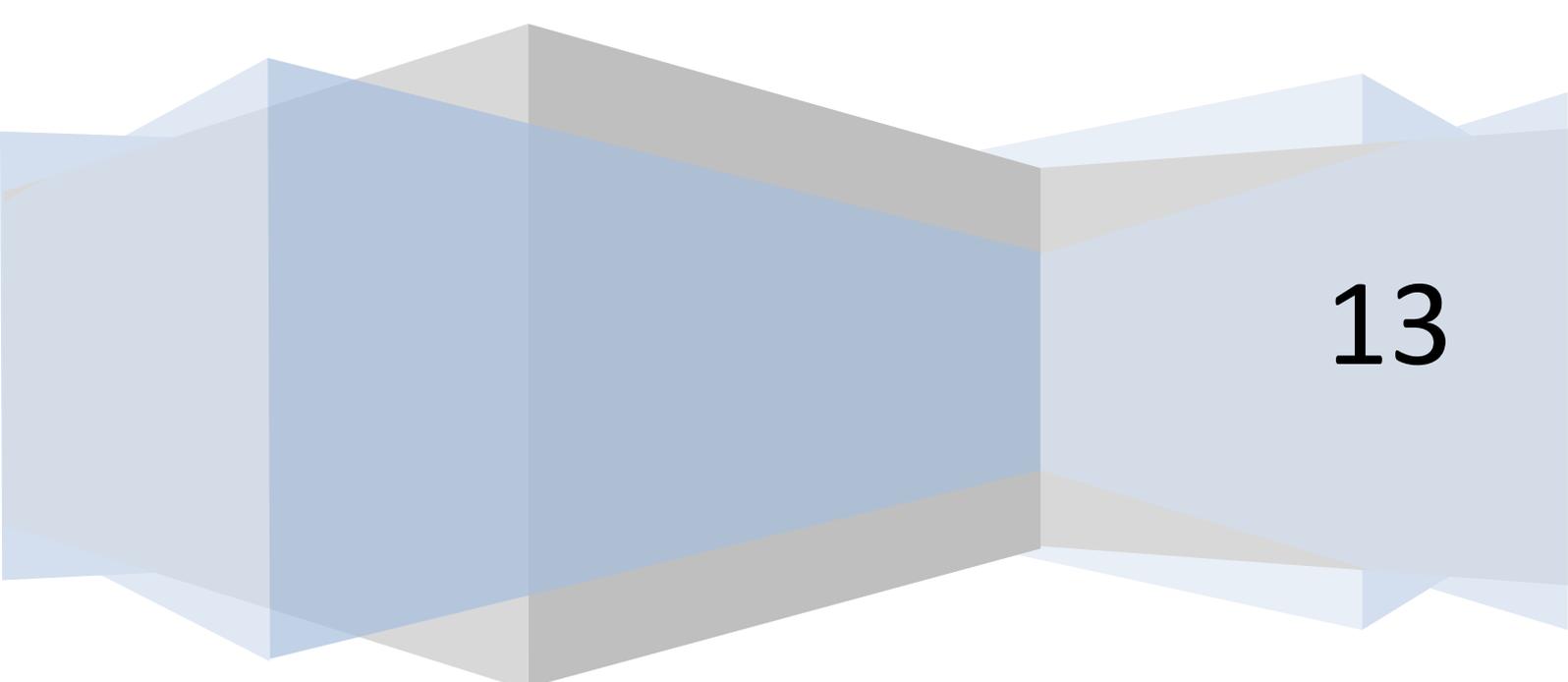


Junior Science Research Project

The Correlation Between Psychological Well-Being and Physical Exercise in Teenage Boys

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9 Science 1



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Introduction

Background Information

Psychological well-being is a growing concern for today's youth. With developments in technology and innovation there is also a growth in the amount of factors that contribute both positively and negatively to psychological well-being, especially in today's youth who are gaining access to things like mobile phones at a younger age than ever before. In the past there has been extensive research into what contributes towards mental health and what factors contribute positively or negatively towards it.

A mental disorder, which is also known as poor psychological well-being, can be classified into many categories. Some of the major disorders include; depression, anxiety, schizophrenia, bipolar mood disorder, personality disorders, trauma and eating disorders. The most common mental disorders in Australia are anxiety and depressive disorders.

Researchers have reported that major factors contributing to a mental health disorder are;

- High levels of social deprivation/poverty
- Family composition (i.e. Being brought up by a single parent)
- Poor mental health of primary caregiver/family history of mental health
- Presence of negative role models with less punitive child management practices/family in disharmony
- Negative life events (i.e. abuse)
- Lower opportunities for employment, education and recreation
- Excessive amounts of free time
- Limited relationships/friends
- Lack of meaning in life and routine/social exclusion

(Gates and Barr, 2009)

The Australian Bureau of Statistics has determined that in 2007 one in five Australians (aged 16-85) have experienced a 12 month mental disorder. However 76% of all young people (aged 16-24 years) self-evaluated themselves to have good mental health/well-being, which compares to only 26% of all young people ever having been diagnosed with a mental disorder in their life. About one quarter of this 26% had experienced, or were experiencing, a severe mental disorder. At this time approximately 18% of young people had an anxiety mental disorder (Australian Bureau of Statistics, 2007).

Levels of psychological well-being are assessed using a range of techniques, but the most common is a self-evaluation questionnaire. Self-evaluation questionnaires allow the participant to rate their level of psychological well-being without knowing whether they have scored high or low until they receive the results. The Ryff Scales of Psychological Well-Being (Ryff, 1989) is one of these questionnaires which requires participants to rate a number of statements on a scale of 1 to 6. The scales divide aspects of psychological well-being into 6 different categories, each containing 14 statements. There are also two shorter versions available containing 9 and 3 statements in each category. The 6 categories, or subdivisions, are Autonomy, Environmental Mastery, Personal

Growth, Positive Relations With Others, Purpose In Life and Self-Acceptance. Ryff (1989) gives definitions, of both a high and low scorer, for each component of the scales. These definitions are;

Self-Acceptance

High scorer: Possesses a positive attitude toward the self; acknowledges and accepts multiple aspects of self, including good and bad qualities; feels positive about past life.

Low scorer: Feels dissatisfied with self; is disappointed with what has occurred with past life; is troubled about certain personal qualities; wishes to be different than what he or she is.

Positive Relations With Others

High scorer: Has warm, satisfying, trusting relationships with others; is concerned about the welfare of others; capable of strong empathy, affection, and intimacy; understands give and take of human relationships.

Low scorer: Has few close, trusting relationships with others; finds it difficult to be warm, open, and concerned about others; is isolated and frustrated in interpersonal relationships; not willing to make compromises to sustain important ties with others.

Autonomy

High scorer: Is self-determining and independent; able to resist social pressures to think and act in certain ways; regulates behavior from within; evaluates self by personal standards.

Low scorer: Is concerned about the expectations and evaluations of others; relies on judgments of others to make important decisions; conforms to social pressures to think and act in certain ways.

Environmental Mastery

High scorer: Has a sense of mastery and competence in managing the environment; controls complex array of external activities; makes effective use of surrounding opportunities; able to choose or create contexts suitable to personal needs and values.

Low scorer: Has difficulty managing everyday affairs; feels unable to change or improve surrounding context; is unaware of surrounding opportunities; lacks sense of control over external world.

Purpose In Life

High scorer: Has goals in life and a sense of directedness; feels there is meaning to present and past life; holds beliefs that give life purpose; has aims and objectives for living.

Low scorer: Lacks a sense of meaning in life; has few goals or aims, lacks sense of direction; does not see purpose of past life; has no outlook or beliefs that give life meaning.

Personal Growth

High scorer: Has a feeling of continued development; sees self as growing and expanding; is open to new experiences; has sense of realizing his or her potential; sees improvement in self and behavior over time; is changing in ways that reflect more self-knowledge and effectiveness.

Low scorer: Has a sense of personal stagnation; lacks sense of improvement or expansion over time; feels bored and uninterested with life; feels unable to develop new attitudes or behaviors.

The scales have been used widely in a number of studies since the scales were released (Abbot, et al, 2008; Marks, 1998; Ruini and Fava, 2009).

Physical exercise is a major part of adolescents' lives. This is due to many factors including it being compulsory at most schools in Australia. In the past few decades there has been a lot of research into the idea that physical exercise makes you happy (Crone, Smith and Gough, 2004; Downward and Rasciute, 2011). In 1970 scientists were curious about how opiates, such as heroin, interact and affect the brain. It was discovered that these opiates interact with special receptors in cells, primarily found in the brain and spinal cord. When the opiates enter these receptors they hinder and sometimes block the cell's ability to transmit signals of pain to other parts of the body. After this was realized the scientists had to find out why these special receptors were there in the first place. The most plausible answer was that these newly named Opioid Receptors existed due to the presence of an opiate-like substance. This theory was eventually proven, and this opiate-like substance was a form of neurotransmitter, called the Endorphin, or Beta-Endorphin (Loh, et al, 1976).

Endorphins are neurotransmitters, which means they pass signals from one neuron to the next, and they play a huge role in the central nervous system. Endorphins originate from various parts of your body such as your pituitary gland, which is a pea-sized gland located at the base of your brain, spinal cord and other parts of your brain and nervous system. These are produced as a response to stimuli such as fear, stress, pain, childbirth, alcohol, chili peppers, acupuncture, ultraviolet light and exercise. When they are produced they mainly interact with the receptors responsible for blocking pain and controlling emotion, also known as Opioid Receptors. Majority of your emotion is controlled by your Limbic System, but it is widely believed that Opioid Receptors help to control the pleasure and happiness side of our emotions.

Studies on rats and mice have indicated interactions between exercise and endorphins (Loh, et al, 1976). The major indication is that both exercise and happiness are independently related to endorphins. They are related in the way that exercise triggers the production of endorphins and they then hinder or block the receptors that transmit messages of pain. This then results in a person feeling happier as they have little or no pain messages being received by their brain.

The purpose of this study was to evaluate the effect of the amount of physical exercise on psychological well-being in teenage boys.

Hypothesis and Aims

Aims

The aims of the study were:

- To find a reliable method of measuring psychological well-being
- To have as many teenage boys, as possible, participate in the survey devised for this experiment
- To use the information gained to compare psychological well-being and physical exercise using correlation
- To determine whether the amount of physical exercise teenage boys undertake influences their level of psychological well-being
- To determine whether the release of endorphins affects psychological well-being within the short term period of 2 weeks

Hypothesis

The hypothesis of this study was that teenage boys who participate in a greater amount physical exercise have a greater psychological well-being, or gain a higher score on the Ryff Scales, than those who participate in a lesser amount of physical exercise.

Materials and Method

Participants

The study participants were 43 boys that were aged between 13 and 18 years old. Participants were from a range of different schools and universities. All participants took part in this experiment voluntarily and agreed to allow the use of any answers provided, in this study. The Survey, which contains the participant information and agreement, are attached as Appendix 1.

