

Physical activity among adolescents in Vava'u, Tonga

- A Rapid Assessment study

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Summary

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Introduction: Physical inactivity is the fourth leading risk factor for mortality globally. The Southern Pacific region is worst struck by the associated obesity epidemic and in Tonga 92.1 % of the adults are overweight or obese. The sedentary lifestyle is established in adolescence and is considered a combination of globalization and sociocultural factors- which especially disfavors women to conduct physical activity.

Aims: The aim of this study was to investigate the knowledge, attitudes and behaviors of physical activity among adolescents in Tonga to identify possible barriers and facilitators.

Methods: The study was set in the town of Neiafu, in the Vava'u island group of Tonga. Data was mostly collected from students, aged ~ 15 years, and their teachers. A Rapid Assessment methodology was used and collection methods mainly consisted of Semi-Structured Interviews (n = 19) and Focus Group Discussions (n = 6, participants n = 46).

Results and discussion: Team sports are the most popular among the students: for girls netball and soccer, for boys rugby and soccer. The Tonga Health Promotion Foundation was well-known among both students and teachers. Barriers were by students mostly identified at an environmental level. Teachers mostly identified barriers on a more general Social-Ecological level. Facilitators were mostly identified on an individual level. The suggestions proposed were mostly on a more general community and societal level. This is an explorative study and conclusions are also limited by the small sample size.

Conclusion: Physical activity among adolescents is influenced by many factors on different levels. The lack of opportunity for continuous physical activity is evident and sociocultural factors are especially important to address the issue.

Abbreviations

BMI	Body Mass Index
CC	Chanel College
FGD	Focus Group Discussion
LMIC	Low and Middle-Income Countries
MC	Malefihi Siu'ilikutapu College
NCD strategy	Tonga National Strategy to Prevent and Control Non-Communicable Diseases
NCD	Non-Communicable Diseases
NGO	Non-Governmental Organization
OPIC	The Pacific Obesity Prevention in Communities project
PA	Physical Activity
PE	Physical Education
RAR	Rapid Assessment and Response
SES	Socioeconomic Status
SPC	Secretariat of the Pacific Community
SSI	Semi-Structured Interview
TASANOC	Tonga Association of Sports and National Olympic Committee
TC	Tailulu College
Tonga	The kingdom of Tonga
TongaHealth	Tonga Health Promotion Foundation
VHS	Vava'u High School
VSC	Vava'u Sports Committee
WHO	World Health Organization

Introduction

Background

Physical inactivity is the fourth leading risk factor for mortality globally causing an estimated 3.2 million deaths annually [1]. Low levels of physical activity (PA) have been found to be associated to overweight and obesity and according to World Health Organization (WHO) data from 2008 an estimated 1.4 billion adults are overweight [2], which poses a serious global health issue. In this scenario, the fact that the island nations in the Southern Pacific region have the highest rates of obesity in the world, with the kingdom of Tonga (Tonga) in top four globally, is of particular concern. The weight gain and sedentary lifestyle mainly occur in adolescence [3].

The Tongan community has strong hierarchal structures with gender differences in the type and frequency of recreational physical activities between adolescents. Gender divided patterns of PA, eating and body size preferences are influenced by culturally specific values and expectations, and the input from Westernization, urbanization and globalization [3-5].

The obesity epidemic, with early onset NCDs, has in Tonga been recognized as a complex issue, although mostly contributed from sociocultural and diet factors. A transition has occurred during the last decades, from the traditional diet with fish, coconuts and local root crops, to convenient store-bought food high in fat, sugar and salt [3, 4, 6-8]. The diet focus has led the PA aspect to be less explored. The inspiration for the methodological approach of this study was a “PA campaign”- study from 2011, with the intent to develop a netball campaign for women in Tonga.

Main aim

The aim of this study was to investigate the knowledge, attitudes and behaviors in regards of PA to identify possible barriers and facilitators among adolescents in the Vava'u island in Tonga.

Specific aims

- What barriers and facilitators of PA can be found in environmental-, social-, cultural, mental-, and religious levels?
- How are these factors distributed on a structural-, community-, and individual-based level?
- For example- how frequent are Physical Education (PE) classes in school? What is the attitude to PA among male and female students and teachers? Is there support from family members and school authorities to promote PA?

