

# ***Fontys University of Applied Sciences***

## ***English Stream Bachelor of Science in Physiotherapy***

### **Thesis project**

Description of anthropometric and cardio-metabolic parameters in first  
year university students

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This research report is a descriptive study which was performed at Fontys University of Applied Sciences with first year physical therapy students. It is conducted as a project for the graduation of the Bachelor in Physical Therapy at the Fontys University of Applied Sciences. My research topic was formulated together with my supervisor, Steven Onkelinx and his project idea allowed me to describe anthropometric and cardio-metabolic parameters in the first year students.

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## 1. Abstract

### **Introduction:**

Cardiovascular diseases (CVD) are still the most common causes of mortality and disability in many developed and developing countries. Raised blood pressure, cholesterol level, overweight and obesity are one of the main risk factors which can increase the chance for developing CVDs. Prevention is focused more on middle aged and older people. It is essential to identify risk factors among young adults to lower the chance for developing CVDs later in life. The aim of this study was to describe the anthropometric and cardio-metabolic parameters in first year physiotherapy students at Fontys University of Applied Sciences.

### **Method:**

150 first year physiotherapy students were included in this study, aged between 18-25. Anthropometric parameters such as body mass index and waist circumference were measured . The total cholesterol and systolic and diastolic blood pressure were measured as cardio-metabolic values. The European Guidelines on cardiovascular disease prevention in clinical practice (version 2012) were used to describe the healthy values according to each parameter. After the data collection, SPSS was used to describe the parameters by using mean and standard deviation.

### **Results:**

The majority of the undergraduates had optimal values according to these parameters. Although, 18,8% of the students were overweight according to BMI classification and 16,7% had a non-optimal waist circumference value. Higher total cholesterol level was found in 14,4% of the whole population. According to blood pressure, 14,8% of the students had a first grade systolic hypertension and 3,4% had first degree diastolic hypertension.

## 2. Introduction

Cardiovascular diseases (CVD) are one of the main causes of mortality and disability in many developed and developing countries (1-3). According to the data of The World Health Organization (WHO), 32 % of all deaths were caused by different kinds of cardiovascular diseases in 2015 (4). CVD affects the heart, brain and the blood vessels. The most common underlying cause for CVDs is atherosclerosis (2,3). This is a process that affects the walls of the arteries by accumulation of fatty substances (3). Atherosclerosis is the main reason for coronary artery, cerebrovascular disease and peripheral vascular disease (2-4). Other CVDs like heart arrhythmias, congenital problems and illnesses which affect the heart valves are less common (2,3). CVDs are not only the main cause of death and disability, but they put significant burden on the health care system. One study of 2005 estimated the economic burden of CVDs to be € 169 billion annually in the European Union (5).

There are different types of risk factors, which can increase the chance of developing CVDs. Non-modifiable factors are age, gender and family history (2,3). Modifiable factors can be divided into different subcategories, based on behavioural, metabolic and other types of risk factors (3). Unhealthy diet and physical inactivity fall in the behavioural category. Raised blood pressure, cholesterol level, overweight and obesity belong to the metabolic category (3). Psychosocial factors can also have negative effect on health status (2,3). Poor living condition, lower income or depression, anxiety can have indirect effect on developing chronic diseases (2).

Metabolic risk factors primarily affect the development of cardiovascular diseases. Overweight and obesity do not only cause CVDs, but also lead to other chronic diseases, such as diabetes and hypertension (2-9). Body mass index (BMI) and waist circumference (WC) are well-known tools which can be used to assess overweight and obesity (2,3,6-9). In literature, the reliability of BMI is questioned, because BMI cannot differentiate between fat and muscle mass(6-9). Even though BMI is not the most accurate tool to measure obesity, it is widely used, because it is relatively simple way to give a general indication for further measures (6-9). In order to get more reliable results, WC should be used, because it measures central adiposity which is associated to a higher risk of developing CVDs. (10).

In 2008, 34% of the world population aged older than 20 years was overweight, as reported by WHO (2). Studies show that the prevalence of overweight and obesity in children and adolescents is increasing every year (2,3,6-9).

Raised blood pressure is one of the main risk factors which is strongly related to chronic diseases. According to the WHO, among adults older than 25 years, 48% had hypertension in 2008 (2). As stated in the European guideline, a person has hypertension if the blood pressure is above 140 mmHg systolic and above 90 mmHg diastolic (2,3). Blood pressure can be measured through different techniques. The most accurate and standard technique to measure blood pressure is with a stethoscope and manual sphygmomanometer, applying Korotkoff sounds (11). Even though this technique gives the most accurate results, training and experience are required in order to perform the

measurement correctly. Oscillometric blood pressure measurement devices are easier to use and do not require training, but they are less accurate than the manual sphygmomanometers (11).

