J, Whitt-Glover MC, Leon AS: 2011 Compendium of Physical Activities: a second update of codes and MET values. *Med Sci Sports Exerc.* 2011 Aug; 43(8):1575-81. doi: 10.1249/MSS.0b013e31821ece12.
- Andersen LB, Harro M, Sardinha LB, Froberg K, Ekelund U, Brage S, Anderssen SA. Physical activity and clustered cardiovascular risk in children: a cross-sectional study
- Andersson, G. B. (1998). Epidemiology of low back pain. *Acta Orthop Scand Suppl*, 281, 28-31.
- Atkins, M. B., Sosman, J. A., Agarwala, S., Logan, T., Clark, J. I., Ernstoff, M. S., . . . Margolin, K. A. (2008). Temozolomide, thalidomide, and whole brain radiation therapy for patients with brain metastasis from metastatic melanoma: a phase II Cytokine Working Group study. *Cancer*, 113(8), 2139-2145. doi: 10.1002/cncr.23805
- Auvinen, J., Tammelin, T., Taimela, S., Zitting, P., & Karppinen, J. (2008). Associations of physical activity and inactivity with low back pain in adolescents. *Scand J Med Sci Sports*, 18(2), 188-194. doi: 10.1111/j.1600-0838.2007.00672.x
- Balague, F., Dutoit, G., & Waldburger, M. (1988). Low back pain in schoolchildren. An epidemiological study. *Scand J Rehabil Med*, 20(4), 175-179.

- Balague F, Nordin M, Skovron ML, Dutoit G, Yee A, Waldburger M. Non-specific low-back pain among schoolchildren (1994): a field survey with analysis of some associated factors. *J Spinal Disord*, 7: 374–379.
- Balague, F., Troussier, B., & Salminen, J. J. (1999). Non-specific low back pain in children and adolescents: risk factors. *Eur Spine J*, 8(6), 429-438.
- Maria Cristina G Barbosa-Silva, Aluísio JD Barros, Jack Wang, Steven B Heymsfield, and Richard N Pierson Jr (2005): Bioelectrical impedance analysis: population reference values for phase angle by age and sex. *Am J Clin Nutr* ; 82:49 –52
- Blettner, M., Sauerbrei, W., Schlehofer, B., Scheuchenpflug, T., & Friedenreich, C. (1999). Traditional reviews, meta-analyses and pooled analyses in epidemiology. *Int J Epidemiol*, 28(1), 1-9.
- Brattberg G (2004). Do pain problems in young children persist into early adulthood? A 13-yearfollow-up. *European Journal of Pain* 8: 187-199.
- Burton, A. K., Clarke, R. D., McClune, T. D., & Tillotson, K. M. (1996). The natural history of low back pain in adolescents. *Spine (Phila Pa 1976)*, 21(20), 2323-2328.
- Bursac Z, C Gauss H, Keith D. W. & Hosmer W D. (2008). Purposeful selection of variables in logistic regression. *Source Code for Bio and Med.*, 3:17 doi:10.1186/1751-0473-3-17
- Cade J, Thompson R, Burley V, Warm D (2002) Development, validation and utilisation of food-frequency questionnaires - a review. *Public Health Nutr*, 5:567-587
- Cardon, G., & Balague, F. (2004). Low back pain prevention's effects in schoolchildren. What is the evidence? *Eur Spine J*, 13(8), 663-679. doi: 10.1007/s00586-004-0749-6
- Chaiamnuay, P., Darmawan, J., Muirden, K. D., & Assawatanabodee, P. (1998). Epidemiology of rheumatic disease in rural Thailand: a WHO-ILAR COPCORD study. Community Oriented Programme for the Control of Rheumatic Disease. *J Rheumatol*, 25(7), 1382-1387.
- Chen, S. M., Liu, M. F., Cook, J., Bass, S., & Lo, S. K. (2009). Sedentary lifestyle as a risk factor for low back pain: a systematic review. *Int Arch Occup Environ Health*, 82(7), 797-806. doi: 10.1007/s00420-009-0410-0
- Christopher S and Emma R Trunk Muscle Endurance and Low Back Pain in Female Dance Students 2014 *Journal of Dance Medicine & Science*, Volume 18, Number 2, pp. 62-66(5).

- Cole T, Lobstein T: Extended international (IOTF) body mass index cut offs for thinness, overweight and obesity. *Pediatr Obes* 2012, 7:284–294
- Craig CL, Marshall A, Sjostrom M et al. International Physical Activity Questionnaire: 12 country reliability and validity *Med Sci Sports Exerc* 2003;August
- Currie C., Samdal, O., Boyce, W. and Smith, B. (2001). Health Behaviour in School-aged Children: A World Health Organization Cross-National Study: Research Protocol for the 2001/02 Survey. Child and Adolescent Health Research Unit. Scotland: University of Edinburgh
- De Onis M, Onyango A, Borghi E, Siyam A, Nishida C, Siekmann J: Development of a WHO growth reference for school-aged children and adolescents. *B World Health Organ* 2007, 85:661–668.
- Deyo, R. A., Diehr, P., & Patrick, D. L. (1991). Reproducibility and responsiveness of health status measures. Statistics and strategies for evaluation. *Control Clin Trials*, 12(4 Suppl), 142S-158S.
- Diepenmaat, A. C., van der Wal, M. F., de Vet, H. C., & Hirasings, R. A. (2006). Neck/shoulder, low back, and arm pain in relation to computer use, physical activity, stress, and depression among Dutch adolescents. *Pediatrics*, 117(2), 412-416. doi: 10.1542/peds.2004-2766
- Dionne, C. E., Dunn, K. M., & Croft, P. R. (2006). Does back pain prevalence really decrease with increasing age? A systematic review. *Age Ageing*, 35(3), 229-234. doi: 10.1093/ageing/afj055
- Dissemination, NHS Centre for Reviews and. (2008). *Systematic review of the effects of interventions for people bereaved by suicide*. New York: University of York.
- Down, H.S. & Black, N.(1998) The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. *J Epidemiol Community Health*;52: 377–384
- Duggleby, T., & Kumar, S. (1997). Epidemiology of juvenile low back pain: a review. *Disabil Rehabil*, 19(12), 505-512.
- Ehrlich, G.E., Khaltayev, N.G., & Management, World Health Organization. Department of Noncommunicable Disease. (1999). *Low Back Pain Initiative*: World Health Organization.
- European Cooperation in the field of Scientific and Technical Research, 2004b

- European Youth Heart Study. *Lancet* 2006, 368: 299-304.
- Fairbank, J. C., Pynsent, P. B., Van Poortvliet, J. A., & Phillips, H. (1984). Influence of anthropometric factors and joint laxity in the incidence of adolescent back pain. *Spine (Phila Pa 1976)*, 9(5), 461-464.
- Feldman, D. E., Rossignol, M., Shrier, I., & Abenhaim, L. (1999). Smoking. A risk factor for development of low back pain in adolescents. *Spine (Phila Pa 1976)*, 24(23), 2492-2496.
- Feldman, L., Harvey, B., Holowaty, P., & Shortt, L. (1999). Alcohol use beliefs and behaviors among high school students. *J Adolesc Health*, 24(1), 48-58.
- Feldman, D. E., Shrier, I., Rossignol, M., & Abenhaim, L. (2001). Risk factors for the development of low back pain in adolescence. *Am J Epidemiol*, 154(1), 30-36.
- Ferruh, T., Betul, T., Ugur, C., Erdal, C., (2013). Determining the Pain-Affecting Factors of University Students with Nonspecific Low Back Pain. *J. Phys. Ther. Sci.*, 25: 1561–1564.
- Fingeld-Connett, D. (2008). Concept synthesis of the art of nursing. *J Adv Nurs*, 62(3), 381-388. doi: 10.1111/j.1365-2648.2008.04601.x
- Fritz, J. M., & Clifford, S. N. (2010). Low back pain in adolescents: a comparison of clinical outcomes in sports participants and nonparticipants. *J Athl Train*, 45(1), 61-66. doi: 10.4085/1062-6050-45.1.61
- Gravetter, Frederick J.; Forzano, Lori-Ann B. (2012). *Research Methods for the Behavioral Sciences* (4th ed.). Belmont, CA: Wadsworth. p.78. ISBN978-1-111-34225-8.
- Grimmer, K., & Williams, M. (2000). Gender-age environmental associates of adolescent low back pain. *Appl Ergon*, 31(4), 343-360.
- Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ) -Short and Long Forms, November 2005, <http://www.ipaq.ki.se/scoring.pdf> last accessed on 3/12/13
- Gunzburg, R., Balague, F., Nordin, M., Szpalski, M., Duyck, D., Bull, D., & Melot, C. (1999). Low back pain in a population of school children. *Eur Spine J*, 8(6), 439-443.
- Hakala, P., Rimpela, A., Salminen, J. J., Virtanen, S. M., & Rimpela, M. (2002). Back, neck, and shoulder pain in Finnish adolescents: national cross sectional surveys. *BMJ*, 325(7367), 743.

- Hakala, P. T., Rimpela, A. H., Saarni, L. A., & Salminen, J. J. (2006). Frequent computer-related activities increase the risk of neck-shoulder and low back pain in adolescents. *Eur J Public Health, 16*(5), 536-541. doi: 10.1093/eurpub/ckl025
- Hangai, M., Kaneoka, K., Okubo, Y., Miyakawa, S., Hinotsu, S., Mukai, N., Ochiai, N. (2010). Relationship between low back pain and competitive sports activities during youth. *Am J Sports Med, 38*(4), 791-796. doi: 10.1177/0363546509350297
- Harreby, M., Neergaard, K., Hesselsoe, G., & Kjer, J. (1995). Are radiologic changes in the thoracic and lumbar spine of adolescents risk factors for low back pain in adults? A 25-year prospective cohort study of 640 school children. *Spine (Phila Pa 1976), 20*(21), 2298-2302.
- Harreby, M., Kjer, J., Hesselsoe, G., & Neergaard, K. (1996). Epidemiological aspects and risk factors for low back pain in 38-year-old men and women: a 25-year prospective cohort study of 640 school children. *Eur Spine J, 5*(5), 312-318.
- Harreby, M., Nygaard, B., Jessen, T., Larsen, E., Storr-Paulsen, A., Lindahl, A., Laegaard, E. (1999). Risk factors for low back pain in a cohort of 1389 Danish school children: an epidemiologic study. *Eur Spine J, 8*(6), 444-450.
- Heaps, N., Davis, M. C., Smith, A. J., & Straker, L. M. (2011). Adolescent drug use, psychosocial functioning and spinal pain. *J Health Psychol, 16*(4), 688-698. doi: 10.1177/1359105310386822
- Hendler, I., Goldenberg, R. L., Mercer, B. M., Iams, J. D., Meis, P. J., Moawad, A. H., Sorokin, Y. (2005). The Preterm Prediction Study: association between maternal body mass index and spontaneous and indicated preterm birth. *Am J Obstet Gynecol, 192*(3), 882-886. doi: 10.1016/j.ajog.2004.09.021
- Hestbaek, L., & Leboeuf-Yde, C. (2000). Are chiropractic tests for the lumbo-pelvic spine reliable and valid? A systematic critical literature review. *J Manipulative Physiol Ther, 23*(4), 258-275.
- Hestbaek, L., Leboeuf-Yde, C., & Kyvik, K. O. (2006a). Are lifestyle-factors in adolescence predictors for adult low back pain? A cross-sectional and prospective study of young twins. *BMC Musculoskelet Disord, 7*, 27. doi: 10.1186/1471-2474-7-27
- Hestbaek, L., Leboeuf-Yde, C., & Kyvik, K. O. (2006b). Is comorbidity in adolescence a predictor for adult low back pain? A prospective study of a young population. *BMC Musculoskelet Disord, 7*, 29. doi: 10.1186/1471-2474-7-29

Higgins, J. P. T., & Green, S. (2009). *Cochrane Handbook for Systematic Reviews of Interventions*. Wiley Cochrane Series.