Reference frame

Physical activity and obesity

Non-Communicable Diseases (NCDs) contribute the largest to mortality globally with 35 million deaths or 60 % of the total deaths. The largest burden, 80 % or 28 million deaths, occur in Low- and Middle- Income Countries (LMICs) [2]. The NCD rate is estimated to increase by 17 % from 2010 to 2020, largely due to population aging, growth, globalization and urbanization [9]. Childhood obesity is well documented in Western Nations as an epidemic, and is increasingly being reported in LMICs [3]. Childhood obesity is associated with serious physical, social and psychological consequences. Obesity-related chronic diseases include cardiovascular disease, type 2 diabetes, osteoarthritis and cancers such as breast, colon and rectal cancer [10]. Childhood obesity is highly associated with obesity into

adulthood, and is hard to reverse with interventions once established [11]. This makes, in combination with the high cost for treatment of NCDs and the fact that most cases of NCDs are considered preventable, primary prevention highly desirable. But even when obesity is established, there has been shown a linear association between increased levels of PA and health benefits [10]. This implicates that interventions should not only focus on weight reduction, but also to enhance cardiorespiratory- and muscular fitness [12].

In Tonga, over 30 years time the average weight for women increased by 21.2 kg to 95.5 kg and for men by 17.4 kg to 98.6 kg [13, 14]. There is a steep increase in weight gain in adolescence. For adolescents, approximately one third of the males and one half of the female adolescents are overweight or obese [3], but almost every adult Tongan is overweight or obese. From WHO's STEPS survey 2004 the overweight and obesity (Body Mass Index (BMI) >25 and BMI >30) prevalence for adults are 92.1 % and 68.7 %. Women have higher prevalence numbers than men over all age groups, and are more obese (mean BMI 34.9 compared with 31.7 for men) [14]. This is exceptional and the long term effects have started to show in the economy. There has been an increase in diabetes from 7.5 % to 15.1 % in the last 30 years [15] and the per capita total expenditure on health has doubled the last ten years, with a clear trend upwards [16].

In Tonga, an increase in sedentariness has been showed between the ages of 11/12 years and 15/16 years [3]. Among adults low or moderate levels of PA have been reported for two thirds of the population, with strong gender differences. Females report less PA than males [14], with the same gender pattern shown for adolescents [3]. To the author's knowledge, there are two studies regarding PA among Tongan adolescents during the last ten years. Both studies sampled data through self report questionnaire. One showed a clear gender division with

twice as many young males in Tonga engaging in regular recreational PA compared to females [3], while the other study showed no difference in PA between male and female adolescents [17]. A questionnaire study from 2001 showed that Tongan adolescent males increased their reported activity from age 13 to age 15 years, while the reverse was true for females [18]. The discrepancy could be due to the bias of self report data, which is well known among adolescents. But the gender differences need to be further investigated, and should be given priority in future epidemiological studies.

Rapid Assessment Studies

The Rapid Assessment and Response (RAR) research approach was originally developed by WHO for HIV prevention and substance abuse, but has since been extensively used for a wide variety of public health issues. RAR has advantages to more conventional research methodologies in assessing complex issues in a time and cost limited setting. RAR uses multiple methods and data sources and an important feature of RAR is cross-checking the data, “data triangulation”, until a satisfied validity and representativeness of the information is achieved. This process is constant throughout the data collection process and RAR does not only aim to answer a set of pre-planned questions, but also investigate new hypotheses as they emerge. This makes RAR more flexible than more traditional research approaches, and complex health behaviors are analyzed in an individual, community and structural level. Further description of the methodology can be found in the *RAR Technical Guide* developed by WHO in 2003 [19].

In 2011 a RAR study was conducted in Tonga with the focus to develop a PA campaign with netball among adult women [20]. The methodology included Semi-Structured Interviews (SSIs) with health authorities as well as Focus Group Discussions (FGDs) with women 16-45 years old and their male partners. Data was collected on the three main island groups of

Tonga. The results showed barriers in form of cultural factors, gender discrimination, socioeconomic factors as well as infrastructure issues. Facilitators of PA were the social aspects of sports, incentives, and religious sanctions for increased PA for women.



Figure 1. Map of Neiafu, Vava'u island, Tonga, retrieved on May 15, 2014. Map data: Google, Kartdata.