Measuring cholesterol levels can also be useful to predict the chance of getting CVDs. There are three types of cholesterol in the blood: total cholesterol (TC), low density-lipoprotein (LDL) and high density-lipoprotein (HDL) (2,3). People have a higher risk to develop coronary heart diseases such as heart attack if they have elevated levels of TC and LDL and less amount of HDL (2,3). The golden standard to analyse the cholesterol levels in the blood is the laboratory test (12,13). However, this is a time consuming and expensive procedure and that is the reason for the easy and fast, so called point of care equipment, such as CardioChek, which can give an indication if further lipid profile investigation is needed (12,13).

Primary prevention can play an essential role to reduce the chance of getting chronic diseases. Nowadays, people get older and the life expectancy at birth is getting higher (14). 18% of the total population were 65 years and older in the Netherlands, in 2014 (14). This number is growing in almost every country, which means that with increased older population, there will be more chronic diseases (14). However, these diseases such as diabetes, could be prevented by a healthy lifestyle (2,3,14). Health care professionals can help with lifestyle changes, optimizing health status and also maintaining their healthy behaviours in the future. Health care professionals, including physiotherapists, can play a major role in assessing and evaluating the health profile of the population (15). Physiotherapy students learn about restoring and optimizing health during their whole education. Prevention should be an essential task for physiotherapists, even though during this education the focus is not on this subject.

The risk for developing chronic illnesses such as CVDs can be reduced by monitoring modifiable parameters such as BMI, WC, blood pressure and cholesterol level not only in later age, but also in children, adolescents and young adults (16-18). These factors can be modified by lifestyle changing. It is important to assess these values in order to gain information about the current health of the person. Furthermore, physiotherapists can assist adjusting the lifestyle of the patients and help lowering the risk of getting chronic diseases. It is essential that future health care professionals understand these risk factors and they can play a major role not just in rehabilitation, but also in primary prevention. In their first year, all students have to take part in the exercise laboratory project. Different measurements are taken to evaluate the health status of the undergraduates. Agility, flexibility and the fitness level are assessed in order to gain more insight of the healthy values of the different measurements. It is important that the students know their own results and how to interpret them.

Therefore the aim of this study is to describe anthropometric parameters such as waist circumference and BMI and cardio-metabolic parameters, namely total cholesterol level and blood pressure among university students. The sub aim for this study is to also describe the cut-off values according to the European guidelines on cardiovascular prevention in clinical practice 2012.

### **3. Method**

#### **3.1 Study design**

This research had a descriptive study design which was used to describe the anthropometric and cardio-metabolic parameters in first year physiotherapy university students according to the cut-off values.

This study was part of a bigger project which was conducted at Fontys University of Applied Sciences. All first year physiotherapy students (2015-2016 year) had to partake in as their professional product. From this project, 3 other graduation projects were formulated, which investigated different topics.

#### **3.2 Subjects and ethical paragraph**

Participants were students from the first year of physiotherapy, at Fontys University of Applied Sciences. A total of 245 students were enrolled as first year students of physiotherapy, at Fontys University of Applied sciences. The participants were obliged to participate in a medical screening, from which they had an overview of their health profile.

Inclusion criteria were enrolled first year physiotherapy students from Fontys, aged between 18-25. Exclusion criteria were students who did not attend to the measurement dates, subjects who had severe injuries and could not take part in the project.

Subjects were informed beforehand by e-mail. An information letter and the inform of consent were sent, and had to be signed before the tests (see Appendix 1-2).

#### **3.3 Measurements**

The health of the students was assessed by various measurements at the exercise laboratory, at Fontys. Flexibility, agility and fitness level were measured next to the anthropometric and cardio-metabolic parameters. Four 4<sup>th</sup> year physiotherapy students were part of the Exercise laboratory project. After reviewing the manual, a pilot study was scheduled in order to gain more insight into the test protocols which took approximately 5 hours. The protocol and the order for the measurements can be found in the Appendix in details (Appendix 3).

Participants were informed beforehand and they were asked not to do vigorous physical activity 24 hours prior to the tests. They were informed that they should not drink 1 hour before their appointment, because the different drinks (especially coffee, energy drink) can alter the results of the measurements.

The first measurements were the BMI, body fat percentage and the blood pressure measurement in order not to influence these data with the different activities. There were agility tests,

different strength tests and at the end VO<sub>2</sub>-max Astrand bike test. Before the submaximal bike test, waist circumference and total cholesterol was measured.

Body height and body weight were taken by a digital scale (Jenix, height, weight and fatness measuring system, model DS-103). BMI was calculated according to the equation of body weight (kg)/ body height (m)<sup>2</sup>. Participants were asked to remove shoes and socks during the measurement.

Waist circumference was measured in the middle between the last rib and iliac crest by elastic tape measure. There was only one person who measured all the subjects in order to avoid bias. Participants were standing with both feet on the ground, arms hanging down and the tape was placed around their waist (3,19). One measurement was noted down.

Total cholesterol was measured by CardioChek cholesterol analyser equipment and capillary blood sample was taken by Unistik®3, from the tip of a finger.

Blood pressure was measured by an automated non-invasive blood pressure monitor (Model: Easy X 800 R/L) in rest. Heart rate, systolic and diastolic blood pressure in mmHg were measured. Participants were seated on a chair with back support and were given instructions during the measurement. Subjects had to put their right arm into the machine, and blood pressure was measured automatically and then the values were noted down.