Method

Variables

Independent

- The person completing the survey
- The amount of physical exercise completed, by the participant, within the past 2 weeks

Dependent

- The psychological well-being of a person, scored from a questionnaire

Controlled

- The age range of participants
- The content within the survey
- Who has access to the survey
- All participants are anonymous
- All participants respond to the exact same survey

Development of Survey

During a 14 day period the survey used for this experiment was developed with the assistance of Miss A Greenwood and Dr E Pariser. The survey questioned participants on their physical exercise participation within the past 2 weeks and asked them to rate statements, on a scale of 1 (strongly disagree) to 6 (strongly agree), which were taken from the Ryff Scales of Psychological Well-Being (Ryff, 1989). The statements taken can be sub-divided into 6 categories. Only 5 statements, of the 14 in each category, were used which is due to previous research into the influence survey length has on the response rate of surveys. Whilst several previous studies have shown that it has little effect, many more studies have shown the opposite, that it does have at least some effect on the response rate. Although the subject which the survey is on plays a large role, the length of the survey also plays a relatively large role. It has been previously determined that the length of a survey has a negative effect on the response rate, the more likely it is to have a lower response rate (Sheehan, 2006). Due to this previous research it was concluded that there would likely be a higher response rate if the survey contained fewer questions. Hence not all 82 statements from the Ryff Scales were used. As 5 from each category was used, 30 statements were used overall.

Data Collection

The survey was launched on Sunday 24th February. It could be accessed through a web link, <https://www.surveymonkey.com/s/VBMTTWN>. This was sent to various people through a number of services. These services were Facebook, Email, Lampada and iMessage. A verbal announcement was also made in an Emery House, House meeting. It was made sure that the link was only received by a teenage boy aged 13 to 18 or a member of the Shore School staff. The survey was disabled on Sunday 17th March after being open for 22 days and can be seen in Appendix 1. During this time 43 people took part in the survey.

Analysis

Once the survey was disabled the results were analysed. Using the Ryff Scales of Psychological Well-Being (Ryff, 1989) meant that the psychological well-being of the participants could be put into quantitative form. It was determined how the scores would be identified as low or high psychological well-being. It is recommended that each group is 25% of the highest possible score (Ryff, 1989) so it was determined that each group contained 37.5 points. A diagram of the scaling of the groups can be seen below.

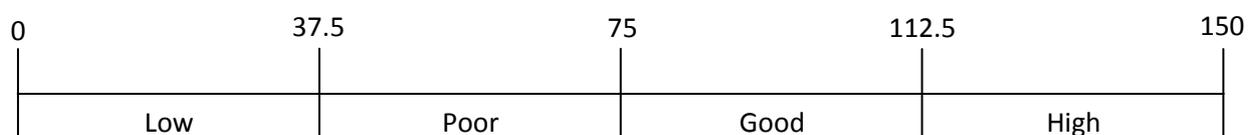


Figure 1

The scale that will be used to place the scores, judging psychological well-being, into different levels of psychological well-being.

As there were 30 statements the lowest score possible was 30, so for the purpose of analysing the final results, each final score out of 180 had 30 points subtracted to make a final score out of 150. As well as the final score being calculated, the score for each sub-division of the scales was calculated. Due to the lowest possible score in this being 5, 5 points were deducted from the final sub-divisional score, meaning the lowest possible sub-divisional score was 0 and the highest possible was 25. The final scores and sub-divisional scores of each participant were calculated. Finally the correlation coefficients of many different variables were calculated. Correlation is a commonly used statistical

comparison. It is a measure of the strength of linear association between two different variables. The final answer, or correlation coefficient, will always be a number between -1.0 and +1.0. If the answer is positive there is a positive linear relationship, whilst if it is negative the linear relationship is negative. The formula used was;

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

In this formula;

r= The correlation coefficient.

n = The sample size.

x = A first Score.

y = A second Score.

$\sum xy$ = The sum of all the products of each first score and second score.

$\sum x$ = The sum of all the first scores.

$\sum y$ = The sum of all the second scores.

$\sum x^2$ = The sum of the square of all the first scores.

$\sum y^2$ = The sum of the square of all the second scores.

Results

General Summary Results

Below is a graph showing the amount of people that scored in each band of psychological well-being.

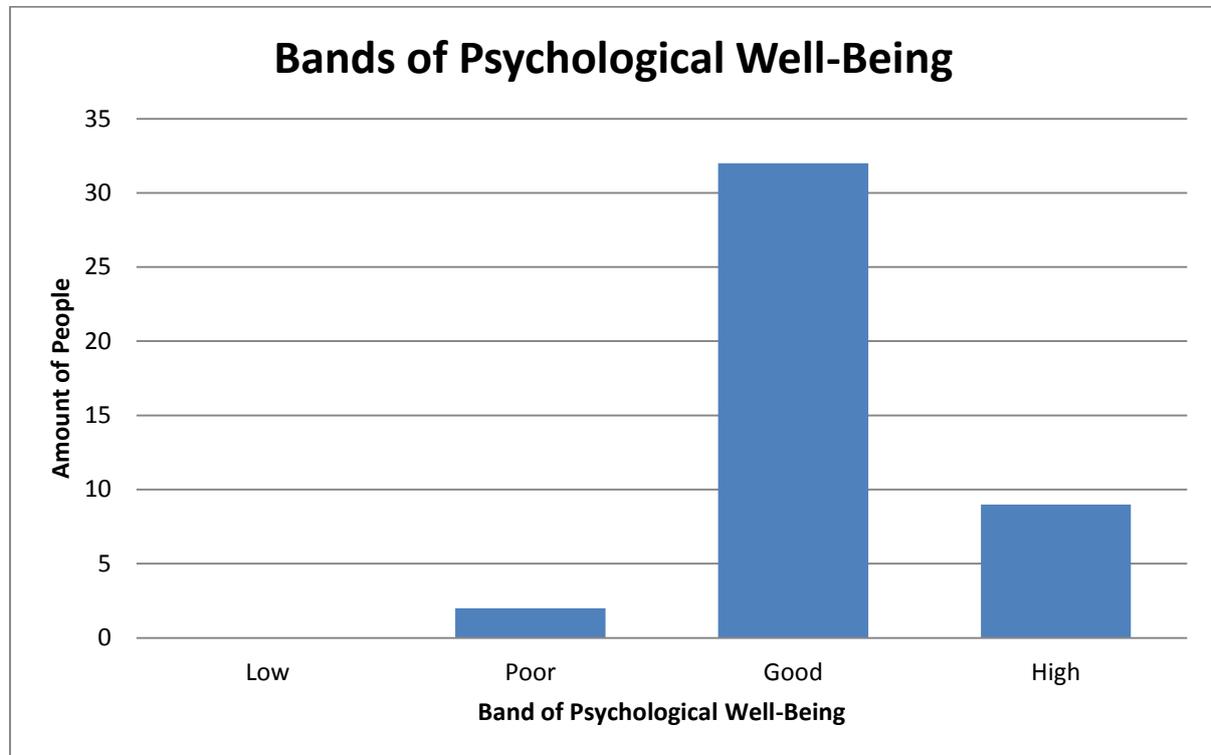


Figure 2

The amount of people in each band of psychological well-being used for this experiment.

Below are averages of different variables.

Variable	Age (Years)	Total Amount of Physical Exercise (Hours)	Final Score (Out of 150)	Amount of Vigorous Physical Exercise (%)	Amount of Moderate Physical Exercise (%)	Amount of Light Physical Exercise (%)
Average	14.9	13.9	101.3	39	34	25

Table 1

The average of different variables tested in this experiment.

Variable	Autonomy (Out of 25)	Environmental Mastery (Out of 25)	Personal Growth (Out of 25)	Positive Relations With Others (Out of 25)	Purpose In Life (Out of 25)	Self-Acceptance (Out of 25)
Average	15.9	15.7	18.3	16.7	16.8	17.9

Table 2

The average of different variables tested in this experiment.

Schools, Sports and Happiness

Out of the 43 participants in the survey, majority were from Shore School. Two participants were from Barker College, and there was one participant each from Sydney University, NSW University, Knox Grammar, Marist North Shore, North Sydney Boys and The Armidale School. In total there were 35 participants from Shore. There was a range of sports played by each participant, these sports were;

- | | | | |
|---|--|--|---|
| <ul style="list-style-type: none"> ▪ Basketball ▪ Cadets ▪ PE ▪ Rowing ▪ Ergometer Work ▪ Running & Jogging | <ul style="list-style-type: none"> ▪ Surf Life Saving ▪ Martial Arts ▪ Surfing ▪ Skating ▪ Trampoline ▪ Fitness ▪ Sailing | <ul style="list-style-type: none"> ▪ Soccer ▪ Cricket ▪ Tennis ▪ Rugby ▪ Dance ▪ AFL ▪ Water Polo | <ul style="list-style-type: none"> ▪ Athletics ▪ BMX ▪ Biathlon ▪ Swimming ▪ Weights ▪ Sports Coaching ▪ Cycling |
|---|--|--|---|

In total, out of the 43 participants, 6 reported not feeling happy, whereas 7 reported feeling happy about half of the time and not happy the other half of the time. The remaining 30 reported feeling happy. The 13 that thought of themselves as not happy, or half way between happy and not happy, gave many reasons for feeling this way. These reasons can be divided into different groups or categories. These groups and reasons were;

- | | | | |
|--|---|--|--|
| <p><i>Work Load Related</i></p> <ul style="list-style-type: none"> ▪ Work Overload | <p><i>General Life Issues</i></p> <ul style="list-style-type: none"> ▪ Feeling Like Their 'Life Was Slipping Away' ▪ Grandma Being Very Sick In Hospital ▪ Being Tired A Lot ▪ Pressure To Do Certain Things | <p><i>Stress Related</i></p> <ul style="list-style-type: none"> ▪ Stress at School ▪ Stress at University | <p><i>Socially Related</i></p> <ul style="list-style-type: none"> ▪ Bullying ▪ Missing Old Friends ▪ Having No Real Friends ▪ Exclusion |
|--|---|--|--|

The 30 that thought of themselves as happy had many reasons for this. They could also be placed into different categories. These reasons were;

School & Work Load Related	Physical Health Related	Socially Related
<ul style="list-style-type: none"> ▪ Going Well at School ▪ The Start of High School Has Been Relatively Easy ▪ Going Well at University ▪ Good Work Ethic ▪ Good Teachers ▪ Little Work ▪ Managing Work Well 	<ul style="list-style-type: none"> ▪ Sport ▪ Taking Care of Physical Health ▪ Healthy Diet 	<ul style="list-style-type: none"> ▪ Good Friends ▪ Enjoying Time With Friends ▪ Increased Self Esteem
<p style="text-align: center;">Motivationally Related</p> <ul style="list-style-type: none"> ▪ Having Motivation 	<p style="text-align: center;">General Life Related</p> <ul style="list-style-type: none"> ▪ There Is Nothing To Be Sad About ▪ Being Organized ▪ Everything Going Smoothly ▪ Nice Dog ▪ Having Time To Relax ▪ Proper Amounts of Sleep ▪ Achieved What Was Desired ▪ Being Honest ▪ Being Busy 	

Age

Below are summary results comparing age to various factors tested in the questionnaire.