Country background

Tonga is an island nation in the Southern Pacific ocean (**Fig. 1**) and stretches over 360,000 km² ocean area [21] (compare to Sweden's land area 400,000 km² [22]), but has only 750 km² of land area. The island nation is located just west of the date line a three hour flight north from New Zealand. The island consists of 170 islands of which 40 are inhabited. The three main island groups are Tongatapu, Ha'apai, and Vava'u. Of the 100,000 inhabitants more than two thirds reside on the main island Tongatapu, where the capital Nuku'alofa is located. The climate is tropical with a mean annual temperature of 23-28°C [23], and an environment which is considered safe. Malaria is non-prevalent [24] and according to multiple sources in Tonga there are no poisonous land-living animals. Though, the first outbreak of Chikungunya, a mosquito-borne disease with flu-like symptoms, was reported during the data collection period [25].

Tonga has a low rate of urbanization at 23 % [9] and the population is very homogenous with 98 % of Tongan origin, a Polynesian ethnic group. One language is spoken, Tongan, besides English. The population is young, median age is 21 years of age and more than one third are aged < 15 years [4]. The life expectancy at birth is 69.3 and 73.1 for males and females.

During the last years Tonga has experienced a democratization reform. The late king died in 2006 and constitutional amendments in 2010 changed the political system loosing the power from the king and the 33 noble families. The first democratic election was held in 2010 and Tonga is today a constitutional monarchy [26].

Tonga is a Lower-Middle Income Country and the economy compares well with some of the other countries in the region [7]. A major contributor to the economy is remittances from relatives who reside overseas. 83 % receive remittances which account for 20 % of the household incomes [21]. The economy has a large subsistence agriculture sector, and important incomes come from fishing and tourism. The currency is called pa'anga and the exchange rate to USD is about 1.8 pa'anga per 1 USD [27].

The high amount of remittances could partly be explained by the Tongan culture. Tonga is the only country in the Southern Pacific that never has been colonized and has strong social hierarchies, with the church and the extended family as two important networks. The Law of Succession, Clause 111, in the Act of Constitution, dictates the eldest male child as the only lawful heir to the estate [28], which puts the extended family in high dependency. Many traditional values have been preserved and the culture is based on caring, responsibility, respect, and humility [29]. Women are considered subordinate to men, but have a higher rank in traditional Tongan values. The higher respect women have is associated with social

expectations on a sedentary lifestyle. Married women/ mothers engaging in PA could be considered frivolous, and many women have stated the weight gain occurred during and after the first pregnancy [4, 7, 20]. Male adolescents have stated pressures on having a big, muscular body, which is believed to come from the immediate community, especially the fathers, rather than the broader society such as radio and TV. Rugby is the main sport for men and a strong body promotes success in the sport. In high income countries the risk of obesity is associated with greater social inequalities, but this is reversed in most countries with a lower income [11], including Tonga. For men and women there is a lack of stigma associated with being overweight and a large body size is a sign of care and prosperity [4, 5, 7]. Although, traditional roles are under the impact from increased exposure to Western values and economic development [7].

The religion plays a fundamental part in everyday Tongan life. Almost everyone are Christian, with the most prevalent denominations: Methodist (Free Wesleyan Church), Church of Latter Day Saints (Mormons), Roman Catholic Church, Free Church of Tonga, and Church of Tonga. The day of the Sabbath is legally enforced as a day of rest in the Act of Constitution of Tonga, Clause 6 [28]. This means that all stores and offices are closed, together with the prohibition of any kind of work, including engagement in sports [30].

Regular epidemiological surveys are conducted by WHO and in 2010 the Secretariat of the Pacific Community (SPC) formed together with WHO the 2-1-22-programme to help address the NCD epidemic in the Southern Pacific Region. The first obesity prevention program for adolescents (OPIC) was conducted in Tonga in 2006-2008. OPIC was a multinational project in the region and as a result the Fiji-based C-POND, Pacific Research Centre for Prevention of Obesity and Non-Communicable Diseases, was established in 2009. The outcome of the OPIC

project showed no impact on adolescents' weight, but as stated in the report, put an emphasis on the complexity of adolescent obesity and the need for a multilevel approach [31].

Tonga's government has established organizations to supplement the Ministry of Health. Churches have been involved by the establishment of the Health Promoting Church Partnership, and the Tonga National Strategy to Prevent and Control NCDs (NCD Strategy) was implemented in 2004, with the current version covering 2010-2015 [32]. The National NCD committee is a multisectoral organization with representatives from Tonga Health Promotion Foundation (TongaHealth), government authorities, Non-Governmental Organizations (NGOs) and church leaders. Subcommittees have been established and The Vava'u NCD Committee started in 2013. The Great Vava'u Workplan 2013 states the importance to advocate for more sports in villages and schools as well as a proposal for a gym [33]. Since 2012 all primary and middle schools in Tonga have PE in the syllabus, the classes are called Movement & Fitness [29]. A landmark in the Tongan government's NCD prevention efforts was the Health Promotion Foundation Act in 2007, which made Tonga the first country in the Pacific region to start a Health Promotion Foundation [34].