### **3.4 European Guidelines on cardiovascular disease prevention in clinical practice (version 2012)**

The usage of an evidence-based guideline in healthcare is essential in order to give quality treatment based on recent knowledge. In the Netherlands physiotherapists use KNGF guidelines in order to optimize their patients 'care. This guideline is an evidence-based resource about CVDs and it can be a good use for any health care professionals. It provides information about risk factors and the different parameters and their healthy values. These cardiovascular guidelines are not only useful for primary health care professionals, but physiotherapists can play an important role in prevention, by knowing how to measure and monitor the different parameters. It describes in details when and how to use prevention programmes.

The healthy values according to the European Guidelines on cardiovascular disease prevention in clinical practice (version 2012):

- BMI value between 25-29,9 kg/m<sup>2</sup> is defined as overweight and above the 30 kg/m<sup>2</sup> defined as obesity (3).
- According to the European guideline, the values of WC for women should be less than 80 cm and for men should be below 94 cm (3).
- In a healthy situation total cholesterol should be below 5 mmol/l (3).

- Optimal blood pressure is below or equal to 120/80 mmHg. There are 3 grades of hypertension, where grade 1 is 140-159 systolic and/or 90-99 diastolic, grade 2 is 160-179 systolic and/or 100-109 diastolic and grade 3 is above 180 systolic and/or above 110 diastolic in most severe cases (3).

### **3.5 Statistical analysis**

Data was first collected with Microsoft Excel 2013 and then assessed by Statistical Package for Social Science (SPSS) v.20. Histogram observation was carried out in order to find out if the parameters were normally distributed. All parameters were found to be normally distributed therefore mean and standard deviation (S.D.) were used. Figures and tables present frequencies to get a clear picture about the different parameters. The mean values and standard deviation of each parameters were also shown by genders.

#### 4. Results

From the 245 enrolled first year physiotherapy students, 193 were taken part in the testing. 43 subjects were excluded due to their age or health condition. After applying the inclusion and exclusion criteria, 150 students were included in the study. 85 of the study subjects were male and 55 were female. One person were in a wheelchair and she could not stand up in order to measure her BMI. Four people refused to take capillary blood sample from their fingertips, due to fear. For the last person, there was an error in the system and the blood pressure measurement data was missing.

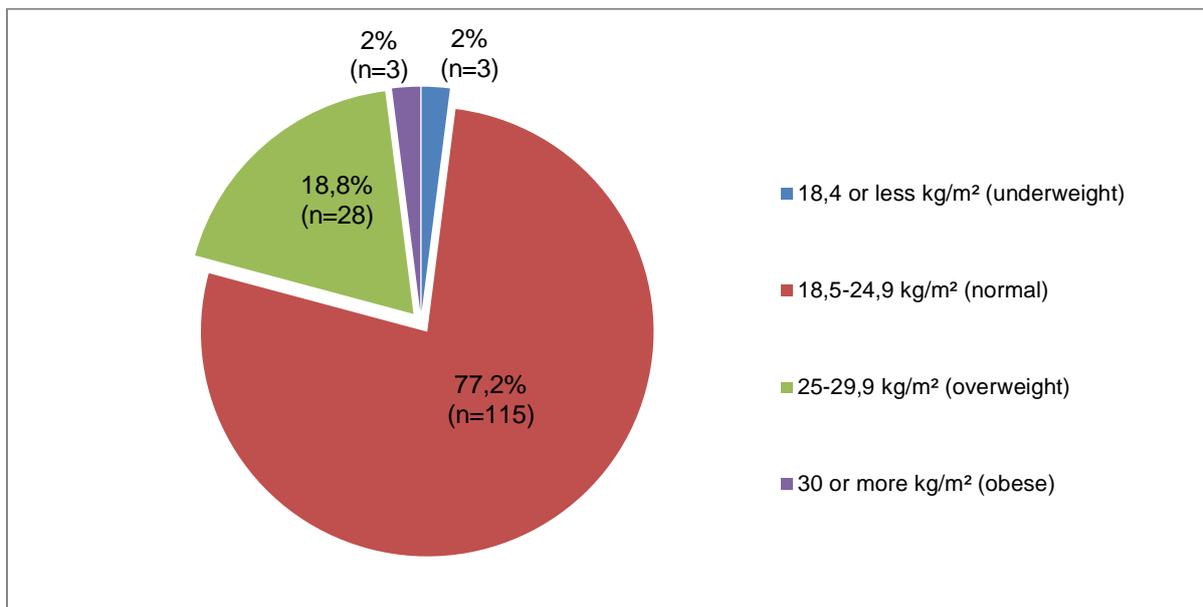
Table 1 shows a summary of the means and standard deviation of age, weight, height, body mass index, waist circumference, total cholesterol, systolic and diastolic blood pressure. It shows also divided by gender. All parameters were normally distributed.