Holden, Ronald B (2010) "Face Validity". In Weiner, Irving B; Craighead, W. Edward. *The Corsini Encyclopedia of Psychology* (4th ed) Hoboken, NJ: Wiley. Pp. 637-638 ISBN 978-0-470-17024-3.

Hoy, D., Toole, M. J., Morgan, D., & Morgan, C. (2003). Low back pain in rural Tibet. *Lancet*, 361(9353), 225-226. doi: 10.1016/S0140-6736(03)12254-4

http://en.wikipedia.org/wiki/List_of_schools_in_the_Otago_Region last accessed on 3/12/13 <http://www.health.govt.nz/system/files/documents/publications/nzhs-adult-questionnaire-may08.pdf> last accessed on 6/12/13 New Zealand health Survey, Adult questionnaire 2006//07

Ito T, Shirado O, Suzuki H, Takahashi M, Kaneda K, Strax TE. (1996) Lumbar trunk muscle endurance testing: an inexpensive alternative to a machine for evaluation. *Arch Phys Med Rehabil* 1996;77: 75-9

Jensen, I. (2007). Neck pain. *Best Pract Res Clin Rheumatol*, 21, 93-108.

Jin, K., Sorock, G. S., & Courtney, T. K. (2004). Prevalence of low back pain in three occupational groups in Shanghai, People's Republic of China. *J Safety Res*, 35(1), 23-28. doi: 10.1016/j.jsr.2003.11.002

Johnson OE, Mbada CE, Akosile CO, Agbeja OA.(2009) Isometric endurance of the back extensors in school-aged adolescents with and without low back pain. *J Back Musculoskelet Rehabil.*; 22(4):205-11. doi: 10.3233/BMR-2009-0235.

Jones, K. L., Krous, H. F., Nadeau, J., Blackbourne, B., Zielke, H. R., & Gozal, D. (2003). Vascular endothelial growth factor in the cerebrospinal fluid of infants who died of sudden infant death syndrome: evidence for antecedent hypoxia. *Pediatrics*, 111(2), 358-363.

Jones, M. A., Stratton, G., Reilly, T., & Unnithan, V. B. (2004). A school-based survey of recurrent non-specific low-back pain prevalence and consequences in children. *Health Educ Res*, 19(3), 284-289. doi: 10.1093/her/cyg025

Jones, G. T., & Macfarlane, G. J. (2005). Epidemiology of low back pain in children and adolescents. *Arch Dis Child*, 90(3), 312-316. doi: 10.1136/adc.2004.056812 Checked

- Julia Smedley, Peter Egger, Cyrus Cooper, David Coggon, Manual handling activities and risk of low back pain in nurses, *Occupational and Environmental Medicine* 1995;52:160-163
- K Walsh, M Cruddas, D Coggon, Low back pain in eight areas of Britain, *J Epidemiol Community Health* 1992;46:227-230 doi:10.1136/jech.46.3.227
- Kemper C, Tholeen R. pain in the back: Avoiding back pain in children and teenagers. Literature research for the EU-funded project. (Online) (Cited 2011 July 12). Available from URL: <http://www.painintheback.info/LiteratureReview-Painintheback.pdf>
- Kovacs, F. M., Abraira, V., Pena, A., Martin-Rodriguez, J. G., Sanchez-Vera, M., Ferrer, E., Mufraggi, N. (2003). Effect of firmness of mattress on chronic non-specific low-back pain: randomised, double-blind, controlled, multicentre trial. *Lancet*, 362(9396), 1599-1604. doi: 10.1016/S0140-6736(03)14792-7
- Kovacs, F. M., Gestoso, M., Gil del Real, M. T., Lopez, J., Mufraggi, N., & Mendez, J. I. (2003). Risk factors for non-specific low back pain in schoolchildren and their parents: a population based study. *Pain*, 103(3), 259-268.
- Kristjansdottir, G., & Rhee, H. (2002). Risk factors of back pain frequency in schoolchildren: a search for explanations to a public health problem. *Acta Paediatr*, 91(7), 849-854.
- Kujala, U. M., Salminen, J. J., Taimela, S., Oksanen, A., & Jaakkola, L. (1992). Subject characteristics and low back pain in young athletes and nonathletes. *Med Sci Sports Exerc*, 24(6), 627-632.
- Kujala, U. M., Taimela, S., Erkintalo, M., Salminen, J. J., & Kaprio, J. (1996). Low-back pain in adolescent athletes. *Med Sci Sports Exerc*, 28(2), 165-170.
- Kujala, U. M., Taimela, S., & Viljanen, T. (1999). Leisure physical activity and various pain symptoms among adolescents. *Br J Sports Med*, 33(5), 325-328.
- Kuorinka, B. Jonsson t, A. Kilbom, H. Vinterberg t t F. Biering-S6rensen, G. Andersson and K. Jorgensen, Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms, *Applied Ergonomics* 1987, 18.3,233-237
- Leboeuf-Yde, C. and Kyvik, K.O. At what age does low back pain become a problem? A study of 24,424 individuals aged 12±41 years. 1998, *Spine*, 23, 228±234

- Leboeuf-Yde, C., Kyvik, K. O., & Bruun, N. H. (1999). Low back pain and lifestyle. Part II--Obesity. Information from a population-based sample of 29,424 twin subjects. *Spine (Phila Pa 1976)*, 24(8), 779-783; discussion 783-774.
- Leboeuf-Yde, C. (2000). Alcohol and low-back pain: a systematic literature review. *J Manipulative Physiol Ther*, 23(5), 343-346.
- Lemos AT, Santos FR, Moreira RB, Machado DT, Braga FC, Gaya AC. *Cad Saude Publica*. 2013; Low back pain and associated factors in children and adolescents in a private school in Southern Brazil. Nov; 29(11):2177-85.
- Lidgren, L. (2003). The bone and joint decade 2000-2010. *Bull World Health Organ*, 81(9), 629.
- Lopez AD, Mathers CD, Ezzati M, et al., editors. Washington (DC): World Bank; 2006. Global Burden of Disease and Risk Factors, chapter 3, the burden of disease and mortality by condition: data, methods, and results for 2001.
- Magarey A, Golley R, Spurrier N, Goodwin E, Ong F:Reliability and validity of the Children's Dietary Questionnaire; a new tool to measure children's dietary patterns. *Int J Pediatr Obes* 2009, 4:257-265
- Manek, N. J., & MacGregor, A. J. (2005). Epidemiology of back disorders: prevalence, risk factors, and prognosis. *Curr Opin Rheumatol*, 17(2), 134-140.
- McLean G, SPARC and Martin Tobias, 2004, The New Zealand Physical Activity Questionnaires Report on the validation and use of the NZPAQ-LF and NZPAQ-SF self-report physical activity survey instruments, Ministry of Health
- Metcalf PA, Scragg RK, Sharpe S, Fitzgerald ED, Schaaf D, Watts C: Short-term repeatability of a food frequency questionnaire in New Zealand children aged 1–14 y. *Eur J Clin Nutr* 2003, 57:1498-1503
- Mierau, D., Cassidy, J. D., & Yong-Hing, K. (1989). Low-back pain and straight leg raising in children and adolescents. *Spine (Phila Pa 1976)*, 14(5), 526-528.
- Mikkonen, P., Viikari-Juntura, E., Remes, J., Pienimaki, T., Solovieva, S., Taimela, S., Karppinen, J. (2012). Physical workload and risk of low back pain in adolescence. *Occup Environ Med*, 69(4), 284-290. doi: 10.1136/oemed-2011-100200
- Ministry of Health. 2012. The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey. Wellington: Ministry of Health.

- Mogensen, A. M., Gausel, A. M., Wedderkopp, N., Kjaer, P., & Leboeuf-Yde, C. (2007). Is active participation in specific sport activities linked with back pain? *Scand J Med Sci Sports*, 17(6), 680-686. doi: 10.1111/j.1600-0838.2006.00608.x
- Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med* 6(6): e1000097. doi:10.1371/journal.pmed1000097
- Moy K, McFarlane K, Scragg R, Robinson S: Validation of MOH-short and SPARC-long Physical Activity Questionnaires. Wellington, NZ: Sport and Recreation New Zealand (SPARC); 2003:1-142.
- Murray CJ, Lopez AD. Global health statistics. 1996, Cambridge, MA, Harvard School of Public Health, (Global Burden of Disease and Injury Series, vol. II), 1996.
- New Zealand physical activity guidelines for children and young people, Sport New Zealand and the Ministries of Health and Education in 2007, <http://www.health.govt.nz/our-work/preventative-health-wellness/physical-activity> last accessed on 6/12/13
- Newcomer, K., & Sinaki, M. (1996). Low back pain and its relationship to back strength and physical activity in children. *Acta Paediatrica*, 85(12), 1433-1439. doi: 10.1111/j.1651-2227.1996.tb13948.x
- Oliveira, R., & Cabri, J. (2006). *Low back pain in young people - Cross-sectional study in Lisbon*. Paper presented at the AIESEP 2005 World Congress, Lisbon.
- Ory, F. G., Rahman, F. U., Katagade, V., Shukla, A., & Burdorf, A. (1997). Respiratory disorders, skin complaints, and low-back trouble among tannery workers in Kanpur, India. *Am Ind Hyg Assoc J*, 58(10), 740-746. doi: 10.1080/15428119791012397
- Paula ML Skidmore, Anna S Howe, Maria A Polak, Jyh Eiin Wong, Alex Lubransky, Sheila M Williams and Katherine E Black. Sleep duration and adiposity in older adolescents from Otago, New Zealand: relationships differ between boys and girls and are independent of food choice, *Nutrition Journal* 2013, 12:128
- Perry, M. C., Straker, L. M., Oddy, W. H., O'Sullivan, P. B., & Smith, A. J. (2010). Spinal pain and nutrition in adolescents--an exploratory cross-sectional study. *BMC Musculoskelet Disord*, 11, 138. doi: 10.1186/1471-2474-11-138

Physical activity and young people, recommended levels of physical activity for children aged 5-17 years, Global Strategy on Diet, Physical Activity and Health, can be accessed from http://www.who.int/dietphysicalactivity/factsheet_young_people/en/

Popay, J., Rogers, A., & Williams, G. (1998). Rationale and standards for the systematic review of qualitative literature in health services research. *Qual Health Res*, 8(3), 341-351.