Tonga Health Promotion Foundation

TongaHealth is an autonomous body which works to promote health and fight NCDs. TongaHealth was founded in 2009 and is according to a government official based on ThaiHealth (Thailand) and VicHealth (Australia). TongaHealth reports to the Minister of Health and is funded from the Tongan government, SPC and WHO. TongaHealth has 4 arms: healthy eating, physical activity, tobacco and alcohol. The physical activity arm consists of grants for sports equipment and workshops to train aerobics instructors. The grants are applicable for organizations, for example village groups, churches and schools. According to a government official the grants have mostly been approved for sport equipment for youth, for

example balls and goals, excluding netballs since the Australian Sports Outreach Program already have had a netball campaign [35]. The workshops for aerobics instructors started in 2013 and have so far had 20 participants from Tongatapu and 14 from Vava'u. A follow up in February 2014 showed only four of the aerobics instructors in Vava'u were still active.

Educational system

The educational system is broadly divided into primary school, secondary school, and post-secondary school. Primary school is compulsory and last for six years, from 6 to 14 years of age, class 1-6. Primary school is free of charge and mostly governmental. Secondary school is seven years, form 1-7, and not compulsory nor free of charge [7, 21]. Most secondary schools are run by different Christian denominations. Some schools only include form 1 and 2 and are called Middle schools.

Post-secondary education is generally six months to three years depending on the type of training. Education is considered important in Tonga and the educational system has consistently improved over the last quarter of a century. Over 90 % of all Tongans have achieved at least secondary education, and 17 % have tertiary education [7, 21]. All schools have uniform policies and most secondary schools have an English policy. Literacy in the Tongan language is almost universal for adults, and among young adults the English literacy is almost universal as well [21]. The academic school year is from January to December.

Vava'u island

Vava'u is the northernmost of the three main island groups of Tonga with a population of 15,000 people. The main town, Neiafu, has a population of about 6,000 people. Vava'u has six secondary schools [21] with around 300-600 students per school, except one school with around 60 students, according to data collected from the principals of the schools (**Appendix 1**). The secondary schools are all located in Neiafu, and every village has its own school bus

responsible for transporting the students. The students from the villages in the outer islands either stay with relatives or in a village house for the island, in Neiafu, during the weekdays. According to one teacher the secondary school fee is around 40-70 pa'anga (20-40 USD) per term and student, with a discount if more children from the same household are enrolled. The average monthly income for rural households is 1,505 pa'anga (840 USD) [36]. According to multiple sources, there is no lunch served in schools, but many schools have canteens where students can buy a snack to eat during the break, such as candy, popsicles, or noodles.

Methods

The study was conducted with a RAR approach. In contrast to other RAR studies, this study had a more exploratory than interventional approach. Therefore the response part of RAR, which is developing, implementing and evaluating an intervention to increase PA, was not included. Also, the study was conducted by the author solely, in contrast to other RAR studies where a team approach is most widely used.

Development of instruments

The instruments that were developed consisted of *Initial spatial mapping guide*, *Interview protocols*, *Focus Group Discussion Guide*, *Structured observation guide* and *Information and consent form- English and -Tongan version*. The structure of the *Focus group discussion guide* was inspired by an earlier RAR study in Tonga [20]. The *Structured observation guide* was copied from the Methods Modules in WHO:s technical guide of RAR [19]. The *Information and consent forms* (**Appendix 3**) were inspired by the consent form in the Australian obesity study The Weight of Opinion [37]. The Tongan translation of the consent form was done with help from staff from the local Prince Wellington Ngu Hospital.

Data collection

The focus of the study was on adolescents. Students were included in interviews and group discussions during school time and on school grounds. Included students were mostly in form 4, around 14 to 16 years of age. Form 4 was chosen as the age span is about the same included in other surveys, such as HBLPY (Health Behavior and lifestyle of Pacific Youth) survey and GSHS (Global School-based Student Health Survey) [17, 18]. The second largest contributor of data was interviews with teachers. Secondary sources, such as articles and survey reports, were reviewed to supplement the fieldwork. Literature review was a continuous process, both before and after data collection.