**Table 1. Summary of values**

	Mean ± S.D.	N	Mean ± S.D.	N	Mean ± S.D.	N
	Total	total	Male	Male	Female	Female
<b>Age (years)</b>	19,89 ± 1,76	150	20,04 ± 1,85	85	19,71 ± 1,65	65
<b>Weight (kg)</b>	70,45 ± 10,99	149	74,88 ± 9,78	85	64,56 ± 9,74	64
<b>Height (m)</b>	1,75 ± 0,09	149	1,80 ± 0,07	85	1,67 ± 0,07	64
<b>BMI (kg/m<sup>2</sup>)</b>	23,02 ± 2,89	149	22,96 ± 2,32	85	23,09 ± 3,54	64
<b>WC (cm)</b>	79,04 ± 7,43	150	80,76 ± 6,01	85	76,78 ± 8,49	65
<b>TC (mmol/l)</b>	4,02 ± 0,88	146	3,66 ± 0,76	84	4,51 ± 0,81	62
<b>Systolic blood pressure (mm Hg)</b>	126,79 ± 14,57	149	130,87 ± 13,98	85	121,36 ± 13,65	64
<b>Diastolic blood pressure (mm Hg)</b>	72,52 ± 8,88	149	73,56 ± 8,75	85	71,14 ± 8,95	64

N=number of participants, S.D.=standard deviation, BMI=body mass index, WC=waist circumference, TC= total cholesterol

Figure 1 provides more detailed information about BMI categories.



**Figure 1. Prevalence of body mass index**

From all participants 77,2% (n=115) students had normal BMI, 2% (n=3) were underweight . 18,8% of the students (n=28) were overweight and 2% (n=3) had BMI over 30.

Table 2 shows the prevalence of waist circumference.

**Table 2. Prevalence of waist circumference**

	N=150	Frequency
<b>Optimal</b>	125	83,3 %
<b>Above optimal value</b>		
(≥ 80 cm for women)	25	16,7 %
(≥ 94 cm for men)		

83,3% of the students (n=125) have optimal waist circumference and 16,7% (n=25) have a waist circumference above the normal value.

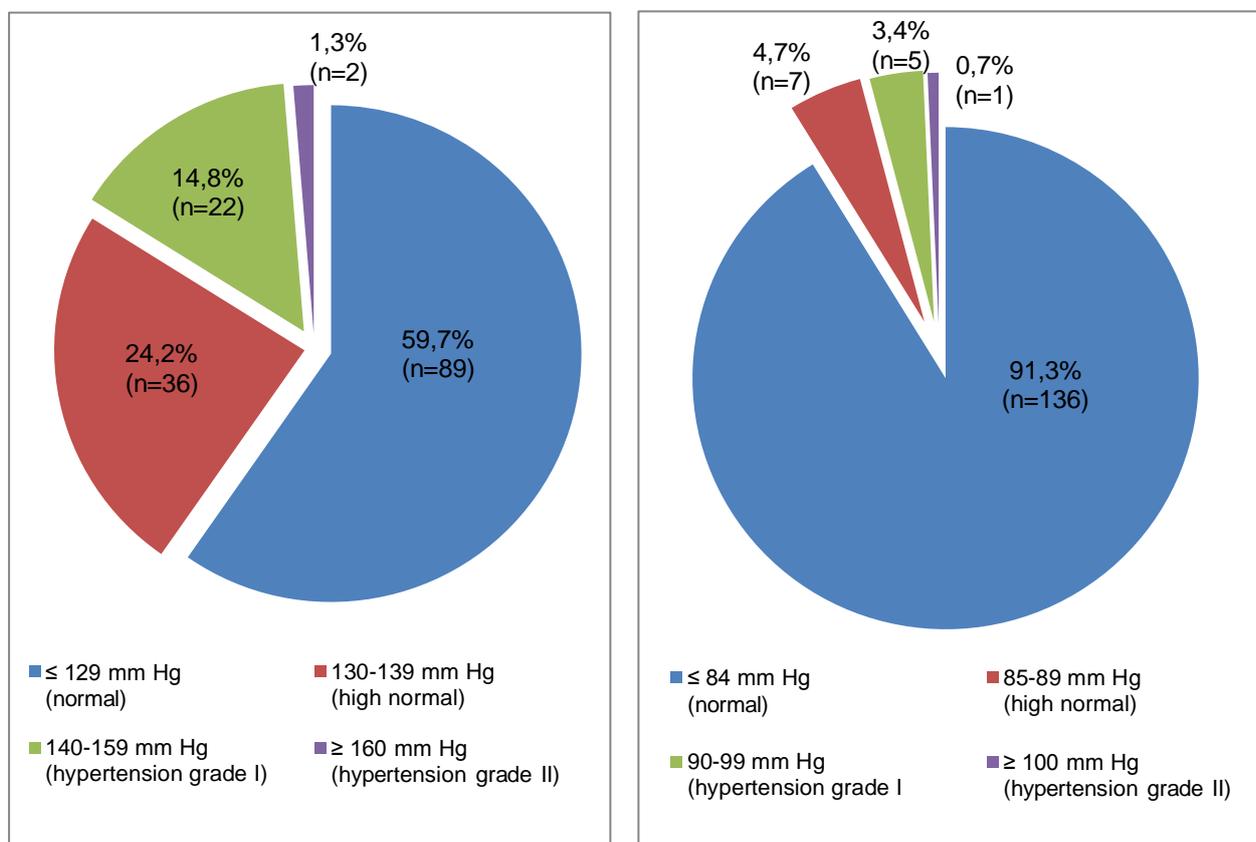
Table 3 presents the values and frequencies of total cholesterol.