Prochaska JJ, Sallis JF, Long B. A Physical activity screening measure for use with adolescents in primary care, *Archives of pediatrics and Adolescent Medicine*, 2001, 155:554-559

Rapoport, J., Jacobs, P., Bell, N. R., & Klarenbach, S. (2004). Refining the measurement of the economic burden of chronic diseases in Canada. *Chronic Dis Can*, 25(1), 13-21.

Research, European Cooperation in the field of Scientific and Technical. (2004b). European guidelines for prevention in low back pain from <http://www.backpaineurope.org>

Rihtaric L M and Kamenov Z. Susceptibility to peer pressure and attachment to friends,. 2013, *PSIHOLOGIJA*, Vol. 46 (2), 111-126

Rivinoja, A. E., Paananen, M. V., Taimela, S. P., Solovieva, S., Okuloff, A., Zitting, P., Karppinen, J. I. (2011). Sports, smoking, and overweight during adolescence as predictors of sciatica in adulthood: a 28-year follow-up study of a birth cohort. *Am J Epidemiol*, 173(8), 890-897. doi: 10.1093/aje/kwq459

Roese I, Kohlman T, Raspe H. Measuring functional capacity in back ache patients in rehabilitation: a comparison of standardized questionnaires. *Die Rehabil* 1996;35 (2):103-108.

Roth-Isigkeit, A., Raspe, H. H., Stoven, H., Thyen, U., & Schmucker, P. (2003). [Pain in children and adolescents--results of an exploratory epidemiological study]. *Schmerz*, 17(3), 171-178. doi: 10.1007/s00482-003-0205-2

Roth-Isigkeit, A., Schwarzenberger, J., Baumeier, W., Meier, T., Lindig, M., & Schmucker, P. (2005). [Risk factors for back pain in children and adolescents]. *Schmerz*, 19(6), 535-543. doi: 10.1007/s00482-004-0379-2

Salminen, J. J. (1984). The adolescent back. A field survey of 370 Finnish schoolchildren. *Acta Paediatr Scand Suppl*, 315, 1-122.

Salminen, J. J., Pentti, J., & Terho, P. (1992). Low back pain and disability in 14-year-old schoolchildren. *Acta Paediatr*, 81(12), 1035-1039.

- Salminen, J. J., Erkontalo, M. O., Pentti, J., Oksanen, A., & Kormano, M. J. (1999). Recurrent low back pain and early disc degeneration in the young. *Spine (Phila Pa 1976)*, *24*(13), 1316-1321.
- Sato, T., Hirano, T., Ito, T., Morita, O., Kikuchi, R., Endo, N., & Tanabe, N. (2011). Back pain in adolescents with idiopathic scoliosis: epidemiological study for 43,630 pupils in Niigata City, Japan. *Eur Spine J*, *20*(2), 274-279. doi: 10.1007/s00586-010-1657-6
- Schmidt-Olsen, S., Jorgensen, U., Kaalund, S., & Sorensen, J. (1991). Injuries among young soccer players. *Am J Sports Med*, *19*(3), 273-275.
- School Health: Health Behaviour in School-Aged Children Survey Questionnaires and Data Tables, can be accessed from <http://www.phac-aspc.gc.ca/hp-ps/dca-dea/prog-ini/school-scolaire/behaviour-comportements/publications/school-health-ecole-sante-eng.php>
- Shehab, D. K., & Al-Jarallah, K. F. (2005). Nonspecific low-back pain in Kuwaiti children and adolescents: associated factors. *J Adolesc Health*, *36*(1), 32-35. doi: 10.1016/j.jadohealth.2003.12.011
- Shirado O, Ito T, Kaneda K, Strax TE. Electromyographic analysis of four techniques for isometric trunk muscles exercises. *Arch Phys Med Rehabil* 1995;76: 225-9.
- Shirado O, Ito T, Kaneda K, Strax TE, Concentric and eccentric strength of trunk muscles: Influence of test postures on strength and characteristics of patients with chronic low-back pain. July 1995, *Archives of Physical Medicine and Rehabilitation*, Volume 76, Issue 7, Pages 604–611
- Sjolie, A. N. (2004). Associations between activities and low back pain in adolescents. *Scand J Med Sci Sports*, *14*(6), 352-359. doi: 10.1111/j.1600-0838.2004.377.x
- Skoffer, B., & Foldspang, A. (2008). Physical activity and low-back pain in schoolchildren. *Eur Spine J*, *17*(3), 373-379. doi: 10.1007/s00586-007-0583-8
- Sluyter JD, Schaaf D, Scragg RKR, Plank LD: Prediction of fatness by standing 8-electrode bioimpedance: a multiethnic adolescent population. *Obesity* 2010, *18*:183–189.
- Sward, L., Eriksson, B., & Peterson, L. (1990). Anthropometric characteristics, passive hip flexion, and spinal mobility in relation to back pain in athletes. *Spine (Phila Pa 1976)*, *15*(5), 376-382.

Szpalski, M., Gunzburg, R., Balague, F., Nordin, M., & Melot, C. (2002). A 2-year prospective longitudinal study on low back pain in primary school children. *Eur Spine J*, *11*(5), 459-464. doi: 10.1007/s00586-002-0385-y

Te Kete Ipurangi Ministry of Education website last accessed on 3/12/13

Thelin, A., Holmberg, S., & Thelin, N. (2008). Functioning in neck and low back pain from a 12-year perspective: a prospective population-based study. *J Rehabil Med*, *40*(7), 555-561. doi: 10.2340/16501977-0205

Trevelyan FC and Legg SJ Risk factors associated with back pain in New Zealand school children. *Ergonomics*. 2011 Mar;54 (3):257-62. doi: 10.1080/00140139.2010.547608.

University of Otago and Ministry of Health. 2011. Methodology Report for the 2008/09 New Zealand Adult Nutrition Survey. Wellington: Ministry of Health

Unpublished data from: Currie C, Nic Gabhainn S, Godeau E, Roberts C, Smith R, Currie D, Pickett W, Richter M, Morgan A & Barnekow Rasmussen V (eds). Inequalities in young people's health: HBSC International report from the 2005/2006 Survey, Health Policy for Children and Adolescents No. 5. WHO Regional Office for Europe, Copenhagen, 2008. (Thanks to Rebecca Smith for this information.)

Van Gemert, C., Hellard, M., McBryde, E. S., Fielding, J., Spelman, T., Higgins, N., Bergeri, I. (2011). Intrahousehold transmission of pandemic (H1N1) 2009 virus, Victoria, Australia. *Emerg Infect Dis*, *17*(9), 1599-1607. doi: 10.3201/eid1709.101948

Vereecken CA, Maes L: A Belgian study on the reliability and relative validity of the Health Behaviour in School-Aged Children food-frequency questionnaire. *Public Health Nutr* 2003, *6*:581-588.

Volinn, E. (1997). The epidemiology of low back pain in the rest of the world. *Spine (Phila Pa 1976)*, *22*(15), 1798.

Von Korff M., *Spine (Phila Pa 1976)*. 1994 Sep 15;19 (18 Suppl):2041S-2046S. Studying the natural history of back pain.

Wagner TC, Lamb MB, Graham LJ, Salamh AP, Hill C, Kolber JM. (2013) Is there an agreement between self reported and scale measurements of height and weight? The internet journal of allied health science and practice, *11*(3), ISSN 1540-580 X

Waist Circumference Measurement by Site, Posture, Respiratory Phase, and Meal Time: Implications for Methodology, Sunil K. Agarwal, Anoop Misra, Priyanka Aggarwal, Amit

Bardia' Ruchika Goel' Naval K. Vikram' Jasjeet S. Wasir'Nazia Hussain' Krithika Ramachandran' Ravindra M. Pandey' Volume 17, Issue 5, pages 1056–1061, May 2009

Walker, B. F. (2000). The prevalence of low back pain: a systematic review of the literature from 1966 to 1998. *J Spinal Disord*, 13(3), 205-217.

Watson, K. D., Papageorgiou, A. C., Jones, G. T., Taylor, S., Symmons, D. P., Silman, A. J., & Macfarlane, G. J. (2002). Low back pain in schoolchildren: occurrence and characteristics. *Pain*, 97(1-2), 87-92.

White J and Halliwell E. Examination of a sociocultural model of excessive exercise among male and female adolescents, 2010, *Body Image* 7, 227–233

Willett W, Lenart E: Reproducibility and validity of food-frequency questionnaires. In *Nutritional Epidemiology*. Edited by Willett W. Oxford: Oxford University Press; 1998

Wong J, Parnell W, Black K, Skidmore P: Reliability and relative validity of a food frequency questionnaire to assess food group intakes in New Zealand adolescents. *Nutr J* 2012, 11:65.

Wynne-Jones, G., Dunn, K. M., & Main, C. J. (2008). The impact of low back pain on work: a study in primary care consulters. *Eur J Pain*, 12(2), 180-188. doi: 10.1016/j.ejpain.2007.04.006

Yao, W., Luo, C., Ai, F., & Chen, Q. (2012). Risk factors for nonspecific low-back pain in Chinese adolescents: a case-control study. *Pain Med*, 13(5), 658-664. doi: 10.1111/j.1526-4637.2012.01369.x

Appendix A

Eligibility criteria using PICOD format to select studies for low back pain among adolescents

Population (P) (AND)	(I) N/A	Lifestyle Factors (C) (AND)	LBP (O) (AND)	Study Design (S) (AND)*
<ul style="list-style-type: none"> • adolescent OR • teenager OR • child 		<ul style="list-style-type: none"> • sedentary life style OR • lifestyle OR • risk factors OR • health behaviour OR • Smoking OR • alcohol drinking OR • alcohol consumption OR • drinking behaviour OR • nutrition OR • food habits OR • food practice OR • food preferences OR • diet OR • dietary patterns OR • physical activity OR • motor activity OR • exercise OR • physical exertion OR • physical exertion(AMED) 	<ul style="list-style-type: none"> • low back pain OR • back pain OR • lumbago OR • backache OR • spinal pain 	<ul style="list-style-type: none"> • cohort studies OR • cross-sectional studies OR • longitudinal studies OR • prospective studies <p>*only used for Ovid Medline, Science Direct, Cochrane Wiley, Scopus</p>

e.g. from Scopus (("low back pain" OR "back pain" OR "backache" OR "spinal plain") AND ("adolescent" OR "child" OR "teenager") AND ("sedentary lifestyle" OR "lifestyle" OR "risk factors" OR "health behavior" OR "smoking" OR "alcohol drinking" OR "alcohol consumption" OR "drinking behavior" OR "nutrition" OR "food habits" OR "food practice" OR "food preferences" OR "diet" OR "dietary patterns" OR "physical activity" OR "physical exertion" OR "motor activity" OR "exercise")) AND ("cross-sectional studies" OR "longitudinal studies" OR "prospective studies"))

Appendix B

Modified Downs and Black checklist for non randomized studies

1 Is the hypothesis/aim/objective of the study clearly described? Must be explicit Yes/No

2 Are the main outcomes to be measured clearly described in the Introduction or Methods section? If the main outcomes are first mentioned in the Results section, the question should be answered no. ALL primary outcomes should be described for YES

Yes/No

3 Are the characteristics of the participants included in the study clearly described? In cohort studies and trials, inclusion and/or exclusion criteria should be given. In case-control studies, a case-definition and the source for controls should be given. Single case studies must state source of patient

Yes/No

5* Are the distributions of principal confounders in each group of subjects to be compared clearly described? A list of principal confounders is provided.