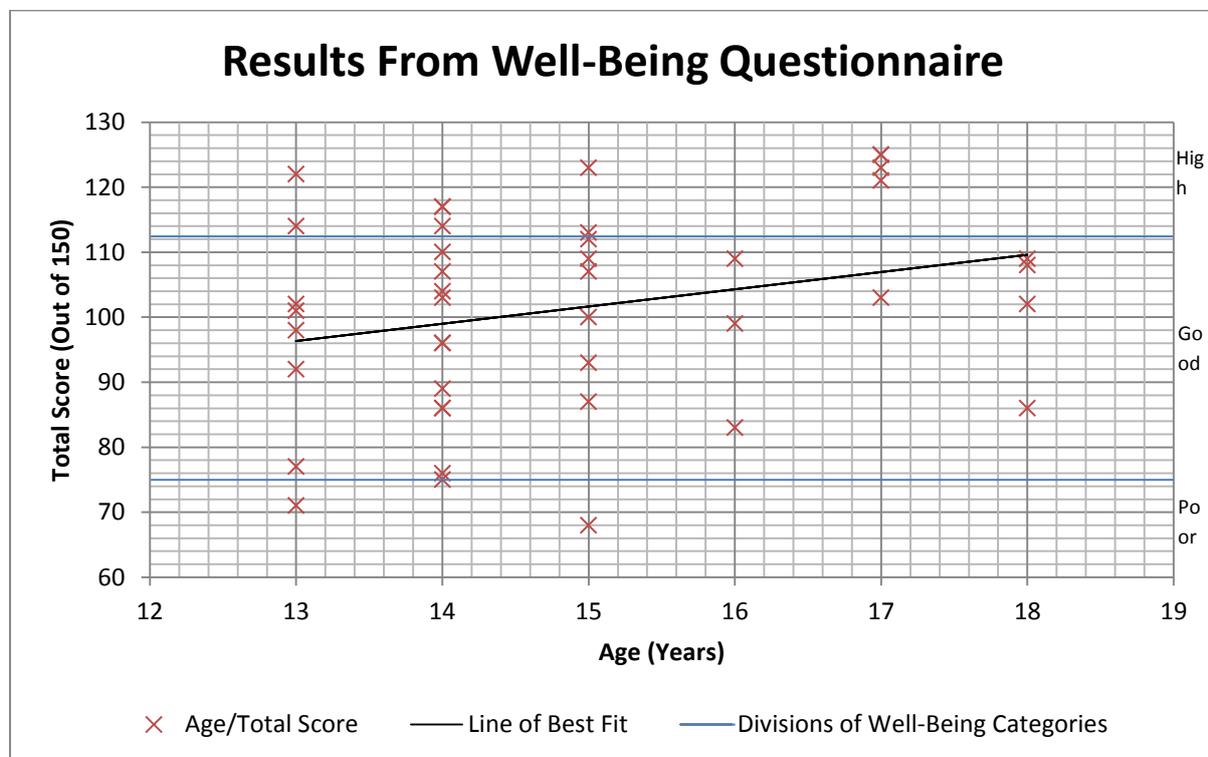


Figure 3
Total scores out of 150, for each participant, compared to age.

Figure 3 shows the relationship between the age of each participant and their total score on the Ryff Scales. When the line of best fit is not included there appears to be no trend in the data. Once it is added there a clear trend which is quite strong compared to other graphs in this report. All participants which reported not feeling happy at all where 15 and below whilst all 16, 17 and 18 year olds thought of themselves as happy (as shown in Figure 3).

The average total score out of 150 was 101.3, the highest was 125 which was achieved by 2 people and the lowest was 68 which was gained by 1 person.

The average age was 14.9 years old, with the lowest 13 and the highest 18 years old.

Figure 4 shows the relationship between the age of each participant and their score in the Autonomy subdivision of the scales. Overall there is nearly no relationship between age and Autonomy, this is highlighted not only through observation of the points alone but also when the line of best fit is placed in it increases positively, but so slightly it's hard to tell.

The average Autonomy score was 15.9 out of 25, the highest was 24 and the lowest was 9, each gained by one person.

Figure 5 shows the relationship between the age of each participant and their score in the Environmental Mastery subdivision of the Ryff Scales. Once again the trend is not very noticeable without the line of best fit but once it is placed in there it is obvious that there is a positive trend in the data.

The average Environmental Mastery score was 15.7 out of 25. The highest was 24 and the lowest was 6. Both the highest and lowest scores were gained by 2 people.

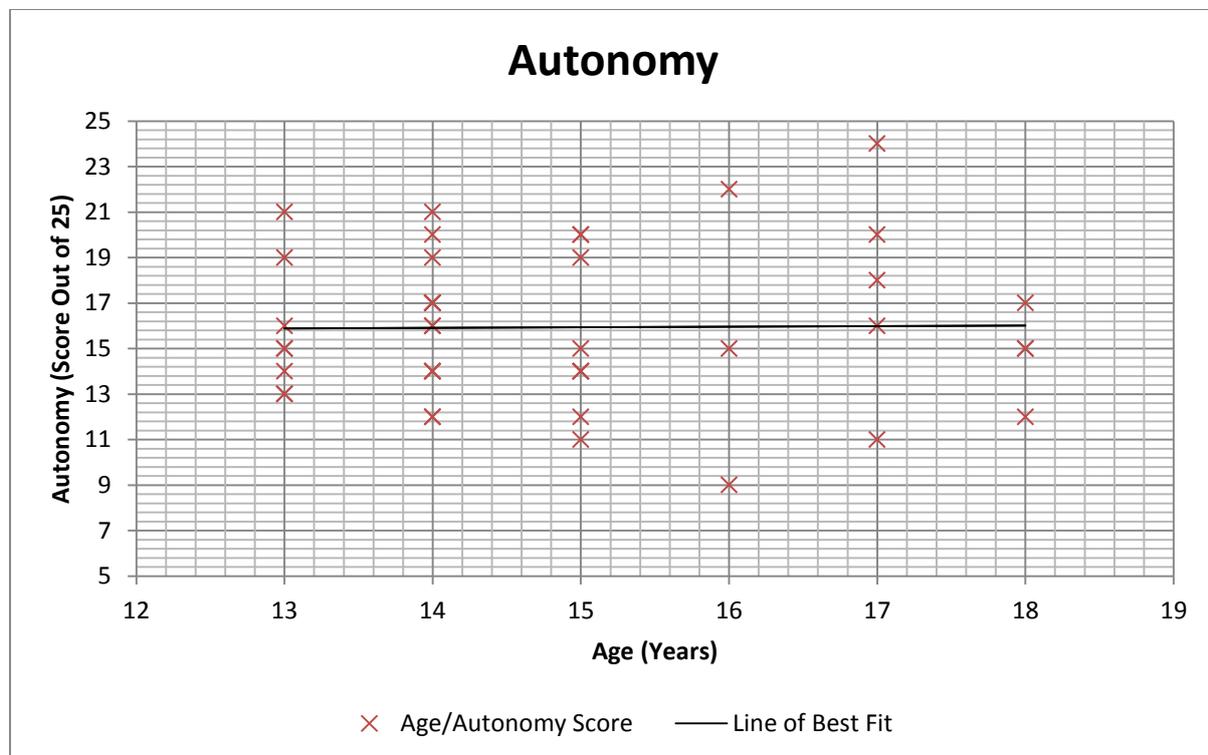


Figure 4
The total score, out of 25, for the first of the subdivisions of the Ryff Scales, Autonomy, compared to Age.

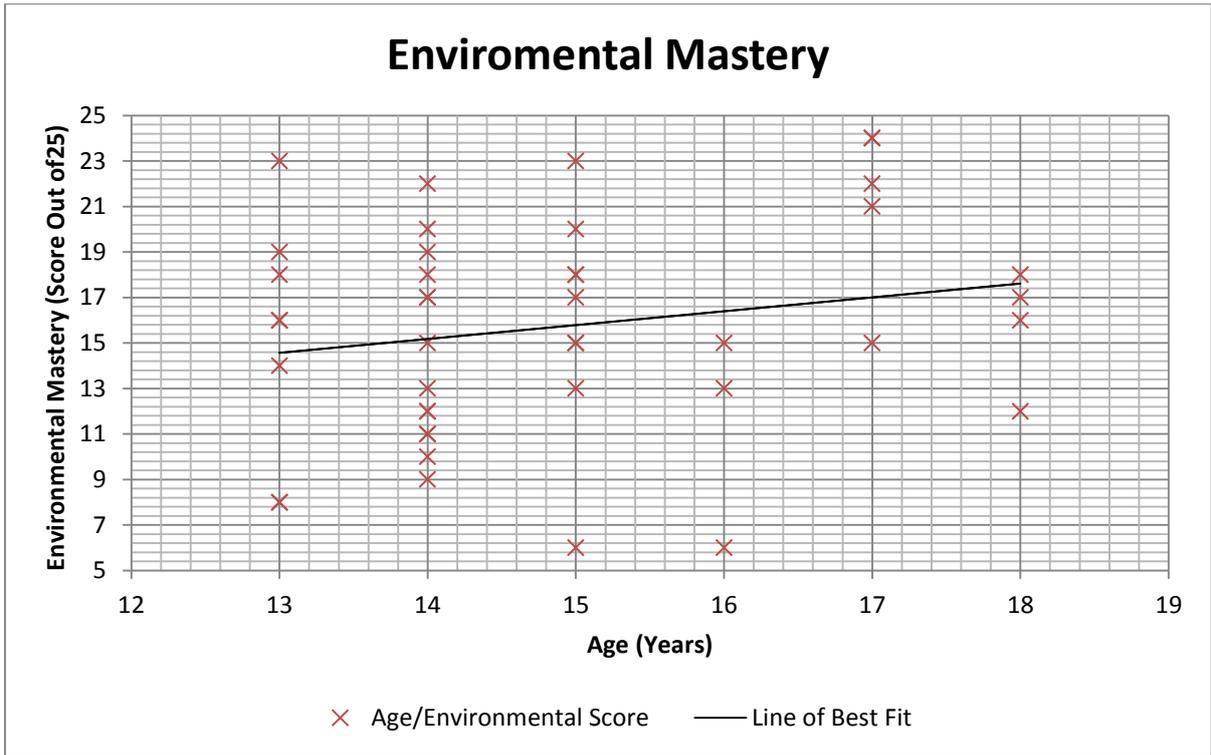


Figure 5
The total score, out of 25, for the second of the subdivisions of the Ryff Scales, Environmental Mastery, compared to age.