**Table 3. Prevalence of total cholesterol**

	N=146	Frequency
<b>4,9 or less mmol/l</b>	125	85,6 %
<b>≥ 5 mmol/l</b>	21	14,4 %

85,6% from the participants (n=125) have total cholesterol level below 5 mmol/l and 14,4% (n=21) have the total cholesterol above or equal to 5 mmol/l.

Figure 2 and 3 shows the values of systolic and diastolic blood pressure.



**Figure 2. (left) prevalence of systolic blood pressure and figure 3. (right) prevalence of diastolic blood pressure**

14,8% of the students (n=22) have 140-159 systolic mm Hg and 1,3% (n=2) have above 160 systolic blood pressure. Furthermore, the majority of the participants (n=136) have equal or less 84 diastolic mm Hg. 4,7% of the students (n=7) have high normal, 3,4% have first graded hypertension (n=5) and 0,7% have a second grade hypertension according to diastolic blood pressure (n=1)

Cut-off values according to the European Guidelines on cardiovascular disease prevention in clinical practice (version 2012) can be seen in the method section.

## 5. Discussion

This study investigated anthropometric and cardio-metabolic values in first year physiotherapy students, at Fontys University of Applied Sciences. The results suggest that the majority of the students had normal weight and optimal waist circumference for their age group. Moreover, most of the undergraduates had ideal total cholesterol levels. Furthermore, according to European Guidelines on cardiovascular disease prevention in clinical practice, they also had normal values in both systolic and diastolic blood pressure while in rest. However, there were some participants who had non-optimal values according to different parameters.

### Description of BMI and WC

Normal BMI values were found among 115 out of 150 students. In this study the mean BMI was  $23,02 (\pm 2,89) \text{ kg/m}^2$  which was similar to other findings. For example, one study showed that Belgian first year university students had a mean BMI of  $21,7 (\pm 2,7) \text{ kg/m}^2$  (20). Furthermore, another study by Papathanasiou et al. investigated medical and physiotherapy university students, where the mean BMI was  $22,7 (\pm 3,1) \text{ kg/m}^2$  (21).

In this study, the mean BMI was very close for males and females. Males had a mean BMI of  $22,96 (\pm 2,32) \text{ kg/m}^2$  in contrast to females, who had a mean BMI of  $23,09 (\pm 3,54) \text{ kg/m}^2$ . Greek, Portuguese and Italian university students showed bigger differences between the genders (21-23). In this study a higher mean BMI was expected for male students, because other studies showed a significant difference of this value between the sexes. In general, men have a higher BMI, because they have more muscle mass than women (6-10,24,25).

The prevalence of overweight defined by BMI in this study's population was 18,8% and 2% of the subjects were obese. For example, a study by Papathanasiou et al. presented that the prevalence of overweight was 17% and 3,1% was obese (21). Among Portuguese first year university students the prevalence of overweight was only 12,2% and obesity was 3,2% (22). Furthermore, another study which investigated only medical students in Greece showed the higher rates, 27% of the total population had BMI over  $25 \text{ kg/m}^2$  and also more than 4% were found to be obese (7). These studies were used for comparison, as they also measured university population and similar parameters as in this study. Compared to these studies, physiotherapy students do not show less prevalence of overweight and obesity.

The mean WC was  $79,04 (\pm 7,43) \text{ cm}$  for the total population of this study. According to a study conducted by Altenburg et al., the mean WC for Dutch young adults between the ages of 18-28 was  $80,56 (\pm 10,1) \text{ cm}$  (26). In this research, female students showed a mean value of  $76,78 (\pm 8,49) \text{ cm}$  and male students a mean value of  $80,76 (\pm 6,01) \text{ cm}$ . This difference in WC can also be seen in other studies. A study in Greece shows that male students had higher WC values than female students (7). Furthermore, an Italian study showed that Italian male students had a mean WC of  $81,7 (\pm 7,3) \text{ cm}$  and female students had a mean WC of  $70,3 (\pm 6,5) \text{ cm}$  (23).

The results showed that 16,7% of the total participants had non-optimal WC values. This corresponds to the findings of the BMI.

### **Description of TC**

The mean TC level was 4,02 ( $\pm$  0,88) mmol/l, which is comparable to other studies. Dutch young adults presented a higher mean value of TC, which was 4,56 ( $\pm$  0,9) mmol/l (26). In this research, there was a big difference between the genders. The mean TC for males was 3,66 ( $\pm$  0,76) mmol/l and the mean TC for females was 4,51 ( $\pm$  0,81) mmol/l. A study performed on Dutch young adults, where males had a mean TC of 4,4 mmol/l and female had a mean TC of 4,6 mmol/l (26). Even though 85,6% of the study population had healthy total cholesterol values, 14,4% presented non-healthy values. A study conducted by Brandao et al., 17,7% showed high TC levels for undergraduates (22).