YES = age, severity

Yes/No

6 Are the main findings of the study clearly described? Simple outcome data (including denominators and numerators) should be reported for all major findings so that the reader can check the major analyses and conclusions.

Yes/No

7 Does the study provide estimates of the random variability in the data for the main outcomes? In non normally distributed data the inter-quartile range of results should be reported. In normally distributed data the standard error, standard deviation or confidence intervals should be reported

Yes/No

9 Have the characteristics of participants lost to follow-up been described? If not explicit = NO. RETROSPECTIVE – if not described = UTD; if not explicit re: numbers agreeing to participate = NO. Needs to be >85%

Yes/No

10 Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?

Yes/No

11 Were the subjects asked to participate in the study representative of the entire population from which they were recruited? The study must identify the source population for participants and describe how they were selected.

Yes/No/UTD

12 Were those subjects who were prepared to participate representative of the entire population from which they were recruited? The proportion of those asked who agreed should be stated.

Yes/No/UTD

16 If any of the results of the study were based on “data dredging”, was this made clear? Any analyses that had not been planned at the outset of the study should be clearly indicated.

Retrospective = NO. Prospective = YES

Yes/No/UTD

17 In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case control studies, is the time period between the intervention and outcome the same for cases and controls?

Where follow-up was the same for all study patients the answer should be yes. Studies where differences in follow-up are ignored should be answered no. Acceptable range 1 yr follow up = 1 month each way; 2 years follow up = 2 months; 3 years follow up = 3 months.....10 years follow up = 10 months

Yes/No/UTD

18 Were the statistical tests used to assess the main outcomes appropriate? The statistical techniques used must be appropriate to the data. If no tests done, but would have been appropriate to do = NO

Yes/No/UTD

19 Was the questionnaire completed? Yes/No/UTD

20 Were the main outcome measures used accurate (valid and reliable)? Where outcome measures are clearly Yes/No/UTD described, which refer to other work or that demonstrates the outcome measures are accurate = YES. ALL primary outcomes valid and reliable for YES

21 Were the participants with and without LBP in different groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?

Patients for all comparison groups should be selected from the same hospital. The question should be answered UTD for cohort and case control studies where there is no information concerning the source of patients

Yes/No/UTD

22 Were study participants with and without LBP (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same time? For a study which does not specify the time period over which patients were recruited, the question should be answered as UTD. Surgical studies must be <10 years for YES, if >10 years then NO Yes/No/UTD

25 Was there adequate adjustment for confounding in the analyses from which the main findings were drawn? In non randomized studies if the effect of the main confounders was not investigated or no adjustment was made in the final analyses the question should be answered as no. If no significant difference between groups shown then YES

Yes/No/UTD

26 Were losses of patients to follow-up taken into account? If the numbers of patients lost to follow-up are not reported = unable to determine. Yes/No/UTD

*Principal Confounders - Gender, back extensor strength, hamstring flexibility, carrying back packs, watching TV/computer games, emotional & behavioral disorders

Secondary confounders - school furniture, socioeconomic factors, BMI, Age, ethnicity

If a study considered two of the principal confounders and two or more of the secondary confounders, score as YES (2), if a study considered one principal confounder and one or more secondary confounders, score as PARTIALLY (1). If the study has not considered at least one of the principal confounders, irrespective of other confounders, score as NO (0).

Appendix C

Table 2.3 Quality assessment of studies using Downs & Black checklist score

Study	Country	Study design	Q1: Aim clearly described	Q2: Outcomes clearly described	Q3: Patients characteristics clearly described	Q4: Interventions clearly described	Q5: Principal confound ers clearly described	Q6: Main findings clearly describe d	Q7: Random variabilit y for the main outcome provided	Q8: Adverse events reported	Q9: Lost to follow up reported	Q10: Actual p-value reporte d	Quality Rating
Sjolie2004		Cross sectional	Yes	Yes	Yes	No	Partial	No	No	No	No	No	30
Kovacs et al.,2003		Survey	Yes	Yes	Yes	No	No	Yes	No	No	No	Yes	50
Feldman et al. 1999		prospective, repeated-measures cohort design	Yes	No	Yes	Yes	No	Yes	No	Yes	No	No	50
Feldman et al. 2001	Canada	Cohort study	Yes	Yes	Yes	No	Partially	Yes	No	No	No	No	40
Skoffer and Foldspang 2008	Denmark	Cross sectional	Yes	No	No	No	No	No	No	Yes	No	Yes	30
Harreby et al., 1999	Denmark	Cross sectional	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	50
Fritz and Clifford 2010		Observational study	Yes	Yes	Yes	No	No	No	No	No	No	No	30
Diepenmaat et al., 2006	The Netherlands	Questionnaire based survey	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	50
Perry et al. 2010	Western Australia	Exploratory cross sectional	Yes	No	Yes	No	No	No	No	No	No	No	20

Mikkonen et al., 2008	Finland	Prospective cohort study	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	50
Mogensen et al. 2007	Denmark	Cross sectional	Yes	No	Yes	No	No	No	No	No	No	No	20
Sato et al. 2011	Japan	Cross sectional	Yes	Yes	Yes	No	No	Yes	No	No	No	No	40
Oliveira and Cabri 2006	Portugal	Cross sectional, survey, descriptive research	Yes	Yes	Yes	No	Partially	Yes	No	No	No	No	40
Yao et al. 2012	China	Case control	Yes	Yes	Yes	No	Partially	Yes	No	No	No	No	40
Heaps et al. (2011)	Australia		Yes	Yes	No	No	No	Yes	No	No	No	No	30
Hestbaek et al. 2006		Cross sectional	Yes	No	Yes	No	No	No	No	No	No	No	20
Kristjansdottir and Rhee 2002	Iceland	Self-administered questionnaire	Yes	Yes	Yes	No	Partially	Yes	No	No	No	No	40
<u>Shehab and Al-Jarallah</u> 2005	Kuwait	cross-sectional	Yes	Yes	No	No	Yes	Yes	No	No	No	No	30
Hangai et al. (2010)		cross-sectional	No	No	No	No	No	No	No	No	No	No	0
<u>Auvinen</u> et al (2008)	Northern Finland	Mailed questionnaire	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	50
<u>Szpalski</u> et al (2002)	Belgium	Questionnaire	Yes	Yes	Yes	No	Yes	Yes	No	No	No	Yes	60
Kujala et al (1996)			Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	50

Burton et al (1996)		Questionnaire	Yes	No	No	No	No	No	No	No	No	No	10
Newcomer and Sinaki (1996)		Questionnaire	Yes	Yes	Yes	No	Yes	Yes	No	No	No	Yes	60
<u>Diepenmaat</u> et al (2004)	Netherlands	questionnaire	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	50
Watson et al (2003)		cross sectional	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	50
<u>Kujala</u> et al (1999)	Finland	cross sectional	Yes	Yes	Yes	No	No	Yes	No	No	No	Yes	50
Mikkonen et al (2012)	Northern Finland		Yes	Yes	Yes	No	No	Yes	No	No	No	No	40
Jones et al (2003)	England		Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	50

Study	Q11: Clear description of source population	Q12: clear description of response of patients	Q13: description of hospital type and country	Q14: clear description of blinding the intervention	Q15: clear description of blinding the treatment outcomes	Q16: details regarding data dredging	Q17: details regarding follow-up adjustments	Q18: Appropriateness of statistical outcomes	Q19: details regarding compliance with interventions	
Sjolie (2004)	Yes	Yes	Yes	NA	y e s	NA	Yes	NA	NA	NA
Kovacs et al.,(2003)	Yes	Yes	NA	NA	y e s	NA	Yes	NA	NA	NA
Feldman et al. (1999)	Yes	Yes	NA	NA	Y e s	Yes	Yes	NA	Yes	NA
Feldman et al. 2001	Yes	Yes	NA	NA	Y e s	Yes	Yes	NA	Yes	NA
Skoffer and Foldspang 2008	Yes	Yes	NA	NA	Y e s	NA	YES	NA	Yes	NA

Harreby et al., 1999	Yes	Yes	NA	NA	Y e s	Yes	Yes	NA	Yes	NA
Fritz and Clifford 2010	Yes	Yes	NA	NA	y e s	NA	Yes	NA	Yes	Na
Diepenmaat et al., 2006	Yes	Yes	NA	NA	Y e s	Yes	NA	NA	Yes	NA
Perry et al. 2010	Yes	Yes	NA	NA	y e s	NA	yes	NA	Yes	NA
Mikkonen et al., 2008	Yes	Yes	NA	NA	y e s	Yes	Yes	No	Yes	NA
Mogensen et al.2007	Yes	Yes	NA	NA	Y e s	NA	yes	NA	Yes	NA
Sato et al. 2011	Yes	Yes	NA	NA	y e s	No	Yes	No	No	NA
Oliveira and Cabri 2006	YES	Yes	NA	NA	y e s	yes	Yes	NA	Yes	NA
Yao et al. 2012	Yes	Yes	NA	NA	y e s	No	yes	NA	Yes	NA

Heaps et al. (2011)	yes	Yes	NA	NA	y e s	NA	yes	NA	Yes	NA
Hestbaek et al. 2006	yes	Yes	NA	NA	y e s	Yes	Yes	NA	Yes	NA
Kristjansdottir and Rhee 2002	yes	Yes	NA	NA	y e s	NA	Yes	NA	Yes	NA
<u>Shehaband Al- Jarallah</u> 2005	Yes	Yes	NA	Na	Y e s	NA	Yes	NA	Yes	NA
Hangai et al. (2010)	yes	Yes	NA	NA	Y e s	yes	yes	NA	Yes	NA
<u>Auvinen</u> et al (2008)	yes	Yes	NA	NA	y e s	NA	Yes	NA	Yes	NA
<u>Szpalski</u> et al (2002)	Yes	Yes	NA	NA	Y e s	Yes	Yes	NA	Yes	NA
Kujala et al (1996)	yes	Yes	NA	NA	y e s	Yes	Yes	NA	Yes	NA
Burton et al (1996)	yes	Yes	NA	NA	y e s	yes	Yes	NA	Yes	NA