Figure 6
The total score, out of 25, for the third of the subdivisions of the Ryff Scales, Personal Growth, compared to age.

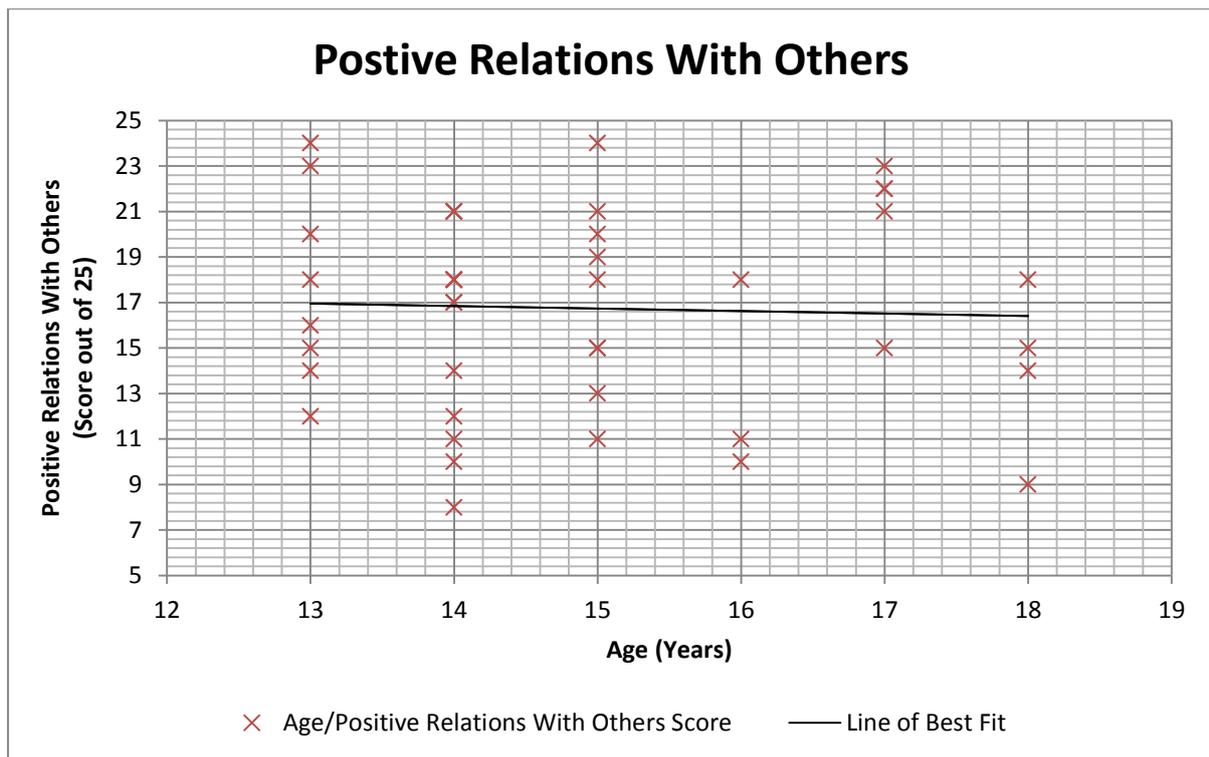


Figure 7

The total score, out of 25, for the fourth of the subdivisions of the Ryff Scales, Positive Relations With Others, compared to age.

Figure 6 shows the relation between Personal Growth and age. There is a slight trend, which is quite steady and gradual, with the highest Personal Growth score being 24 and the lowest being 11. The average score was 18.3 with 1 person achieving the highest and lowest score.

Figure 7 shows the relationship between age and Positive Relations with others. There is again a gradual and steady trend but in this case it is negative. The highest score achieved is 24, by 2 people. The lowest score achieved is 8, by 1 person. The average score was 16.7 out of 25.

Figure 8 shows the relationship between the subdivisional scale of Purpose In Life and age. There is quite a steep trend in this compared to other trends seen in the data in this report. The trend is positive and the average score out of 25 was 16.8. The highest score was 23 whereas the lowest score was 9, both gained by 1 person.

Figure 9 shows the relationship between Self-Acceptance and age. Again in this one there is a positive trend but it is not as steep as that of Purpose In Life. The average score was 17.9 which had the lowest at 6, gained by 2 people, and the highest at 24, gained by 5 people.



Figure 8
The total score, out of 25, for the fifth of the subdivisions of the Ryff Scales, Purpose In Life, compared to age.

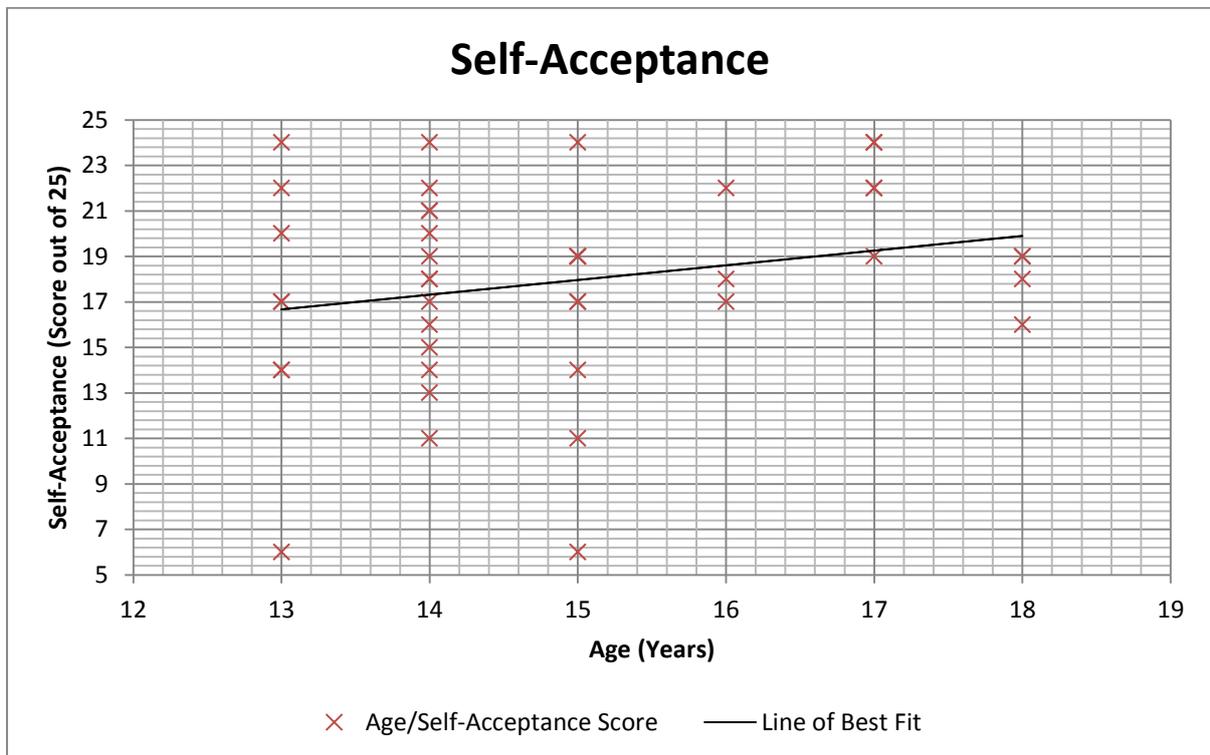


Figure 9
The total score, out of 25, for the sixth of the subdivisions of the Ryff Scales, Self-Acceptance, compared to age.

Total Amount of Physical Exercise

Below are summary results comparing the total amount of physical exercise to various factors tested in the questionnaire.

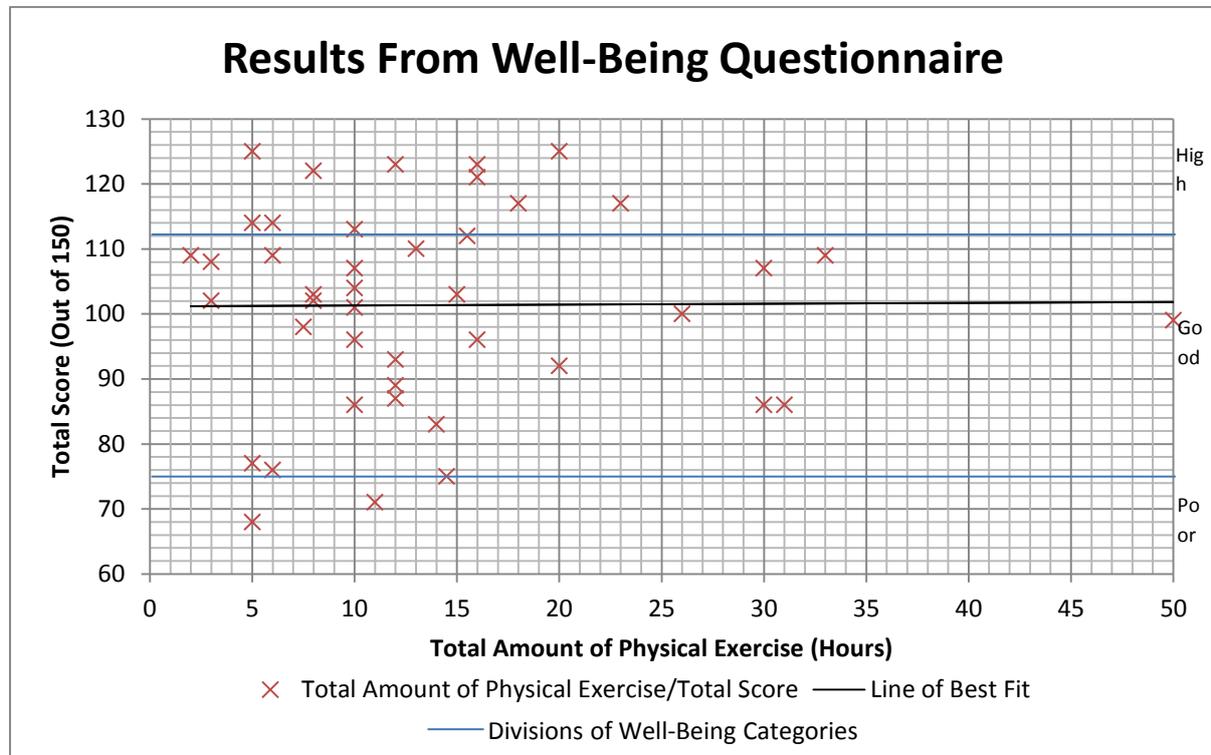


Figure 10

Total scores out of 150, for each participant, compared to the total amount of physical exercise.