During the measurement, the majority of the students did not know about the healthy values of total cholesterol level. This could be an important indication for the university to inform students better about optimal range and also how to measure it. Even though the majority had optimal numbers, there were already 21 subjects who presented values above the cut-off point. This unawareness can lead to health issues in the long-term and is one of the reasons why students should be taught how they can improve their health. Total cholesterol level can be influenced by many factors. There are elements which can be controlled, like diet, weight and physical activity (27). However, there are factors which cannot be influenced, such as age, gender and also heredity (27,28). In this study not only Dutch students were measured, but also students from the English stream. Students came from different countries, culture and nutrition intake, which could explain why values of some students stand out. People who had higher TC levels should be investigated further, to find the possible reasons behind the non-optimal levels in order to prevent health issues in the future. As stated in the introduction, the golden standard to measure blood lipid levels is the usage of laboratory tests (12,13). CardioChek devices are useful to give an impression of the total cholesterol level, but it is not as punctual as a laboratory test (12,13). The reliability of this point-off care tool is not the best for measuring a larger population, but it is a good tool to give indication for further investigation.

### **Description of blood pressure**

The mean value of systolic blood pressure was 126,79 ( $\pm$  14,57) mm Hg and the mean value of diastolic blood pressure was 72,52 ( $\pm$  8,88) mm Hg in the total population. These mean values showed resemblance to another study, in which Greek medical and physiotherapy students were measured. The mean systolic blood pressure was 123,8 ( $\pm$  12,6) mm Hg and the mean of the diastolic was 74,9 ( $\pm$  9,2) mm Hg (21). The study conducted by Altenburg et al., presented a mean systolic blood pressure of 126,26 ( $\pm$ 13,4) mm Hg and a mean diastolic blood pressure of 75,76 ( $\pm$  8,5) mm Hg (26). Furthermore, there was a diversity between the genders. As shown in this study, the mean

systolic and diastolic blood pressure were higher in male students than in female students. Systolic blood pressure presented 130,87 ( $\pm$  13,98) mm Hg in male undergraduates and 121,36 ( $\pm$  13,65) mm Hg in female. These findings show similarity to other European studies. In addition, Portuguese, Italian, Finn and Belgian young males have higher systolic and diastolic blood pressure (20,23,29-32). As reported by Altenburg et al., the mean systolic blood pressure value was 134,36 ( $\pm$  12,1) mm Hg in male participants and the mean systolic value was 121,16 ( $\pm$ 11,6) mm Hg in female participants (26).

This study showed high normal systolic values in 24,2% of the total population. 14,8% of all students showed hypertension grade I systolic blood pressure. As reported by another study where medical and physiotherapy students were measured, the prevalence of hypertension grade I systolic blood pressure was 12,1% (21). According to these unexpected findings, physiotherapy students show higher prevalence of non-optimal blood pressure. One explanation for this could be that the measurement was performed only once, while at other studies this was performed at least twice. The most punctual way to measure blood pressure is with a stethoscope and manual sphygmomanometer (11). In this research the schedule was tight for every individual and it was easier to use the device in order not to get delay with the other measurements, such as the Astrand bike test.

Another possible explanation could be that, even though students were informed about the study protocols and measurement, their excitements caused higher levels of blood pressure. Moreover, there are many other factors which can influence blood pressure, such as age, gender, family history and ethnicity. Smoking, diet, weight are also factors which should be taken into consideration (33-35). These results indicate that further assessment of underlying causes of the high prevalence of hypertension in this age group might be relevant. Students should be acquainted with the values of optimal blood pressure. Blood pressure measurement should be performed more often, because this can be an indication for further risk factor investigation.

### **Study strengths and limitations**

This study has a homogenous study population with adequate number of participants. This result gives a clear information about the values of BMI, WC, total cholesterol and blood pressure in this specific population.

One of the strengths of this study is that, next to BMI, waist circumference was also assessed and the two tools together give a better indication for overweight and obesity. There are many articles which discuss the usage of BMI alone and the validity to use it as the only measurement for overweight and obesity (6-10,24,25).

One of the weaknesses of this study is that only the total cholesterol was measured. In the future, it would be beneficial to also measure the low-density lipid (LDL) and the high-density lipid (HDL) (2,3). HDL is known as the good cholesterol which does not cause atherosclerosis. If the blood shows a low concentration of HDL and a high concentration of LDL, it indicates a higher risk for getting CVDs (3). The CardioChek analyser that was also used in this study can measure the HDL concentration. However, this would double the costs of the study. In a future study, it is recommended

to combine the measurement of TC, HDL and LDL concentration to get more reliable result about the person's lipid profile.