Newcomer and Sinaki (1996)	yes	Yes	NA	NA	y e s	Yes	Yes	NA	Yes	NA
Watson et al (2003)	yes	Yes	Na	NA	y e s	Yes	NO	NA	Yes	NA
<u>Kujala</u> et al (1999)	yes	Yes	NA	NA	y e s	NO	yes	NA	Yes	NA
Mikkonen et al (2012)	yes	Yes	Na	NA	y e s	NO	yes	NA	Yes	NA
Jones et al (2003)	ye s	Yes	NA	NA	y e s	NA	yes	NA	Yes	NA

Appendix D

Table 2.4 Critical appraisal of included studies

Author	Publication year	Sample size	Study design	Age Range	Lifestyle factors studied (outcome measure)	P value	Outcome	Quality Rating
Yao et al.	2012	1,214 adolescents	case control study		Physical Activity		Family history, feeling schoolbag uncomfortable, duration of schoolbag carrying, basketball playing and rest position between classes are the major risk factors for nonspecific LBP in adolescents	40
Mikkonen et al	2012	1984 adolescents	Multinomial logistic regression	16-18	Physical Activity		Physical workload factors constitute a risk for LBP even in adolescents.	40
<u>Heaps</u> et al	2011	1608 adolescents		14	Alcohol consumption		The use of alcohol, but not cigarettes or marijuana, has a	30

							significant independent association with adolescent spinal pain.	
Sato	2010	43,630 pupils	cross-sectional study		Physical Activity	P=0.001	Sports activity is possible risk factors for the occurrence of LBP, and it might increase the risk for LBP in childhood and adolescence.	40
Perry et al	2010	1424 male and female adolescents	Multivariate analyses	14	Nutrition		Certain aspects of diet may have an association with spinal pain in adolescence.	
Hangai et al.	2010	4667 students	Cross-sectional study		Physical Activity		Excessive exposure to competitive sports activities during youth was associated with LBP and symptoms in the lower extremities, with the severity varying with the sport.	0
Fritz and Clifford	2010	58 adolescents	Observational study	15.40 ± 1.44	Physical Activity	P = .048	the pattern of clinical outcomes in this sample of adolescents	30

				years			with LBP was similar to that of adults with LBP	
Mikkonen et al	2008		Prospective cohort study	16-18	Smoking		Regular smoking in adolescence was associated with LBP in young adults. Pack-years of smoking showed an exposure-response relationship among girls.	50
Auvinen et al	2008	5999 boys and girls	multinomial logistic regression	15-16	Physical activity		Very active participation in physical activities in both sexes and a high amount of sitting in girls is related to self-report LBP.	50
Skoffer and Foldspang	2008	546 School Children	cross-sectional Study	15-16	Physical Activity		More than half of the children reported pain or discomfort in the low-back region during the preceding 3 months, and 1/4 experienced a decreased functioning or need of care because of LBP	30
Mogensen et al	2007	439 children	Cross-sectional study	12-13	Physical Activity		There was no association between back problems and the	20

							practising of sports in general.	
Hestbaek et al.	2006	9,600 twins	Cross-sectional study	12-22	Smoking, alcohol consumption and overweight		The twin control study failed to confirm a statistically significant link between smoking and LBP.	20
Diepenmaat et al	2006	3485 adolescents		12-16	Physical Activity		The overall prevalence of neck/shoulder, low back, and arm pain was 11.5%, 7.5%, and 3.9%, respectively	50
Oliveira and Cabri	2006	575 boys and 564 girls		10-18	Physical Activity	P<.05	The tobacco habits and number of hours/week watching TV or playing electronic and or computer games didn't related significantly with self reported LBP	40
Bejia	2005	622 children 326 females and 296 males	cross-sectional study	11-19	Physical Activity		The prevalence of LBP among Tunisian schoolchildren and adolescents is high	40
<u>Shehaband</u>	2005	400	cross-sectional	10-18	Physical		Back pain in Kuwaiti	

Al-Jarallah		schoolchildren	study		Activity		schoolchildren and adolescents is associated with older age, female gender, increase in physical activity, and time spent watching television.	
Diepenmaat et al	2004	3485 adolescents		12-16	Physical activity		Musculoskeletal pain is common among adolescents and is associated with depression and stress but not with computer use and physical activity.	50
Sjolie	2004	88 Adolescents	Cross-sectional study	Mean age 14.7 years	Physical Activity		LBP was inversely associated with time spent on physical activity	30
Jones et al	2003	1046 school children	Prospective population-based cohort study	11-14	Physical Activity		Children who reported high numbers of somatic symptoms at baseline were at greater risk of developing LBP	50
Watson et al	2003	1446 schoolchildren	Cross sectional study	11-14	Physical Activity		Psychosocial factors rather than mechanical factors are more important in LBP occurring in young populations and could	50

							possibly be a reflection of distress in schoolchildren.	
Kovacs et al	2003			13-15	Physical Activity	P<0.001		50
<u>Szpalski</u> et al	2002	287 children	Logistic regression	9–12	Physical Activity	P<0.0001	Psychological factors play a role in the experience of LBP in a similar way to what has been reported in adults. Poor self-perception of health (health belief) could be a factor behind the reporting of LBP	60
Kristjansdottir and Rhee	2002	2173 Students	Stepwise regression method	11–12 & 15-16	Physical, behavioral and social factors		Back pain showed significant associations with different aspects of physical condition such as chronic health conditions, tiredness and physical fitness.	40
Feldman et al	2001	502 high school students	Cohort study		Smoking		LBP occurrence at a frequency of at least once a week in the previous 6 months	40
Feldman	1999	502 students	Prospective, repeated-		Smoking		Smokers experienced LBP more than non-smokers	50

			measures cohort design					
Kujala et al	1999	344 girls and 354 boys		10-17	Physical Activity	p = 0.022	LBP found more often in subjects participating in large amounts of leisure physical activity	50
Harreby et al.	1999	671 boys and 718 girls	Cross-sectional study	14-15	Physical Activity		a cumulative life-time prevalence of LBP of 58.9%, a 1-year prevalence of 50.8% and an increase in LBP prevalence of 6.4% from 14 to 15 years of age, independent of gender	50
Kujala et al	1996	98 adolescents	Multivariate analyses		Physical Activity		Low individual physiologic maximum of lower segment lumbar extension mobility may cause overloading of the low back among athletes involved in sports with frequent maximal lumbar extension and that it predicts future LBP	50
Burton et al	1996	216 children		11-15	Physical activity		There was a positive link between sports and back pain	10

							only for boys	
Newcomer and Sinaki	1996	53 boys and 43 girls		10-19	Physical activity	$p= 0.008$	LBP is common in children, and, in contrast to adults, LBP in these children was more common with increased physical activity and stronger back flexors.	60

Appendix E

Information for teachers

Reference #11/223

Otago Back Pain and Lifestyle study



Otago Back Pain and Lifestyle Study

Study overview: Information for Teachers

What is the Study about?

This study aims to focus on Otago adolescent females aged between 13-18 years and will explore the relationship between low back pain and lifestyle factors.

Evidence shows that the prevalence of low back pain is higher in adolescents than previously thought especially in females and that low back pain in adolescents is a strong predictor of adult low back pain which is one of the major health issues of modern living.

What will the study involve?

We are aiming to screen teenage girls aged **13-18 years** in provincial schools throughout Otago. For this study we aim to collect information from your girls about low back pain and lifestyle factors via custom designed questionnaires. This will be followed by physical measures of height, waist circumference, body composition and strength testing of the back muscles.

Permission process

With your permission we are sending the information packs for the girls of name of the school “eg. *Lawrence High School*” of year 9 through to year 13. These packs contain a cover letter, information sheets and consent forms for each of them and their parents/guardians.

Students will be requested to return their and parent/guardians signed informed consents to school two weeks following distribution of the forms after which time the researchers will make contact with the school.

Information collection

Two investigators will visit the school at an agreed time convenient to the school. Only those girls who have signed consent form along with their parent consent will be screened and will complete the online questionnaire in the computer lab and a short physical activity questionnaire in a hard copy format. This will take approximately 30 minutes per class. Following which body measurements and strength testing will be done in the school gym/sports hall. It will take approximately 5 minutes for each student to carry out the physical measurements.

School involvement We have included our study's poster with this information for putting on a notice board to help promote awareness of the study.

We would like to take this opportunity to thank you very much for taking part in the Otago Back Pain and Lifestyle Study. Response from each student is extremely valuable to us and it would not have been possible without your support.

Please do not hesitate to contact the study team if you have any queries.

Principal investigators:

Nidhi Mehta

and/or

Dr. Gillian Johnson

Department of Physiotherapy

Department of Physiotherapy

University Telephone Number: 03 479 9619
5424

University Telephone Number: 03 479

Email Address: mehni171@student.otago.ac.nz

Email Address: gill.johnson@otago.ac.nz

Appendix F

Letter to parents



Otago Back Pain and Lifestyle study

Date: 02-03-2012



Dear Parent/Guardian,

We are writing to invite your daughter along with other girls in her class to take part in an important study to explore relationship between low back pain and lifestyle factors in girls aged between 13-18 years.

This study will be run by researchers from the University of Otago and is planned to take place in the Otago region over Semester One of 2012. Name of the school “eg. Lawrence High School” has agreed to take part in this study and have allowed us to invite all girls in your daughter’s class to participate.

We very much hope that your child will be able to take part in the study. We have enclosed an information sheet for you and your daughter. Please discuss the study with your daughter and fill in and sign the consent form enclosed with this letter to say whether or not you are happy for her to take part.

Please put the consent form in the envelope provided and give it to your daughter to return to school as soon as possible. If you would like any more information or you have any questions please feel free to contact:

Dr. Gillian Johnson

and/or

Nidhi Mehta

Senior Lecturer

Masters of health Science Candidate

School of Physiotherapy

School of Physiotherapy

University Telephone Number: 03 479 5424

University Telephone Number: 03 479 9619

Email Address: gill.johnson@otago.ac.nz Email Address: mehni171@student.otago.ac.nz

Thank you for considering your child's participation in this research study. Your help is greatly appreciated.

Sincerely

Dr Gillian Johnson (project supervisor)

Senior Lecturer

Centre for Physiotherapy Research

Nidhi Mehta

Masters of Health Sciences

Centre for Physiotherapy Research

Appendix G

Information for parents



Otago Back Pain and Lifestyle study

Department of Human Nutrition

School of Physiotherapy



The Otago Back Pain and Lifestyle study

Parent/Guardian information Sheet

What is the study about?

Evidence indicates that adolescents are prone to low back and that adolescent low back pain is a strong predictor of adult low back pain. One recent New Zealand study on school children indicate that back pain levels may be as high as 48%. There are many factors which may be related to low back pain in this age group, and further exploration is required to establish these links. This study aims to firstly determine the prevalence of low back pain in adolescent girls in the Otago region and secondly will help us to understand factors that are related to the condition. This is important, as an understanding of these factors will help us to develop strategies for promoting spinal health into old age.

Why my daughter?