Figure 10 shows a positive, but very minute trend between the final results and the total amount of physical exercise. The line of best fit shows a basically flat trend. It increases very slightly, it is nearly impossible to see through the naked eye.

The average total amount of physical exercise was 13.9.

Figure 11 shows a gradual negative trend in the data. Once again the relationship between Autonomy and the total amount of physical exercise is only obvious once the line of best fit is placed in the graph.

Figure 12 shows a small, negative trend in the data between Environmental mastery and the total amount of physical exercise. The trend is obvious through inspection of the line of best fit, but as in all the other graphs is not obvious without it.

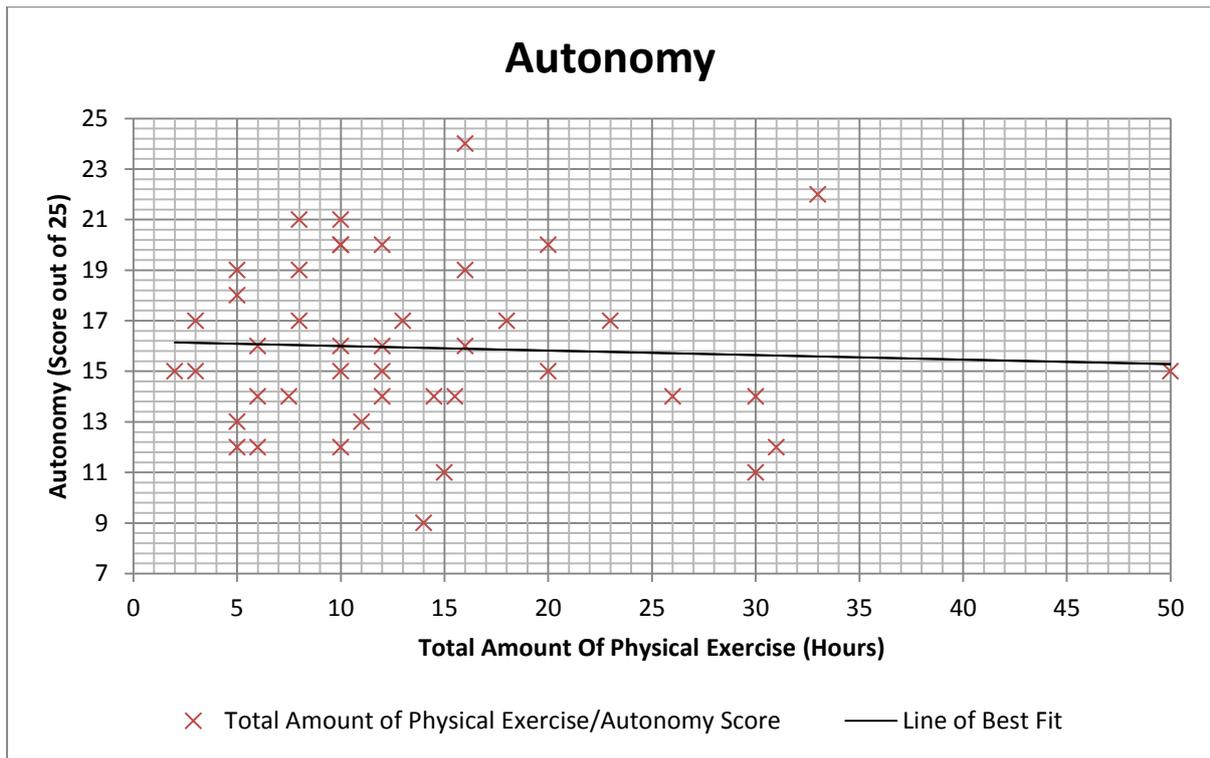


Figure 11

The total score, out of 25, for the first of the subdivisions of the Ryff Scales, Autonomy, compared to the total amount of physical exercise.

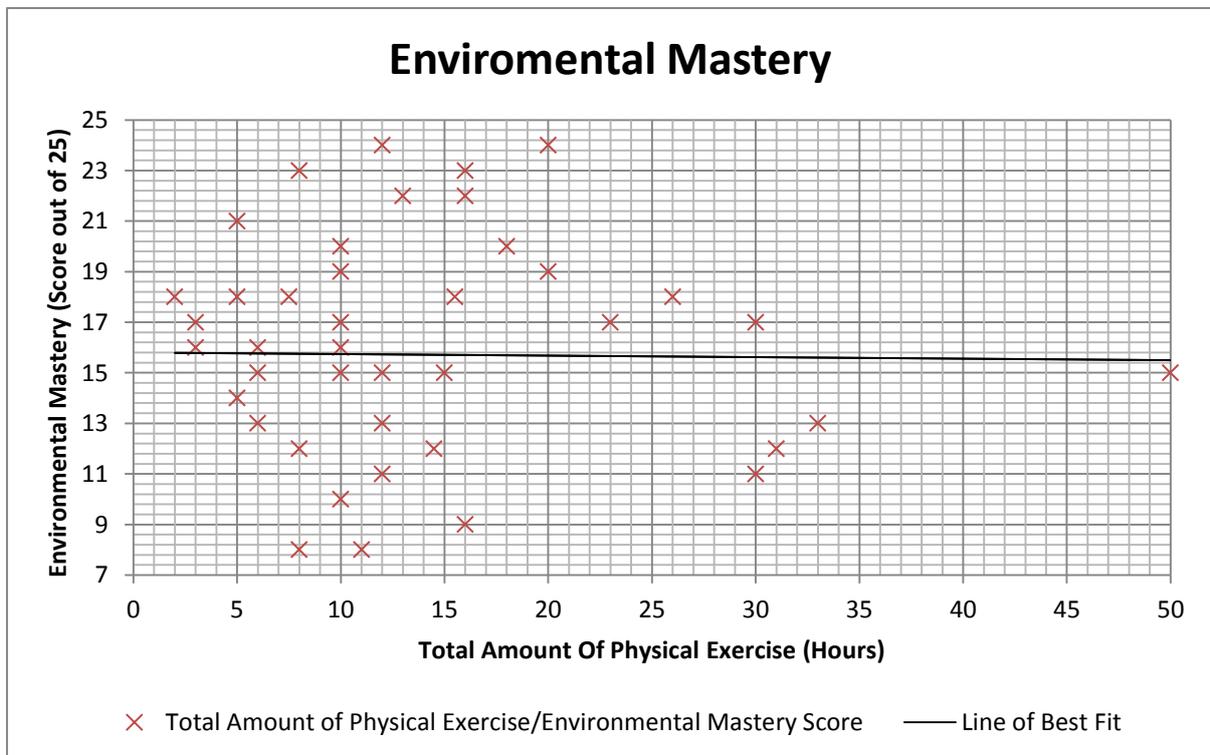


Figure 12

The total score, out of 25, for the second of the subdivisions of the Ryff Scales, Enviromental Mastery, compared to the total amount of physical exercise.

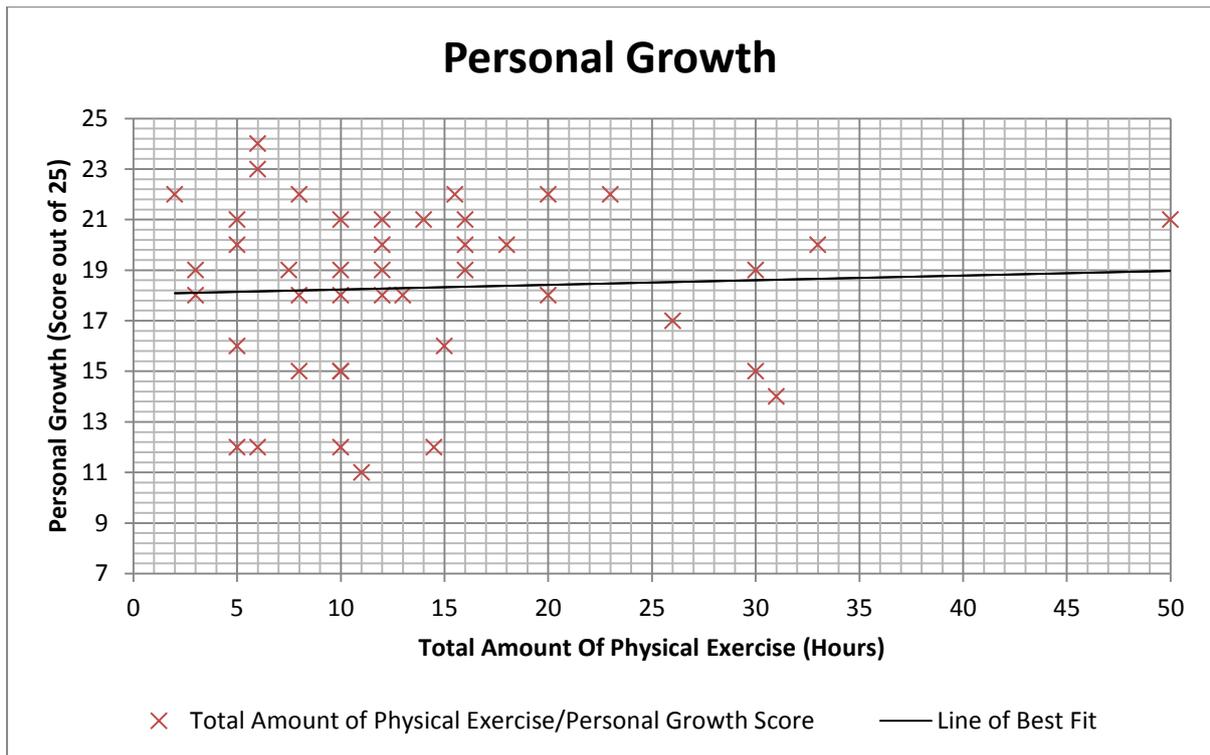


Figure 13

The total score, out of 25, for the third of the subdivisions of the Ryff Scales, Personal Growth, compared to the total amount of physical exercise.