Another limitation may be the design of the study. It is a descriptive study, which gives clear insights about the current situation, but it does not give information about reasons for these results. For prevention of CVDs, it would be a good start to investigate these reasons. Furthermore, another weakness might be that the results of this specific may not be representative for university students in general.

### **Possible consequences of the results**

Even though the majority of the population have optimal values according to these parameters, there are many students who have values above the healthy range. This can be a good indication to consider a prevention program for university students, where they can learn more about cardiovascular diseases and related risk factors. There were students who were not aware of the healthy parameters of the different measurements. As healthcare professionals, it is essential to have knowledge about our health. This study showed that the students could learn more about cardiovascular diseases and about their risk factors. Young adults are not aware how important is to check these parameters, because it will influence their future health status. The University could provide more lectures or workshops in order to learn more about this topic.

### **Recommendations for further research**

This study can be a starting point for future studies because these findings present relatively high prevalence of unhealthy values. Physiotherapy students should show better values, because they promote healthy lifestyles. The underlying causes of unhealthy values should be investigated. Further research could also investigate university students from different studies and it could be measured whether there is a difference between students who study health related subjects and students from different departments.

### **Conclusion**

The findings from this study show that most of the participants have healthy values in all parameters, although there are still a number of participants who had values above the optimal range. This result highlights the necessity for using primary prevention programs and specific health education about modifiable risk factors for young adults.

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## 7. Appendix

### Appendix 1: Information letter in Dutch and English

#### Informatiebrief

Beste medestudent,

Als onderdeel van ons afstudeeronderzoek willen we jullie, eerstejaars studenten fysiotherapie, uitnodigen om deel te nemen aan een fysieke screening. In de bijlage vinden jullie een overzicht van de tijdsplanning wanneer je ingedeeld bent. We zullen een aantal metingen verrichten, de duur daarvan zal ongeveer 60 minuten in beslag nemen.

- BMI (lengte, gewicht, vetpercentage)
- Bloeddruk en hartslag
- Buikomvang
- Reactietijd, spronghoogte en balans test
- Handknijpkracht
- VO2 Sub--maximaaltest op de fiets
- Rugspier kracht
- Lenigheid van de hamstrings en lage rug (Sit & Reach)
- Sit--ups
- Cholesterol en glucose gehalte in het bloed
- Side--step

Daarnaast dient er ook een vragenlijst ingevuld worden, deze kun je invullen als je klaar bent met de testen en kan dan meteen ingeleverd worden. Voor een correcte meting is het van belang een aantal voorwaarden te stellen. Het is niet toegestaan zware lichamelijke inspanning te verrichten in de 24 uur voorafgaand aan de test. Daarnaast dient in de twee uur voorafgaand aan het onderzoek niets genuttigd te worden wat de hartslag zou kunnen beïnvloeden, zoals koffie, energydranken etc. Ook mag een uur voor de test niets meer gedronken worden. Tijdens de meting zal er gezorgd worden voor wat te drinken mocht je daar behoefte aan hebben.

De resultaten van de tests en vragenlijsten zullen vertrouwelijk behandeld worden, en zullen automatisch verwerkt worden in een database voor statistische verwerking.

De tests zullen worden uitgevoerd in het inspanningslab van de Fontys Paramedische Hogeschool aan de Theodoor Fliednerstraat te Eindhoven. Het inspanningslab bevindt zich bij binnenkomst direct rechts, voorbij de kapstokken.

Het is mogelijk dat je gevraagd wordt om een week lang een Activ8 te dragen, dit is een klein kastje wat je dagelijkse fysieke activiteit meet. Mocht je hiervoor worden uitgekozen, dan zal de nodige informatie uitvoer met je besproken worden.

**Wat je nodig hebt:**

- student nummer
- geschikte kleding: sportschoenen

**Denk eraan:**

- geen zware fysieke inspanning vanaf 24 uur voorafgaand aan de test
- niets nuttigen wat de hartslag zou kunnen beïnvloeden vanaf 2 uur voorafgaand aan de test
- niets drinken (ook geen water) vanaf een uur voorafgaand aan de test

Met vriendelijke groet,

Mies van den Biggelaar, Renáta Rácz, Marius van Roosmalen, Judith van de Lockand

**Information letter**

Dear 1st graders,

As part of our thesis, we require your participation in completing our projects. Fontys want to carry out a follow-up analysis of their physiotherapy students, and fortunately of us, we can use this information in our projects.

We will be carrying out a series of procedures, with a total run time of ~ 1 hour per student:

- BMI
- Bloodpressure and heartrate
- Circumference
- Reactiontime and jump hight
- Gripstrength
- VO2 Sub-maximal test on bicycle
- Back strength
- Agility
- Sit--ups
- Cholesterol and glucose

As well as filling out a questionnaire. After which you can start with the measurements (please if you're able to fill in and print the questionnaire before your appointment at the exercise lab.) In the event of participating in our project, it will be necessary to avoid any physical activity 24 hours prior to your scheduled appointment, and the consumption of food or drinks 2 hours prior to your appointment which may alter heart rate values, such as coffee, energy drinks etc. As well as not to drink anything 1 hour before the appointment. The results from your tests will be kept anonymous, and will be automatically updated into a software program for the use of statistical analyses. The tests will be carried out in Fontys University of Applied Sciences, Theodor Fleidnerstraat building (Room 0.106).