The rapid assessment period lasted for four weeks in early 2014, between 02/14-04/07 with a break 02/27-03/24 due to a medical emergency for the author. Data was obtained from different sources using a number of methods; **spatial mapping, SSIs, FGDs, structured observations, visual methods and unstructured interviews**. Triangulation was used to increase validity and reliability, and a reflexivity journal, of a total of about 10 A4 pages, was kept for transparency.

- **Spatial mapping** was a continuous process of gathering knowledge that would serve as a foundation for the report. The people interviewed for this were called key informants as they served a crucial role in introducing new facts to explore. A simple guide was used to help find key informants that could be interviewed. The guide, *Spatial mapping guide*, consisted of five questions about infrastructure, schools, playgrounds and church locations (**Appendix 2**). Field notes from the initial interviews were taken for approximately 4 A4 pages. Mapping was particularly important in the beginning of the study, but when new

issues and key informants appeared during the data collection period, more interviews were held to gather information about the local setting (**unstructured interviews**).

- **SSIs** were conducted to gather in-depth information from students (boys n= 8, girls n= 11) and teachers (male n= 3, female n= 3). This was done with *Interview protocols* (**Appendix 4**). Interviews were audio-recorded and later transcribed Verbatim.

- **FGDs** were conducted with a *Focus Group Discussion Guide* (**Appendix 5**). The interviews were audio-recorded and later transcribed Verbatim. FGDs were conducted to gather information from students from a different perspective compared to SSIs. In the FGD the students had the opportunity to discuss their ideas in a group, and the students could express themselves in their mother tongue as a teacher (assigned from the principals of the schools) helped with translation. Six FGDs were held, divided by gender: male (n= 3) and female (n= 3).

- **Structured observations** were conducted with a *Structured observation guide* (**Appendix 6**). The guide consisted of questions divided into eight categories (settings, people, activities, signs, events, time, goals, and networks). The observations were held the 26th and 28th of March for half a day each at the 36th Annual Inter-Collegiate Athletics Competition, a track and field competition which lasted for three days. Field notes were taken for approximately 5 A4 pages.

- **Visual materials** such as photographs and videos from the observations, as well as from schools, sport venues and roads around Vava'u, supplemented the collected data. All individuals' faces were digitally blurred to ensure anonymity.

Initially FGDs were not as prominent in the study methodology and SSIs were planned to be conducted with parents, church leaders, politicians and church leaders as well. Due to lack of time the parents were excluded, but the other categories were partly included due to the

mapping process and the unstructured interviews. Halfway through the SSI with students the interview protocol was modified to improve communication, with a more simple language and a shift of focus from physical activity to sports.

Selection process

The secondary schools of the Vava'u island group are all located in the main town Neiafu, which was ideal for this kind of study with limited resources. All principals of the six secondary schools in Vava'u were informed about the study individually, by direct contact. Excluded were all primary schools and the two middle schools. Due to schedule issues the Saineha High School (Mormon) and Mizpah High School (Seventh Day Adventists) chose not to participate.

After the principals' approval, participants were recruited by informing selected classes and individuals by direct contact. The selection of participants was a mixture of random and nonrandom sampling, different at every school due to the principals' different requests. The initial process of mapping the surroundings, as well as the unstructured interviews throughout the study, can be described as theoretically sampled. The FGDs at Chanel College (CC) were randomly selected. The principal chose between my two hands behind my back, each hand contained a piece of paper which represented one of the two form 4 classes. At Tailulu College (TC) both of the two form 4 classes were included. Student SSIs were mainly conducted at the governmental Vava'u High School (VHS), which was chosen to get a representation of as many religious denominations as possible. The students were randomly selected by including every third student on the class lists of the four form 4 classes. At Malefihi Siu'ilikutapu College (MC) an opportunistic approach was preferred by the principal due to schedule issues. The secretary was assigned to choose students in the school hall who had optional classes before lunch time, with the instructions of choosing students more fluent

in English, around the age of 15 years. At TC the initial goal was to include students for SSIs but because of poor student participation in the first interview, combined with the earlier experiences from VHS, the data collection process was changed to FGDs. Teachers to be interviewed in SSI were selected from VHS. Included were teachers who taught form 4 and also taught at least one period of PE class per week. Four out of five teachers who met the criteria were interviewed. In this group also the sport master and a Japanese teaching volunteer was included. Their opinions were considered valuable in the aim to get as many different perspectives as possible.

In total 19 students were included in SSI (11 VHS, 7 MC, 1 TC), with the age span of 14 to 20 years of age, median 15 years. Six FGDs were conducted (4 TC, 2 CC), with a total of 46 students, median 15 years. For teachers a total of six SSIs were conducted, age span of 24-32 years.