Initially we want to screen adolescent girls in the wider Otago region, so as to build our knowledge around the possible factors local populations. We are aiming at reasonable cross-section of rural and urban female population aged 13-18 years across Otago to participate in this study. Your child's school (name of the school) has decided to take part in this study and have allowed us to invite all girls in your child's class to participate. Each child can

individually decide whether or not they would like to take part in the study. For those participating we also need parent/guardian consent.

Where will this study take place?

We will arrange a suitable time with your school principal so as not to disrupt normal school activities.

What will the study involve for your child?

If you and your daughter agree to participate in this study, the trained research staff present will collect information on the following:

Demographics, low back pain, physical activity, diet and smoking questionnaire: Students will be asked to complete an online questionnaire about their age, ethnicity, low back pain, diet, physical activity and smoking habits. Teachers and other school personnel will be present, but to ensure confidentiality our team will assist your daughter to complete the questionnaire where necessary. All information collected will be anonymous and will not be identifiable in any circumstances.

These questions are not like a school test, there are no right or wrong answers and your child does not have to answer every question if they do not want to.

Physical measurements: Trained research staff will measure and collect information about height, body composition and waist measurement; this will be measured with students wearing school uniform and without shoes and socks

Endurance and the strength of the back muscles will be evaluated using a standard physical test. The test is non-invasive and no adverse risks are anticipated with this test and will be performed one at a time in a screened-off area. Pupils will be given feedback on how they compare with normative values of girls in the same age group if they would like to have this information.

Please note:

Following students will not be allowed to participate

- If they have suffered from injury or have undergone surgery to the back in the past year.

- Or if they have any known congenital (by birth) or developmental spinal problems that have been diagnosed by a Doctor and/or Physiotherapist.
- Any student with a pre-existing medical condition for which physical exertion is not allowed will be unable to take part in fitness testing part of the study.
- Students where parent/guardian has stated on the consent form that you do not wish your child to take part in the study.
- Students who do not give informed consent.
- Students who sign the consent but do not wish to participate on the day of the school visit will not be required to participate.

What will the study team do with the things your child tells them?

Each student's personal information will be collected on a separate paper form and this will be kept separate from other information we collect during the study. The anonymised information and data from all the questionnaires will be sent to the University web server and only researchers involved in the project will have access to the data. The data collected will be summarised, and results reported in research journals and at international conferences. At the end of the study the overall results will be available to children and parents who took part. We will also supply a summary of the average findings to the principal of each school that takes part in this study. No personal information about individual children will be reported.

What do I do now?

We very much hope that your daughter will be able to take part in the study. Please discuss the study with your child. Your daughter can choose not to take part, or she can withdraw from the study at anytime. This will not affect their future education or care in any way. Please fill in and sign the consent form whether or not you wish your daughter to take part in this study and give it to your daughter to return to school.

Who can tell me more about the study?

If you have any questions about this project, please contact either of the following:

Dr. Gillian Johnson

and/or

Nidhi Mehta

Senior Lecturer

Masters of health Science Candidate

Department of Physiotherapy

Department of Physiotherapy

University Telephone Number: 03 479 5424 University Telephone Number: 03 479 9619

Email Address: gill.johnson@otago.ac.nz Email Address: mehni171@student.otago.ac.nz

Thank You for taking time to read this information sheet

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the committee through the Human Ethics Committee Administrator (Ph 03 479 8256). Any issues will be treated in confidence and investigated and you will be informed of the outcome.

Appendix H

Information for students



Otago Back Pain and Lifestyle study



Information Leaflet for Students

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you of any kind and we thank you for considering our request.

Why we are doing this study?

The Otago back pain and lifestyle study is looking at the health of the adolescent girls and exploring the relationship between low back pain and lifestyle habits such as nutrition/food habits, smoking and physical activity/exercise in school girls residing in the Otago region. We hope that you will help us with this important study, which may help to make students in New Zealand healthier.

This study will help determine the level of back pain in schools girls and if lifestyle factors such as diet, smoking and physical activity are impacting on these levels. This project is being undertaken as part of the requirements for a Masters of Health Sciences at the School of Physiotherapy at the University of Otago.

Why me?

We are interested in adolescent females aged between 13-18 years **with or without back pain** who attend school in the Otago region. You do not have to take part in study but if you do it will be of great help to us. Individuals with the following conditions will be excluded from the study if you have any of the following:

- Suffered from injury to back or have undergone surgery to the back in the past year.
- Or if you have any known congenital (by birth) or developmental spinal problems that have been diagnosed by a Doctor and/or Physiotherapist.
- Any student with a pre-existing medical condition for which physical exertion is not allowed will be unable to take part in fitness testing part of the study.
- Students whose parent/guardian has stated on the consent form that they do not wish their child to take part in the study.
- Students who do not give informed consent and students who sign the consent but do not wish to participate on the day of the school visit will not be required to participate.

What would I have to do?

If you do decide to take part, we will come to your school during school time so you will not have to give up any of your free time to take part. We will then ask you to fill out a questionnaire which will contain questions on your back pain history, food habits, smoking habits and physical activity. **All of these questions have been used before in studies in students and are very safe.** However, you do not have to complete all the questions if they are not applicable or if you do not want to.

Research staff will also take some simple measurements:

- Your height, body weight and waist circumference will be measured. You will be required to only remove your shoes and socks in order to measure your height. Waist measurements will be recorded using a tape measure around your waistline with school uniform on without shoes and socks.

Should it be required these measurements could be repeated, but not more than three times.

- We are also interested in measuring your endurance and strength of back muscles and a short test will be conducted for this. It is described here if you would like to go through it.

You will be required to lie on a plinth with the lower body secured by three straps and your ability to maintain the horizontal position of the upper trunk is timed (seconds). The test is non-invasive and no adverse risks are anticipated with this test. The test will be performed one at a time in a screened area

It will take approximately 30 minutes to fill in the questionnaires and 5-7 minutes for physical measurements and fitness testing. There are no discomforts, risks or inconveniences associated as a result of participation

What happens after the study?

When we have finished visiting the schools in Otago, we will send your principal the summary results of the study. These will be for all students together and we will make sure that the principal/class teacher will not see your answers to the questions under any circumstances. The data will be collected and stored anonymously and only the investigators will be able to access it. If any publication of the data is done, it will not be possible to identify anyone who took part in the study.

At the end of the project any personal information will be destroyed immediately except that, as required by the University's research policy, any raw data on which the results of the project depend will be retained in secure storage for five years, after which it will be destroyed. The

results of the project may be published and will be available in the University of Otago library (Dunedin, New Zealand) but every attempt will be made to preserve your anonymity.

What do I do now?

Thank you for reading this information. We hope you will be able to take part in our study. Please fill in the reply form with your parent or guardian and bring it back to the school.

Please be aware that you may decide not to take part in the project without any disadvantage to yourself of any kind.

If you have any questions about our project, either now or in the future, please feel free to contact either:-

Nidhi Mehta

and/or

Dr. Gillian Johnson

Department of Physiotherapy

Department of Physiotherapy

University Telephone Number: 03 479 9619

University Telephone Number: 03 479 5424

Email Address: mehni171@student.otago.ac.nz

Email Address: gill.johnson@otago.ac.nz

Thank You for taking time to read this information sheet

This study has been approved by the University of Otago Human Ethics Committee. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph 03 479 8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

Appendix I

Consent form for students



Otago Back Pain and Lifestyle study



Consent Form for Student Participants

Thank you for reading the attached information sheet for this study. Please ask us if there is anything that is not clear or if you would like more information.

I have read the Information Sheet concerning this project and understand what this study is about. All my questions have been answered in a way that makes sense. I understand that I am free to request further information at any stage.

I know that:-

1. My participation in this study is entirely voluntary, which means that I don't have to take part if I don't want to and nothing will happen to me. I can also stop taking part at any time and don't have to give a reason.
2. I am free to withdraw at any time without any disadvantage.
3. If I have any worries or I have any other questions, then I can talk about these with Nidhi.
4. My answers will only be seen by Nidhi and her supervisors. They will keep whatever I say private.

5. Nidhi will write up the results from this study for her university work. The results may also be written up in journals and talked about at conferences. My name will not be on anything the investigators write up about this study.
6. Personal identifying information will be destroyed at the conclusion of the project but any raw data on which the results of the project depend will be retained in secure storage for at least five years.
7. The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand) but every attempt will be made to preserve my anonymity.

I agree to take part in this project

.....

(Signature of the participant)

.....

(Date)

.....Name of the Participant

Appendix J

Consent form for students

(back strength testing sub study)

Otago Back Pain and Lifestyle study



Consent Form for Student Participants

For Back Strength Testing Sub study

Thank you for reading the attached information sheet for this study. Please ask us if there is anything that is not clear or if you would like more information.

I understand what this study is about. All my questions have been answered in a way that makes sense..

I know that:-

1. Participation in this study is entirely voluntary, which means that I don't have to take part if I don't want to and nothing will happen to me. I can also stop taking part at any time and don't have to give a reason.
2. I am free to withdraw at any time without any disadvantage.
3. If I have any worries or I have any other questions, then I can talk about these with Nidhi
4. Nidhi will write up the results from this study for her university work. The results may also be written up in journals and talked about at conferences. My name will not be on anything the investigators write up about this study.

I agree to take part in fitness testing study.

.....

(Signature of the participant)

.....

(Date)

.....Name of the Participant

Appendix K

Consent form for parents

Otago Back Pain and Lifestyle study



Consent Form for Parents

Thank you for reading the attached information sheet for this study. Please ask us if there is anything that is not clear or if you would like more information.

I have read the Information Sheet concerning this project and understand what this study is about. All my questions have been answered in a way that makes sense. I understand that I am free to request further information at any stage.

I know that:-

1. My daughters' participation in this study is entirely voluntary, which means that she don't have to take part if she doesn't wants to and nothing will happen to her. She can also stop taking part at any time and don't have to give a reason.
2. She is free to withdraw at any time without any disadvantage.
3. If I have any worries or I have any other questions, then I can talk about these with Nidhi.
4. Personal identifying information will be destroyed at the conclusion of the project but any raw data on which the results of the project depend will be retained in secure storage for at least five years.
5. The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand) but every attempt will be made to preserve my anonymity.

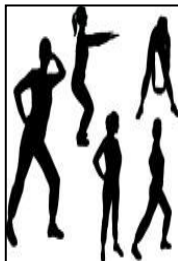
- I agree for my daughter to take part in this project
- I do not agree for my daughter to take part in this project

.....
(Signature of parent/guardian)

.....
(Date)

.....Name of parent/guardian

Appendix L
Questionnaire



Otago Low Back Pain & Lifestyle study

Otago Low Back Pain & Lifestyle study

1) Please enter your **personal ID number** provided for this study

Personal ID number _____

2) What is your **date of birth**? e.g. 15/01/1996

___/___/_____

3) Which **ethnic group or groups** do you belong to? Please tick as many as apply

New Zealand European

Māori

Samoaan

Cook Island Māori

Tongan

Niuean

Chinese

Indian

Dutch, Japanese, Tokelauan or others please state _____

PHYSICAL ACTIVITY

All the questions in this questionnaire are about how you feel and think about physical activity.