Through the rotating doors, immediately on the right (past the coat hangers).

You might get asked to wear an Activ8 accelerometer for a week (this is a measurement tool which measures your daily physical activity), when you're chosen for this measurement you will be informed about the details.

**You will need:**

- fill out the questionnaire prior to appointment
- student number
- suitable attire: trainers

**Remember not to:**

- physically exert yourself 24 hours prior to appointment
- drink or eat 2 hours prior to appointment which may alter heart rate values
- drink at all 1 hour prior to appointment (including water!)

Kind Regards,

Mies van den Biggelaar, Renáta Rácz, Marius van Roosmalen, Judith van de Lockand

## Appendix 2: Inform of Consent in Dutch and English

### Toestemmingsverklaring

Voor deelname aan het wetenschappelijk onderzoek:

- Ik ben over het onderzoek geïnformeerd.
- Ik heb de informatiebrief gelezen.
- Ik ben in de gelegenheid gesteld om vragen over het onderzoek te stellen, en heb het recht ook in de toekomst vragen te stellen over het onderzoek.
- Ik heb over mijn deelname aan het onderzoek kunnen nadenken.
- Ik heb het recht om mijn toestemming, zonder opgaaft van redenen, op ieder moment weer in te trekken.
- Ik weet dat de over mij verzamelde gegevens alleen gebruikt zullen worden voor bovenstaand onderzoek en dat deze vertrouwelijk en volgens de geldende ethische normen zullen worden behandeld.
- Ik stem toe met deelname aan het onderzoek.

Naam:

Geboortedatum:

Handtekening:

Datum:

Ondergetekende, verantwoordelijke onderzoeker, verklaart dat de hierboven genoemde persoon zowel schriftelijk als mondeling over het bovenvermelde onderzoek is geïnformeerd.

Naam:

Handtekening:

Datum:

### **Informed Consent**

For taking part in the scientific study:

- I have been informed about the study.
- I have read the information letter.
- I have been given the opportunity to ask questions about the study, and am also allowed to ask questions in the future.
- I have been able to think about taking part in the study.
- I have the right to withdraw my consent at any given time, without stating the reason for this withdrawal.
- I know that the data which will be collected will only be used for the purpose of this study and that they will be handled with confidentiality and according to current ethical standards.
- I consent to participation in this study.

Name:

Date of birth:

Signature:

Date:

I, the researcher responsible for the study, hereby declare that the person named above has been informed both verbally and in writing about the study mentioned above.

Name:

Signature:

Date:

### **Appendix 3. Protocol for the testing**

1. The study participant enters the testing area wearing sports clothes and on bare feet
2. The participant then has to sign the Informed Consent before the testing takes place (Appendix 2)
3. After signing, a specific number is given to the subject in order to type it in the THP2 program, which gathers all the measured data into one program

4. The first measurement is the height and weight measurement on bare feet
5. Next is the body fat percentage with the bioelectrical impedance analysis device, on which the participants is required to be on with bare feet and is not allowed to have any metal objects on their body in order for the measurement to work optimally. The subject is required to hold the holders for the duration of the test and is not allowed to move or speak.
6. The third test is the blood pressure and heart rate measurement. The subject sits on a chair while being measured and is required not to move or speak during the test.
7. The fourth test is the hand grip strength test. The dynamometer is adjusted to the size of the subjects hand and then in the first test the subjects squeezes the dynamometer with his/her right hand as hard as possible during 3 seconds. Thereafter, the second test is done with the left hand.
8. The fifth test was the back strength test. Here the subject is instructed to fully extend their knees while pulling the bar up, in order to test the back strength and not so much the strength of lifting in the legs. The subjects are required to do the test two times and hold the lift for at least 5 seconds.
9. The sixth test is the hamstring and lower back flexibility test. The subject is required to extend their knees during the whole testing time and is required to do the test twice.
10. The seventh test is the 1 minute sit-up test. Here the subject is required to do as many sit-ups as possible in 60 seconds with his/her feet locked into a bar.
11. The eighth test is the side-step test, in which the subject is required to side-step as many times as possible from one side to the other on a pressure plate platform in 20 seconds. The subject is required to wear sport shoes in order to complete this test. Men are required to go until the outer yellow line of the platform while side-stepping and the women are required to go until the inner yellow line of the platform.
12. After the side-step test, the subject's waist circumference is tested. The subject is required to lift up his/her shirt in order to avoid extra material between the meter and the skin.
13. The tenth test is a blood glucose and cholesterol level measurement test, in which the subject is pinched on the side of one finger in order to draw a sample of blood to put to be assessed on the device.
14. The last test is a 6 minute Astrand-Ryhming cycle-ergometer test to measure cardiorespiratory fitness. The participant wears a heart rate monitoring device and is required not to talk during the test.