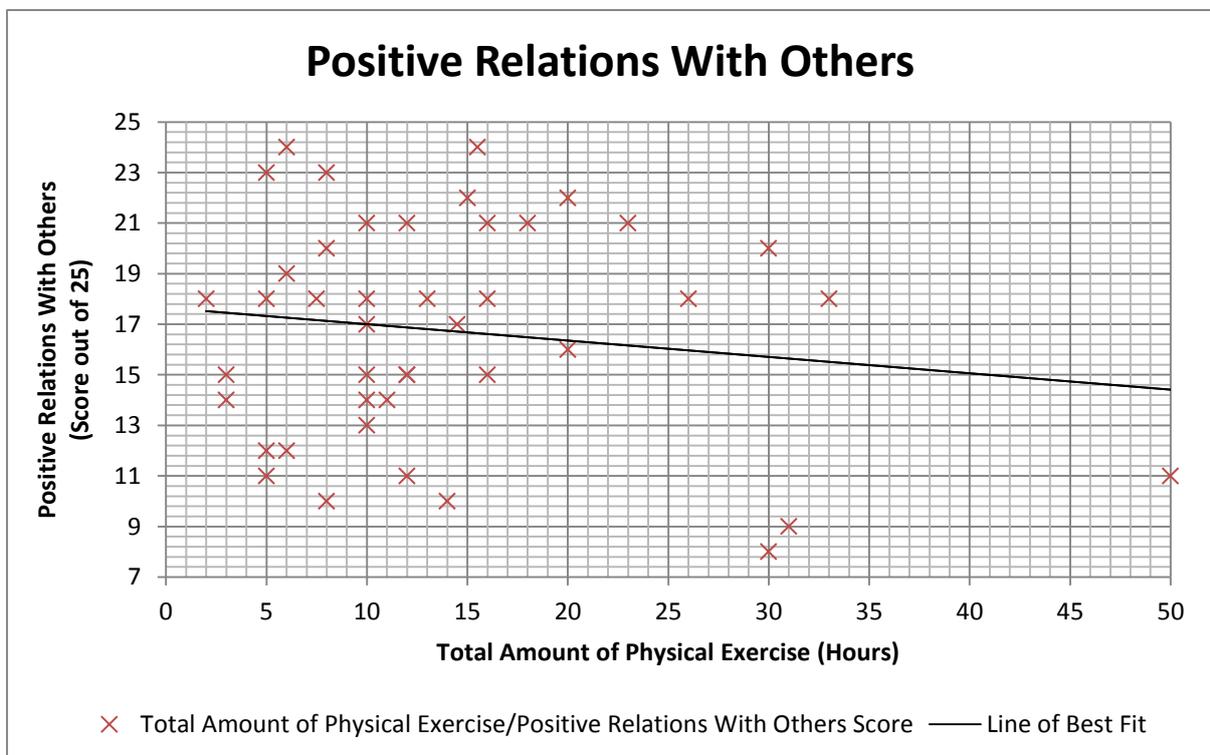


Figure 14

The total score, out of 25, for the fourth of the subdivisions of the Ryff Scales, Personal Relations With Others, compared to the total amount of physical exercise.

Figure 13 shows a positive trend in the data gained from the questionnaire. The trend is gradually increasing which can be seen through the line of best fit.

Figure 14 shows a large negative trend between the total amount of physical exercise and Positive Relations With Others. The line of best fit declines quite rapidly, compared to other negative trends. It is the largest negative trend in this report.

Figure 15 shows a slight positive trend in the data, recorded from the questionnaire, between the total amount of physical exercise and the score for purpose in life. The line of best fit highlights this positive trend in the data.

Figure 16 shows a gradual positive trend between the total amount of physical exercise and the score for self-acceptance. The line of best fit is similar to that of other graphs and quite large compared to some others.

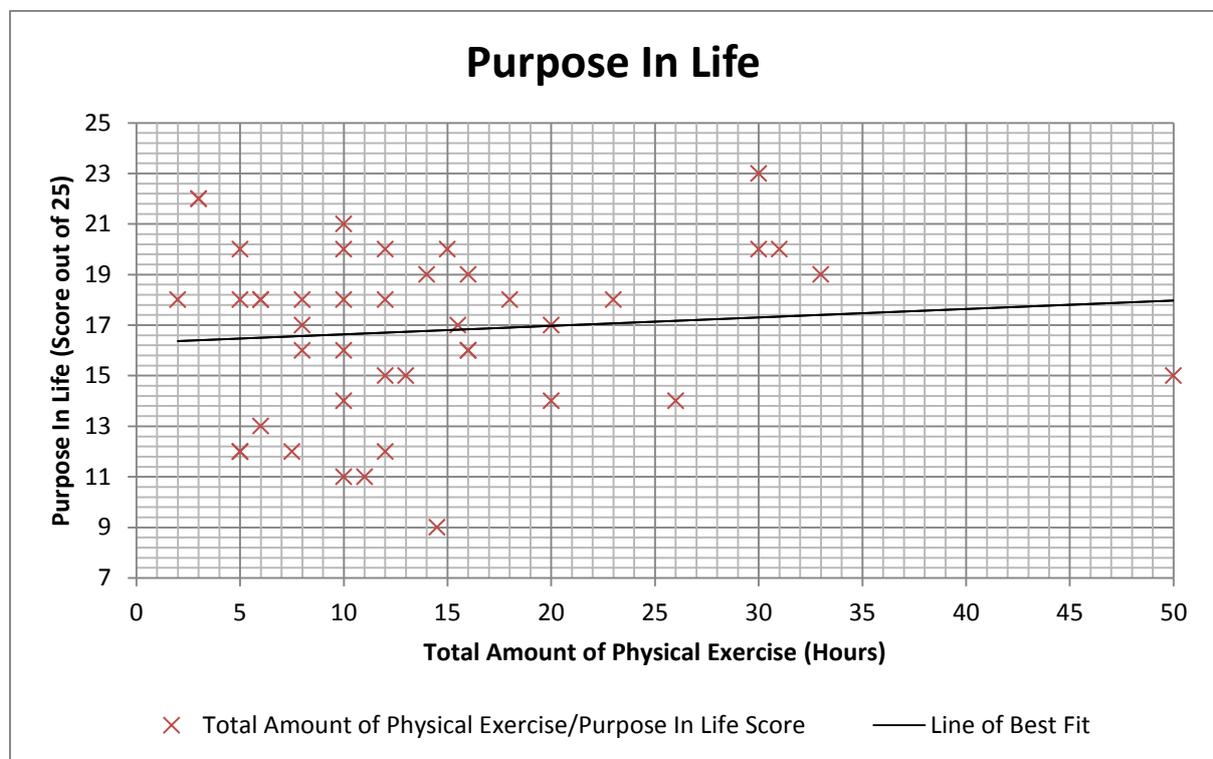


Figure 15
The total score, out of 25, for the fifth of the subdivisions of the Ryff Scales, Purpose In Life, compared to the total amount of physical exercise.

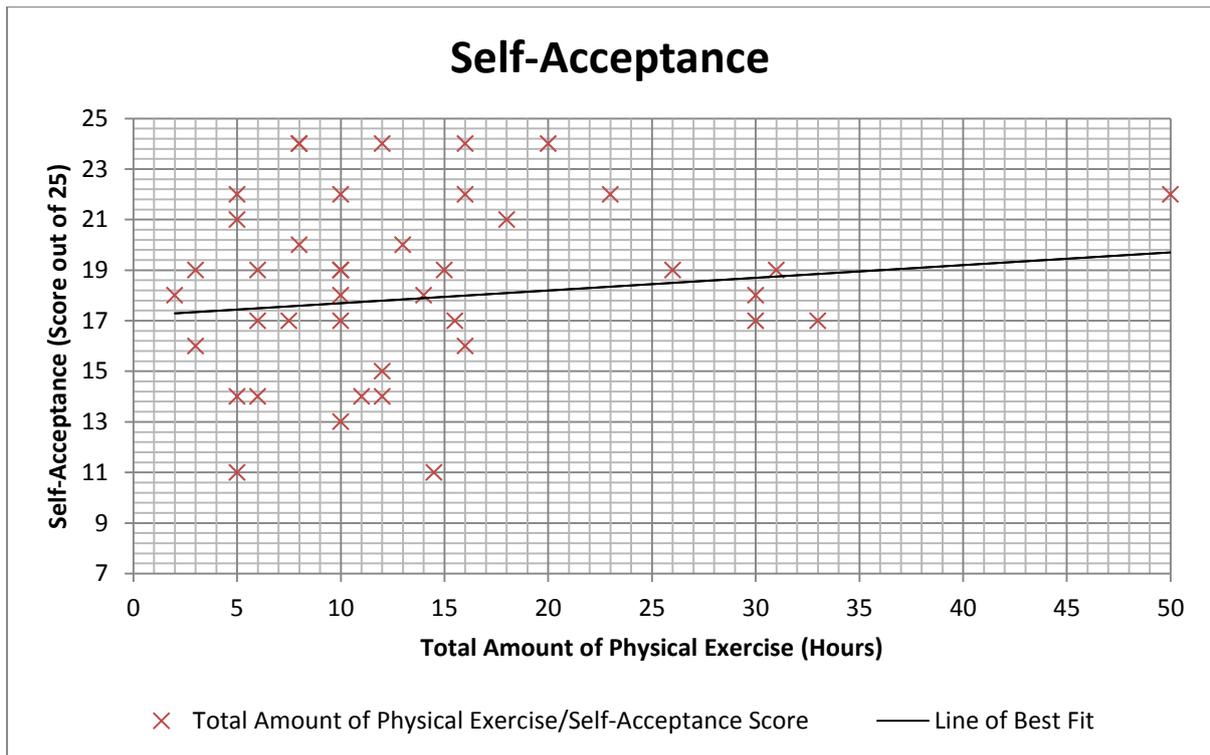


Figure 16
 The total score, out of 25, for the sixth of the subdivisions of the Ryff Scales, Self-Acceptance compared to the total amount of physical exercise.

Intensity

Below are summary results comparing the amounts of the different intensities of physical exercise to the total score on the Ryff Scales.

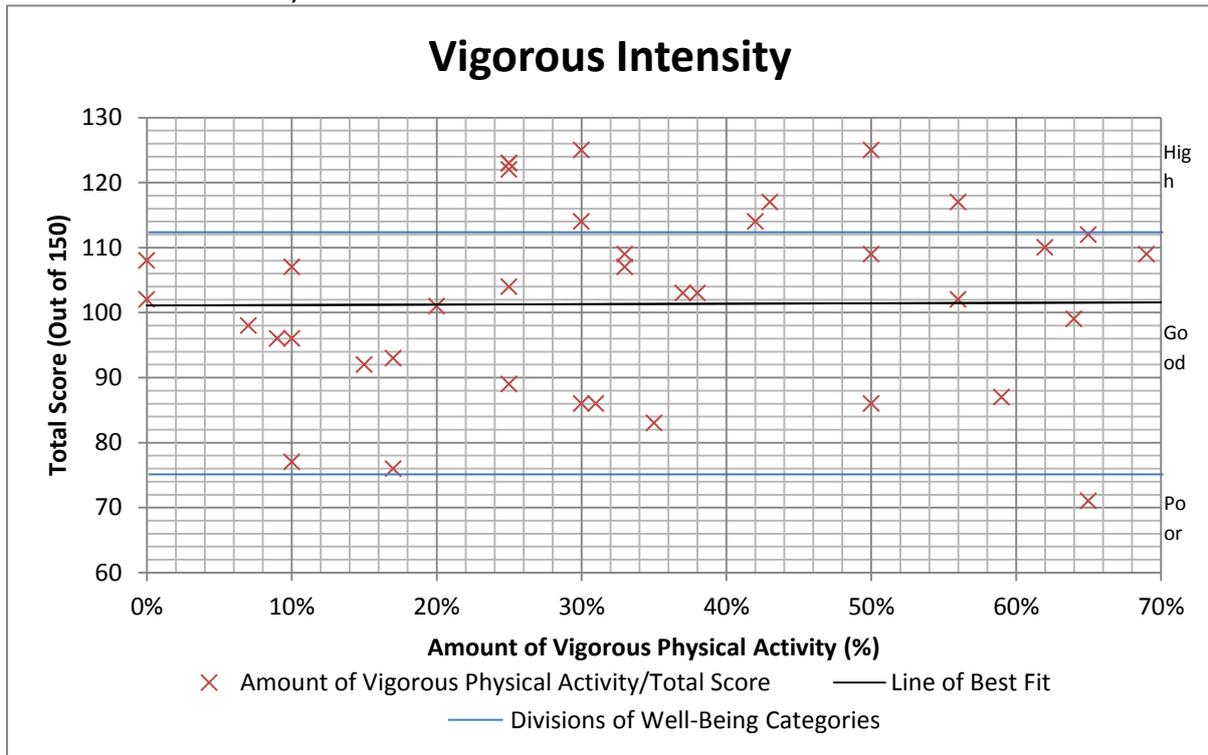


Figure 17

The total score on the Ryff Scales compared the percentage, of the total amount of physical activity, of Vigorous physical activity.