Here we will be talking about time you spent being physically active in **last 7 days**.

Active means doing activities at work, school or home, getting from place to place and any activities you did for exercise, sport, recreation or leisure.

We will ask you separately about brisk walking, moderate activities and vigorous activities

Walking

- 4) During **the last 7 days**, on how many days did you **walk at a brisk pace**?

A brisk pace is a pace at which you are breathing harder than normal? This includes walking at work or school, while getting from place to place, at home and at any activities that you did solely for recreation, sport, exercise or leisure.

Think only about brisk walking done for at least 10 minutes at a time

- a) _____ days per week (Go to question number 2)

- b) None (Go to question number 3)

- 5) How much time did you typically spend walking at a brisk pace on each of those days?

- a) _____ hours _____ minutes

Moderate physical activity

- 6) During **the last 7 days**, on how many days did you do **moderate physical activities**?

Moderate activities make you breathe harder than normal, but only a little – like carrying light loads, bicycling at a regular pace, or other such activities. Do not include walking of any kind.

Think only about those physical activities done for at least 10 minutes at a time.

a) _____ days per week (Go to question number 4)

b) None (Go to question number 5)

7) How much time did you typically spend on each of those days doing moderate physical activities?

a) _____ hours _____ minutes

Vigorous physical activity

8) **During the last 7 days**, on how many days did you do **vigorous physical activities**?

Vigorous activities make you breathe a lot harder than normal ('huff and puff') – like heavy lifting, digging, aerobics, fast bicycling, or other such activities.

Think only about those physical activities done for at least 10 minutes at a time.

a) _____ days per week (Go to question number 6)

b) None (Go to question number 7)

9) How much time did you typically spend on each of those days doing vigorous physical activities?

a) _____ hours _____ minutes

Frequency of Activity

10) Thinking about all your activities **over the last 7 days** (including brisk walking), on how many days did you engage in:

- At least 30 minutes of moderate activity (including brisk walking) that made you breathe a little harder than normal,

OR

- At least 15 minutes of vigorous activity that made you breathe a lot harder than normal ('huff and puff')?

a) _____ days per week

b) None

Stage of Change

11) Describe your regular physical activity **over the past six months**.

Regular physical activity means at least 15 minutes of vigorous activity (makes you ‘huff and puff’) or 30 minutes of moderate activity (makes you breathe slightly harder than normal) each day for 5 or more days each week. Include brisk walking.

I am not regularly physically active and do not intend to be so in the next 6 months

I am not regularly physically active but am thinking about starting in the next 6 months

I do some physical activity but not enough to meet the description of regular physical activity

I am regularly physically active but only began in the last 6 months

I am regularly physically active and have been so for longer than 6 months

12) Over the **past seven days**, on how many days were you **physically active** for a total of **at least 60 minutes per day?**

0 days

1 day

2 days

3 days

4 days

5 days

6 days

7 days

13) Over a typical or usual week, on how many days are you physically active for a total of at least 60 minutes per day?

0 days

1 day

2 days

3 days

4 days

5 days

6 days

7 days

LOW BACK PAIN (Please do not include any pain due to menstruation or fever)

14) Have you ever experienced low back pain in your lifetime that lasted for one day or more?

Yes

No

15) Have you had low back pain in **last 3 years** that **lasted for one day or more?**

Yes

No

16) Have you experienced low back pain in **last 1 year** that **lasted for one day or more?**

Yes

No

17) Have you experienced low back pain in **last 6 months** that **lasted for one day or more?**

Yes

No

18) Have you experienced low back pain in **past month** that **lasted for one day or more?**

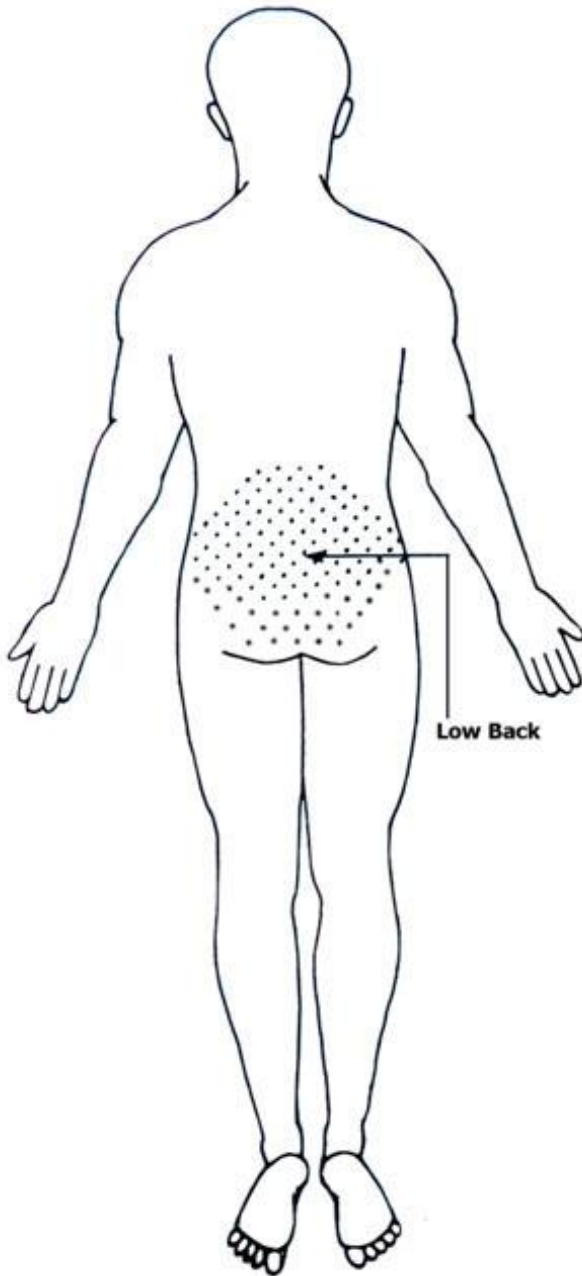
Yes

No

19) In the **past month** have you experienced any **pain in the shaded area** marked as **low back** on the picture which **lasted for day or longer**?

Yes

No



20) Do you **currently** have low back pain?

Yes

No

21) Are you **undergoing any treatment** for low back pain **currently**?

Yes

No

If your answer is “no” to **all** of the **LOW BACK PAIN** questions above, please go to **QUESTION NUMBER 18**.

If your answer is “yes” to any of the **LOW BACK PAIN** questions please answer the **following questions**

22) Thinking back **over past month**, how many days have you had low back pain which **lasted for the day?**

_____ days

23) Please mark with a cross on the scale below **how bad this pain** was at its worst **during past month**.

No pain at all 0 _____ 10 *Worst pain you can imagine*

24) **How long** does your low back pain **usually last?**

Less than 12 hours

12-24 hours

1-7 days

More than 1 week

25) Does your low back pain **ever spread down your leg?**

Yes

No

26) Please put a tick against any of the following you have **visited during the past year for treatment of your low back pain?**

Doctor

Physiotherapist

School nurse

Other _____ (Please state)

I have not seen anyone about my back pain

27) Do these pains and aches in your low back make **any of the following daily activities difficult** (please tick the appropriate answers)?

Reaching up to get a book from high shelf?

Yes/No

Carrying your school bag to school?

Yes/No

Sitting on school chair for a 45-min lesson?

Yes/No

Standing in a queue for 10 min?

Yes/No

Sitting up in a bed from lying position?

Yes/No

Bending down to put your socks on?

Yes/No

Standing up from an armchair at home?

Yes/No

Running fast to catch a bus?

Yes/No

Sports activities at school?

Yes/No

LIFESTYLE FACTORS

28) Have you **ever smoked cigarettes or tobacco at all**, even just a few puffs?

Yes

No

Don't Know

29) Have you ever **smoked a whole cigarette?**

Yes

No

If Yes, Please answer following questions; otherwise go to QUESTION NUMBER 25

30) About **how old were you** when you **first smoked a whole cigarette?**

9 years or under 13 years

10 years 14 years

11 years 15 years

12 years 16 years

Older than 16

31) Have you ever **smoked** a total of **more than 10 cigarettes** in your **whole life?**

Yes

No

Don't know

32) Have you ever **smoked** a total of **more than 100 cigarettes** in your **whole life**?

Yes

No

Don't know

33) **How often** do you **smoke now**?

You don't smoke now

At least once a day

At least once a week

At least once a month

Less often than once a month

34) On average, **how many** cigarettes do you **smoke a day**?

Less than 1 per day

1-5 per day

6-10 per day

11-15 per day

16 -20 per day

21-25 per day

26-30 per day

31 or more a day

Don't know/unsure

FOOD & DRINK

35) **How often** do you usually have **food for breakfast (more than a drink)**?

Please tick one box for weekdays and one box for weekends

Weekdays	Weekends
<input type="checkbox"/> I never have breakfast during weekdays	<input type="checkbox"/> I never have breakfast during the weekend
<input type="checkbox"/> One day	
<input type="checkbox"/> Two days	<input type="checkbox"/> I usually have breakfast on only one day of the weekend (Saturday OR Sunday)
<input type="checkbox"/> Three days	
<input type="checkbox"/> Four days	<input type="checkbox"/> I usually have breakfast on both weekend days (Saturday AND Sunday)
<input type="checkbox"/> Five days	

36) **How often** do you usually have **lunch (more than a drink or snack)**?

Please tick one box for weekdays and one box for weekends

Weekdays	Weekends
<input type="checkbox"/> I never have lunch during weekdays	<input type="checkbox"/> I never have lunch during the weekend
<input type="checkbox"/> One day	
<input type="checkbox"/> Two days	<input type="checkbox"/> I usually have lunch on only one day of the weekend (Saturday OR Sunday)
<input type="checkbox"/> Three days	
<input type="checkbox"/> Four days	<input type="checkbox"/> I usually have lunch on both weekend days (Saturday AND Sunday)
<input type="checkbox"/> Five days	

37) **How often** do you usually have a **meal in the evening (more than a drink or snack)?**

Please tick one box for weekdays and one box for weekends

Weekdays	Weekends
<input type="checkbox"/> I never have an evening meal during weekdays	<input type="checkbox"/> I never have an evening meal during the weekend
<input type="checkbox"/> One day	
<input type="checkbox"/> Two days	<input type="checkbox"/> I usually have an evening meal on only one day of the weekend (Saturday OR Sunday)
<input type="checkbox"/> Three days	
<input type="checkbox"/> Four days	<input type="checkbox"/> I usually have an evening meal on both weekend days (Saturday AND Sunday)
<input type="checkbox"/> Five days	

These next two questions ask about the **amount of fruit and vegetables** that you eat

38) (a) On average, **how many servings of fruit** (fresh, frozen, canned or stewed) do you eat **per day?**

A 'serving' = 1 medium piece or 2 small pieces of fruit or ½ cup of stewed fruit
e.g. 1 apple + 2 small apricots = 2 servings

- I don't eat fruit
- Less than 1 per day
- 1 serving
- 2 servings
- 3 servings
- 4 or more servings

(b) On average, **how many servings of vegetables** (fresh, frozen, canned and raw) do you eat **per day?**

A 'serving' = 1 medium potato/ kumara or $\frac{1}{2}$ cup cooked vegetables or 1 cup of salad vegetables

e.g. 2 medium potatoes + $\frac{1}{2}$ cup of peas = 3 servings

- I don't eat vegetables
- Less than 1 per day
- 1 serving
- 2 servings
- 3 servings
- 4 or more servings

Now, we would like to know about the types of **foods and drinks** that you **usually** eat/drink and **how often** you eat/drink them.