Figure 17 shows a positive trend that is next to nothing between the final score on the Ryff Scales and the amount of Vigorous intensity physical exercise. It is so slight and every so small but regardless it is still there.

The average percentage of Vigorous intensity was 39%.

Figure 18 shows a positive trend between the final score on the Ryff Scales and the amount of Moderate intensity physical exercise. It is quite a large trend compared to Figure 16.

The average percentage of Moderate intensity was 34%.

Figure 19 shows a negative trend between the amount of Light intensity physical exercise and the final score on the Ryff Scales. It is quite a weak trend but nevertheless it is there.

The percentage of Light intensity was 25%.

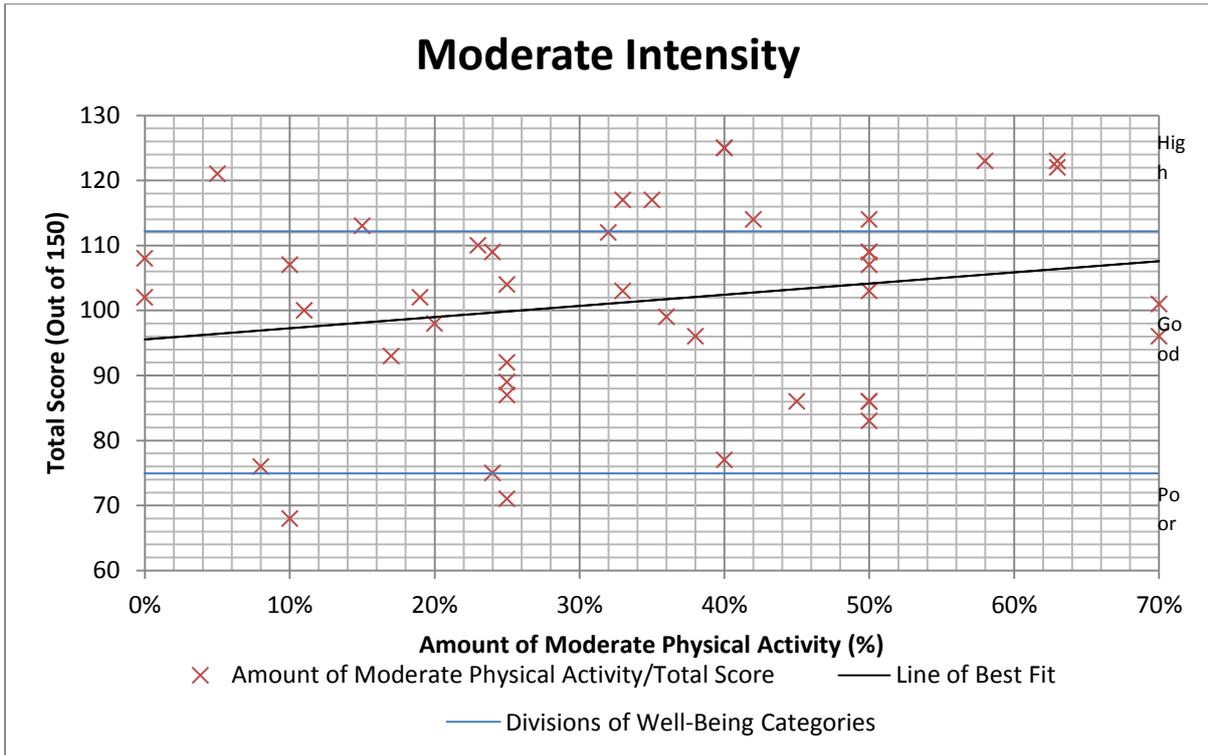


Figure 18
 The total score on the Ryff Scales compared the percentage, of the total amount of physical activity, of Moderate physical activity.

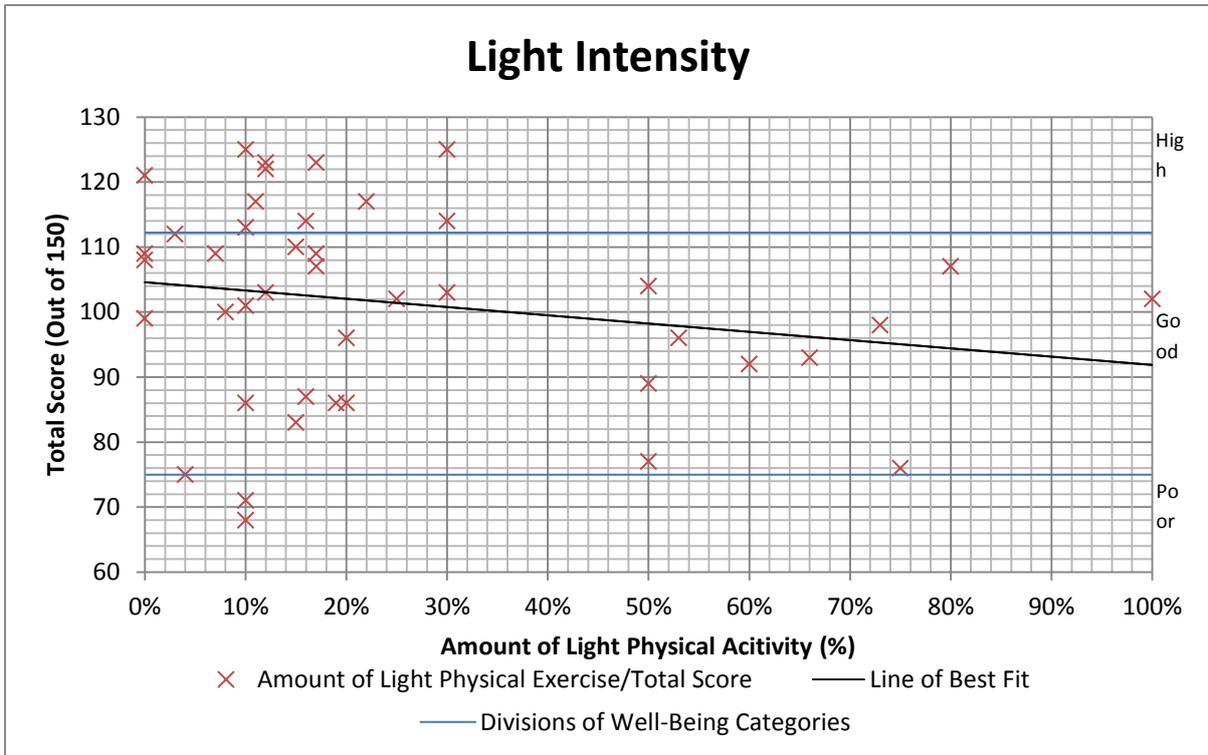


Figure 19
 The total score on the Ryff Scales compared the percentage, of the total amount of physical activity, of Light physical activity.

Correlation

Below is a table of the correlation co-efficients of different variables and the different scores on the Ryff Scales.

Variable	Age	Total Amount of Physical Exercise
Autonomy	0.01	-0.05
Environmental Mastery	0.2	-0.01
Personal Growth	0.16	0.05
Positive Relations With Others	-0.04	-0.14
Purpose In Life	0.53	0.1
Self-Acceptance	0.23	0.11
Total Score	0.27	0.01

Table 3

The different correlation co-efficients of Age and the Total Amount Of Physical Exercise, with the different variables tested in the questionnaire.

Below is a table of the correlation co-efficients of the different intensities of sport and the total score on the Ryff Scales and the Age of each participant.

Variable	Total Score	Age
Vigorous	0.01	0.08
Moderate	0.21	-0.13
Light	-0.21	-0.17

Table 4

The different correlation co-efficients of Age and the Total Score, with the different intensities of physical exercise.

Discussion

Although the study was focused on determining the correlation between psychological well-being and physical exercise strong positive correlations were found between psychological well-being and age. In fact the strongest correlation in the entire study was between age and purpose in life. This may be due to the fact that as a person grows they tend to realise what it is they want to do in life, and how they want to live it. Carol Ryff defines a person that has a true purpose in life as someone who has goals in life and a sense of directedness; feels there is meaning to present and past life; holds beliefs that give life purpose; has aims and objectives for living (1989). A person who is 13 and just started high school would not be worrying about what they want to do in life, they would worry just about moving schools, if they had goals in life it would be to do with school. Whereas an 18 year old who just finished the HSC would have many goals in life, such as getting a job in this field, and buying a house, they would want to be achieving these goals and gaining a purpose in life. The strong correlation between purpose in life and age in this study may be due to the fact that as teenagers grow up and gain new experiences they tend to realise what it is they want to do in life, and they start to gain a purpose in life.

There was very little correlation between age and autonomy and positive relations with others. Little correlation between age and these two variables could be because they are both things that can always change no matter what point in your life, for example you could lose friends at both the age of 9 and 47, plus for autonomy you could be able to resist social pressures in some situation, but in others you can't. These are both variables which can change at any point of any given life, which may be why there is little correlation between each and age.