39) **How many times a week** do you **usually** eat or drink any of the following?

Please tick one box for each item

Foods/Drinks	None	Less than once a week	Once a week	2 to 4 days a week	5 to 6 days a week	Once a day	More than once a day
Fruit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vegetables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lollies (e.g. Jelly beans, marshmallows, wine gums, liquorice, minties)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chocolate confectionary (e.g. Dairy Milk, Moro, Crunchy, Roses, Chocolate Fish, M&M's, Jaffas)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sugar-sweetened drinks including soft drinks (e.g. Coke, Raro, Refresh, Lemonade, cordials)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Non-sugar sweetened drinks (e.g. Diet coke, coke zero)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

or 'light' diet drinks)

Foods/Drinks	None	Less than once a week	Once a week	2 to 4 days a week	5 to 6 days a week	Once a day	More than once a day
Standard milk (dark blue)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low fat milk (light blue) / Trim milk (green) / Calci Trim milk (yellow)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cheese	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Breakfast cereals (all kinds)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
White bread	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Brown / wholegrain bread	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coffee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Black tea (ordinary tea like Dilmah, Bell etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Green tea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fruit or Herb tea e.g camomile, peppermint,	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

strawberry, ginger etc

Foods/Drinks	None	Less than once a week	Once a week	2 to 4 days a week	5 to 6 days a week	Once a day	More than once a day
Potato crisps / corn snacks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hot chips / wedges	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alcoholic drinks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rice / pasta / noodles	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Foods/Drinks	None	Less than once a week	Once a week	2 to 4 days a week	5 to 6 days a week	Once a day	More than once a day
Yoghurt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ice-cream	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fish (including canned tuna or salmon, fish cakes, fish fingers, fish pie, battered fish)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other seafood (including mussels, oysters,	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

prawns)

Eggs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Chicken, turkey, duck (including chicken nuggets)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Beef (including mince, corned beef, roast and steak)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Lamb or mutton (including roast, and chops)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Processed meat (including sausage, salami and luncheon)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Pork (including roast, chops, ribs, ham and bacon)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
---	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Nuts and seeds	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
----------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Meat alternatives (e.g. tofu, vegetarian sausages, felafel)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------	--------------------------

Next, we would like to know in more detail about the **type of fruits, vegetables and other foods** that you **ate** in the **last week**.

40) How often have you eaten the **following fruits and vegetables** (fresh, frozen, canned, stewed, cooked or raw) over the **past seven days**?

Please tick one box for each item

Fruits	None	Once	Twice	3 times	4 times	5 times	6 times	7 times	+8 times
Apples	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pears	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oranges / Mandarins	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Bananas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peaches / Nectarines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Apricots	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plums	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kiwifruit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strawberries or other berries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grapes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Melons (including watermelon, rockmelon, honeydew)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pineapple	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Avocado	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Potatoes (not fried, e.g. boiled, mashed, baked)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Potatoes (hot potato chips, French fries, wedges, hash brown, roasted)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Fruits	None	Once	Twice	3 times	4 times	5 times	6 times	7 times	+8 times
Carrots	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mixed vegetables (e.g. stir-fried, frozen)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peas / green beans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vegetables	None	Once	Twice	3 times	4 times	5 times	6 times	7 times	+8 times
Corn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Broccoli / cauliflower / broccoflower	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lettuce / salad greens	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tomatoes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Silverbeet / spinach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Watercress / puha	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Legumes (e.g. baked beans, chickpeas, lentils, kidney beans)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kumara	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Taro	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cabbage / coleslaw	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Brussel sprouts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pumpkin / squash	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peppers / capsicum	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(green, red, or yellow)									
	None	Once	Twice	3 times	4 times	5 times	6 times	7 times	+8 times
Zucchini / courgette	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cucumber	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Celery / asparagus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vegetables	None	Once	Twice	3 times	4 times	5 times	6 times	7 times	+8 times
Onion / leek	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mushrooms	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

41) How often have you eaten each of the following food/drink items over the past seven days?

Other foods / drinks	None	Once	Twice	3 times	4 times	5 times	6 times	7 times	+8 times
Peanut butter or nut spread	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sweet biscuits / cakes / muffins / doughnuts / fruit pies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Potato chips/crisps or savoury snacks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Confectionary / sweet snack bars / roll-ups	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chocolate confectionary	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sugar-sweetened drinks including soft drinks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

(e.g. Coke, Raro,
Refresh, Lemonade,
cordials)

Non-sugar sweetened drinks (e.g. Diet coke, coke zero or 'light' diet drinks)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ice-cream	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pies / sausage rolls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pizza	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hot chips / wedges / French fries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Energy drinks e.g. V, Mother, Red Bull	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

42) **How often** do you eat **takeaways** (such as McDonalds, KFC, Fish 'n' Chips, Domino's Pizza, Hell Pizza, Pizza Hut, Country Fried Chicken, Asian takeaways)?

- Never
- Less than once a week
- Once a week
- 2 to 4 days a week
- 5 to 6 days a week
- Once a day
- More than once a day

43) Do you take any form of **Vitamin or Mineral Supplements?**

If yes can you please provide details below

Supplement 1: Brand_____

Number of tablets/spoonfuls taken per day_____

Supplement 2: Brand_____

Number of tablets/spoonfuls taken per day_____

Supplement 3: Brand_____

Number of tablets/spoonfuls taken per day_____

Please check that you have answered all the questions

Thank you for completing this questionnaire

Appendix M

Ethics approval

UNIVERSITY
OF OTAGO



UNIVERSITY
OF OTAGO

Academic Services

Manager, Academic Committees, Mr Gary Witte

11/223

7 September 2011

Dr G Johnson
School of Physiotherapy

Dear Dr Johnson

I am again writing to you concerning your proposal entitled "The relationship between spinal pain and key lifestyle factors in New Zealand adolescent females", Ethics Committee reference number 11/223.

Thank you for sending to me the revised application addressing the Committee's concerns. We are grateful for the minor rewording of the Information Sheet, and for the condensing of the Consent Form for Parents/Guardians.

On the basis of this response, I am pleased to confirm that the proposal now has full ethical approval to proceed.

Approval is for up to three years. If this project has not been completed within three years from the date of this letter, re-approval must be requested. If the nature, consent, location, procedures or personnel of your approved application change, please advise me in writing.

Yours sincerely,

Mr Gary Witte
Manager, Academic Committees

Tel: 479 8256

Email: gary.witte@otago.ac.nz

c.c. Professor G D Baxter Dean School of Physiotherapy

NGĀI TAHU RESEARCH CONSULTATION COMMITTEE
TE KOMITI RAKAHAU KI KĀI TAHU

23/08/2011 - 42
Tuesday, 23 August 2011

Dr Johnson
School of Physiotherapy
Dunedin

Tēnā koe Dr Johnson

Title: The relationship between spinal pain and key lifestyle factors in New Zealand adolescent females-a pilot study.

The Ngāi Tahu Research Consultation Committee (The Committee) met on Tuesday, 23 August 2011 to discuss your research proposition.

By way of introduction, this response from the Committee is provided as part of the Memorandum of Understanding between Te Rūnanga o Ngāi Tahu and the University. In the statement of principles of the memorandum, it states "Ngāi Tahu acknowledges that the consultation process outlined in this policy provides no power of veto by Ngāi Tahu to research undertaken at the University of Otago". As such, this response is not "approval" or "mandate" for the research, rather it is a mandated response from a Ngāi Tahu appointed committee. This process is part of a number of requirements for researchers to undertake and does not cover other issues relating to ethics, including methodology; they are separate requirements with other committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee base consultation on that defined by Justice McGechan:

"Consultation does not mean negotiation or agreement. It means: setting out a proposal not fully decided upon; adequately informing a party about relevant information upon which the proposal is based; listening to what the others have to say with an open mind (in that there is room to be persuaded against the proposal); undertaking that task in a genuine and not cosmetic manner. Reaching a decision that may or may not alter the original proposal."

The Committee considers the research to be of importance to Māori health.

As this study involves human participants, the Committee strongly encourage that ethnicity data be collected as part of the research project. That is the questions on self-identified ethnicity and descent, these questions are contained in the 2006 census.

The Ministry of Health website <http://www.Māorihealth.govt.nz/moh.nsf/indexma/publications> contains a list of Māori health publications. The Committee recommends you review the Māori health publications on this website, eg. Unequal Impact II: Māori and Non-Māori Cancer Statistics by Deprivation and Rural-Urban Status 2002-2006 and Tatau Kahukura: Māori Health Chart Book 2010. Another

The Ngāi Tahu Research Consultation Committee has membership from:

*Te Rūnanga o Ōtākou Incorporated
Kāti Huirapa Rūnaka ki Puketeraki
Te Rūnanga o Moeraki*

NGĀI TAHU RESEARCH CONSULTATION COMMITTEE

TE KOMITI RAKAHAU KI KĀI TAHU

Publication, Hauora: Māori Standards of Health IV (200-2005), has its own website, <http://www.hauora.Māori.nz/>. These publications provide information on a range of Māori health issues and will assist in ensuring your research has an appropriate Māori health focus.

The Committee notes this is a pilot project and asks that if the project continues past the pilot stage that the researchers come back to the Committee for further consultation.

The Committee suggests dissemination of the research findings to Māori health organisations, relevant National Māori Education organizations and Toitu te Iwi at Te Rūnanga o Ngāi Tahu regarding this study.

We wish you every success in your research and the Committee also requests a copy of the research findings.

This letter of suggestion, recommendation and advice is current for an 18 month period from Tuesday, 23 August 2011 to 23 February 2013.

The recommendations and suggestions above are provided on your proposal submitted through the consultation website process. These recommendations and suggestions do not necessarily relate to ethical issues with the research, including methodology. Other committees may also provide feedback in these areas.

Nāhaku noa, nā



PR. NTREC

Mark Brunton
Kaiwhakahaere Rangahau Māori
Research Manager Māori
Research Division
Te Whare Wānanga o Otago
Ph: +64 3 479 8738
email: mark.brunton@otago.ac.nz
Web: www.otago.ac.nz

The Ngāi Tahu Research Consultation Committee has membership from:

*Te Rūnanga o Ōtākou Incorporated
Kāti Huirapa Rūnaka ki Puketeraki
Te Rūnanga o Moeraki*