Correlation between age and environmental mastery, personal growth and self-acceptance are all within ± 0.05 of 0.2. In these there is some correlation which is quite large compared to other correlations in this study. This may be due to many factors. For environmental mastery it might be due to the fact that it can vary, so a person might not be able to manage everyday affairs one day, as they are not what they're used to, and another day they can manage them easily. Also the small correlation could be because as you get older people generally become wiser, and you know how to handle more situations and deal with more affairs, as you have had more experience at life and its affairs in general. For personal growth it could be related to the fact that it also can vary, for example one person could feel like they have continued development one day and then something could occur causing them to change their mind. This also might have a small correlation as when a person grows they have more to see as being positive and helping them develop as a person and there is a longer period to reflect on so there is more opportunities to have grown personally. Finally self-acceptance might have a small correlation as when a person becomes older with more experiences in life they become wiser and less naive and tend to realise, acknowledge and accept multiple qualities of their past present and future, which have been for the better or worse. They also tend to realise that life is short, and want to just accept the bad things they have done and move onwards in life. This, like the other two can be forever changing and the mind can manipulate how one thinks of themselves, and whether they choose to accept, or not accept it.

Another strong correlation found in the study is between age and the total score on the Ryff Scales. This may be due to the fact that around the age of 13 boys start to gain new challenges in life such as puberty and beginning their high school journey. As teenage boys begin to grow they start to overcome these challenges and develop a greater sense of happiness in life as these things that used

to be challenges become everyday things that they are accustomed to. This leads to a general trend of overall well-being increasing as age increases, which can be seen from the results of this study.

Overall there wasn't relatively strong correlations between psychological well-being and the amount of physical exercise. Also there were very few people included in the study who reported having poor psychological well-being. This could be due to majority of the sample being from a specific private school where all the boys are expected to participate in a school sport and all the boys have a high standard of living. Regardless there was a few trends in the data, the highest being a negative trend between positive relations with others and the total amount of physical exercise. This could be due to the likelihood that the people who do more physical exercise aren't able to socialise as much as the exercise is taking up some of the time they have outside of school, like a game on the weekend. This could then result in them going out with friends rarely as they are tired from sports and therefore having fewer positive relations with others.

All the other correlations between the total amount of physical exercise and each variable was ± 0.15 from 0. These are all quite small correlations and therefore in this study it was found that the total amount of physical exercise would have little impact on each measure of psychological well-being as they were generally not affected by how much sport they did. It can also be believed that in this study, even though the endorphins blocked the Opioid receptors with physical exercise, this did not affect the receptors, for long enough after the physical exercise, as to majorly effect the psychological well-being of a person.

There was also some correlation between the variable of each intensity of physical exercise and the total scores and ages of the participants. There was an extremely small correlation between the total score, and percentage of vigorous activity, but there was quite a high correlation, for this study, between the total score and percentage of moderate and light physical activity. However the correlation between the total score and the percentage of light activity was a negative correlation. There were also negative correlations between age and the percentage of moderate and light physical activity. From this it can be believed that in this study those who participate in a greater amount of light physical activity, have fewer endorphins produced, meaning fewer Opioid receptors are blocked, the same can be believed for vigorous activity, as most people who participate in a large amount of vigorous activity feel pain, so the pain may be felt as the body is too tired to make enough endorphins to block the pain. It can also be believed that moderate physical activity creates the most amount of endorphins as to block the pain being felt by the body and that as the age of a person increases the amount of light and moderate physical exercise is less.

Discussion of Errors

The accuracy of the psychological well-being portion of the survey was maximised by using the Ryff Scale of Psychological Well-Being which have been used widely in a variety of studies. Although this portion was not completely accurate as not every statement from the scales was used, due to an increased likelihood of a smaller sample size.

The reliability of the survey in general was average, but the reliability of the physical exercise portion was not very high as participants were using their long term memory to try and recollect how much, how intense and what physical exercise they had participated in. In addition to this it would have been good to look at the effects of physical exercise, straight after the exercise was completed, to find out whether the effects are greatest on mood straight away, not just generally on well-being. Also the final results would be more reliable if the sample size was greater.

The validity of the study was affected by many variables. One major one was the background of the participants, with majority coming from private schools, and majority coming from one single school. This could have affected the validity as most children who attend a private school have a similar upbringing with an extremely high standard of living. Other factors that may have affected the validity was the possibility of social desirability bias from the participants of the survey for personal reasons. To improve the validity of the study it would have been better to have the sample size from a broader range of schools, backgrounds, age and gender.

Improvements

Using the entire Ryff scales would increase the reliability of the survey greatly. It would also increase the reliability if participants were asked to keep a journal of what physical exercise they did, how intense it was and how much of it they did, or if they were monitored by a person over the period of time. It would be interesting to see the results if the participants came from a range of different schools, cities and backgrounds to make the results more reliable and valid. The study would also have been improved greatly if in the survey the participant was questioned on how long ago they last participated in physical activity, this would have been a very interesting correlation to find between how long ago they last participated in activity and the total score on the Ryff Scales. It would also have been good to increase the age range, and also increase the amount of people from different schools, backgrounds, that participate in less physical exercise, and maybe even include girls in the study as well as question the participants on how they felt immediately after the exercise.

Conclusion

The original aims of the experiment were achieved. A reliable way of measuring psychological well-being was found, as many teenage boys as possible took part in the survey, psychological well-being and the total amount of physical exercise were compared using correlation, and it was determined whether the amount of physical exercise teenage boys undertake influences their level of psychological well-being and whether the release of endorphins affects psychological well-being within the short term period of 2 weeks. It was determined in this study that the amount of physical exercise teenage boys undertake slightly influences their level of psychological well-being and the release of endorphins does not affect psychological well-being within the short term period of 2

weeks. In this study teenage boys who participated in a greater amount of physical exercise did not have a greater psychological well-being than those who participated in a lesser amount.

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Appendix

The Correlation Between Psychological Well-Being and Physical Exercise

Information About Study

Purpose of Study

You have chosen to participate in an online survey. The purpose of this survey is to determine the correlation between physical exercise and psychological well-being. The study is focused on males aged 13-18.

Description of Study

If you decide to continue with this survey you will be questioned on;

- Your age and school/university
- Your physical exercise history within the past two weeks
- How you rate your psychological well-being, according to the Ryff Scales, within the past two weeks
- How you describe your overall happiness within the past two weeks

The survey contains 36 multiple choice questions and 2 questions that require you to write the answer. This survey is being conducted using a program named Survey Monkey.

Confidentiality of Study

All participants of the survey are completely anonymous. Your name or any other personal details will not be asked and you cannot be tracked in any form or way. No one, not even the study coordinator will know anything about the person that completes the survey other than what answers they give. Any answers that are not multiple choice will not be published in a full, complete quotation. Only final results of the study will be published in the Junior Science Research Project (JSRP) of Riley Tapp (Shore School, 9EY3).

Agreement

By taking this survey you are agreeing to answer all questions truthfully.

All answers are greatly appreciated and are helping a study into a serious issue in today's youth.

Kind Regards,
Riley Tapp
Shore School, 9EY3

* 1. What is your age?

* 2. What school or university do you attend?

Physical Exercise

Questions 3-7 deal with your physical exercise history within the past 2 weeks.

* 3. Within the past two (2) weeks what physical exercise have you participated in? (e.g. backyard cricket, jogging, school basketball, walking to school, etc.)

* 4. Within the past two (2) weeks approximately how many hours of physical exercise have you completed? (e.g. 1.5 hours, 6 hours, etc.)

* 5. Approximately how much of this exercise was of vigorous intensity? (You had deep and rapid breathing, were sweating and it was hard to speak without pausing for a breath)

* 6. Approximately how much of this exercise was of moderate intensity? (Your breathing was faster than usual, you had a light sweat and you could carry on conversation but couldn't sing)

* 7. Approximately how much of this exercise was of light intensity? (You had a normal breathing pattern, you could easily sing or make conversation)

Psychological Well-Being

Questions 8-38 deal with how you feel about yourself and your life. Please remember that there are no right or wrong answers. Select the number that best describes your agreement or disagreement with each statement based on the past two weeks.

***8. I tend to worry about what other people think of me.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***9. Being happy with myself is more important to me than having others approve of me.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***10. I tend to be influenced by people with strong opinions.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***11. I have confidence in my opinions even if they are contrary to the general consensus.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***12. I judge myself by what I think is important, not by the values of what others think is important.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

Psychological Well-Being

Questions 8-38 deal with how you feel about yourself and your life. Please remember that there are no right or wrong answers. Select the number that best describes your agreement or disagreement with each statement based on the past two weeks.

***13. In general, I feel I am in charge of the situation in which I live.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***14. The demands of everyday life often get me down.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***15. I do not fit very well with the people and the community around me.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***16. I am quite good at managing the many responsibilities of my daily life.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***17. I often feel overwhelmed by my responsibilities.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

Psychological Well-Being

Questions 8-38 deal with how you feel about yourself and your life. Please remember that there are no right or wrong answers. Select the number that best describes your agreement or disagreement with each statement based on the past two weeks.

***18. I don't want to try new ways of doing things. My life is fine the way it is.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***19. I think it is important to have new experiences that challenge how you think about yourself and the world.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***20. For me, life has been a continuous process of learning, changing, and growth.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***21. I gave up trying to make big improvements or changes in my life a long time ago.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***22. There is truth to the saying, "You can't teach an old dog new tricks."**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

Psychological Well-Being

Questions 8-38 deal with how you feel about yourself and your life. Please remember that there are no right or wrong answers. Select the number that best describes your agreement or disagreement with each statement based on the past two weeks.

***23. Maintaining close relationships has been difficult and frustrating for me.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***24. I often feel lonely because I have few close friends with whom to share my concerns.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***25. People would describe me as a giving person, willing to share my time with others.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***26. I have not experienced many warm and trusting relationships with others.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***27. I know that I can trust my friends, and they know they can trust me.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

Psychological Well-Being

Questions 8-38 deal with how you feel about yourself and your life. Please remember that there are no right or wrong answers. Select the number that best describes your agreement or disagreement with each statement based on the past two weeks.

***28. I live life one day at a time and don't really think about the future.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***29. I don't have a good sense of what it is I'm trying to accomplish in life.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***30. I enjoy making plans for the future and working to make them a reality.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***31. Some people wander aimlessly through life, but I am not one of them.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***32. I sometimes feel as if I've done all there is to do in life.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

Psychological Well-Being

Questions 8-38 deal with how you feel about yourself and your life. Please remember that there are no right or wrong answers. Select the number that best describes your agreement or disagreement with each statement based on the past two weeks.

***33. When I look at the story of my life, I am pleased with how things have turned out.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***34. I like most aspects of my personality.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***35. I made some mistakes in the past, but I feel that all in all everything has worked out for the best.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***36. In many ways, I feel dissatisfied about my achievements in life.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

***37. The past had its ups and downs, but in general, I wouldn't want to change it.**

- 1-Strongly Disagree
- 2-Disagree Somewhat
- 3-Disagree Slightly
- 4-Agree Slightly
- 5-Agree Somewhat
- 6-Strongly Agree

Psychological Well-Being

Questions 8-38 deal with how you feel about yourself and your life. Please remember that there are no right or wrong answers. For question 38 please type your response.

***38. In the past two weeks have you been feeling happy? Why or why not?**