Ethics

Ethical approval was obtained from the *Tonga National Health Ethics and Research Committee*. Due to the non-invasive, undergraduate nature of the study, Swedish ethical clearance was not required. Prior to the interviews participants were informed both verbally and written through the *Information and consent form* (translated from English to Tongan language), which they needed to sign to participate. For the one non-Tongan speaker the consent form was written in English. Minors also needed their guardian's written consent to be included. Participants, and in case of minors, also guardians, were informed that all data were handled confidentially and that participation in the study was voluntary. Participants were free to withdraw at any time without giving a reason and without facing any negative consequences. Names were replaced with ID codes throughout the study.

Data analysis

The process of the qualitative data analysis first consisted of reading through the data multiple times. Thereafter the data was summarized into codes, organized in categories and finally sorted under the themes Barriers and Facilitators, in descriptive tables [20, 38]. The data was polished to remove English grammatical blunders, without changing the assumed core meaning of the texts. Analysis of both within-cases and cross-cases were performed. The SSI students' sport participation was described in circle diagrams. In text the mapping data, the observations and the unstructured interviews were used to further elaborate issues of interest. The gender aspect was constantly taken into consideration during the process of handling the data.

Results and Discussion

Interviews and group discussions were conducted to gather data on the local setting, behaviors and attitudes. All collected data were analyzed in regards of gender differences, but if not stated otherwise, no obvious differences were noted. In Tonga the social organization favors collective pursuits [4], which reflect in the fact that team sports were recorded most popular (**Fig. 2**). For girls netball and soccer were the dominant sports, but other sports were present as well. For boys the dominant sports were rugby and soccer. Sports only played by boys include rugby, cricket and table tennis. Netball is only played by girls. The rest of the sports, with soccer, track and field, and volleyball being popular, are played by both genders, but with separate teams. In FGDs girls reported a wider distribution of sports they were engaged in compared to what the boys reported. Even though this part of the study was randomly sampled, conclusions to be drawn are limited by the small sample size, total $n = 46$ (**Fig. 2**). Students in individual interviews were asked about their weight. Fourteen students considered

themselves to have a healthy weight, five students said they did not think they have healthy weight or did not respond.

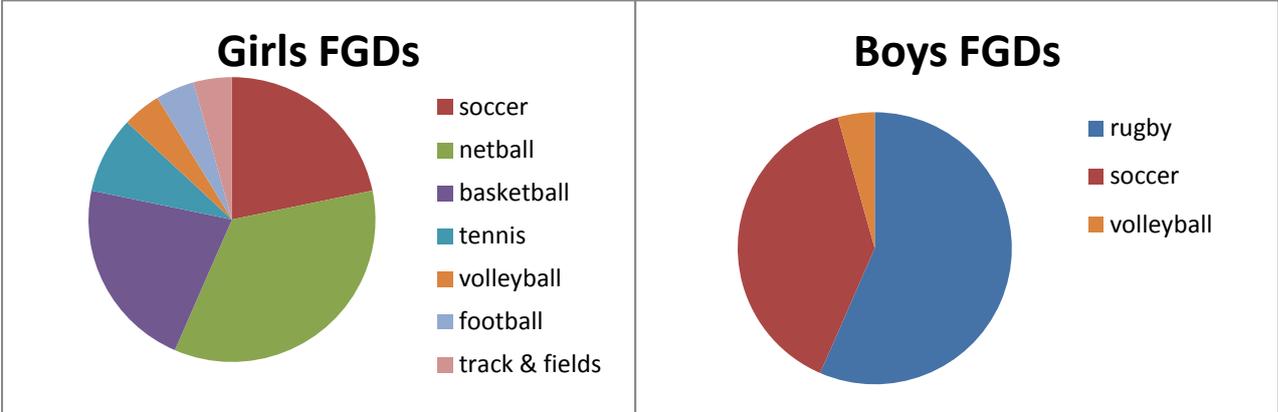


Figure 2. Self reported sport participation from Focus Group Discussions (FGDs), divided by gender. Girls (n = 23). Boys (n = 23).

The PA pattern among adolescents in Vava’u is unevenly distributed throughout the year. It is a tradition for the schools to have different sport competitions for different terms, and the schools take turn in hosting the inter-collegiate competitions. Regarding the secondary schools in Vava’u one of the schools, the smallest one, does not participate in the sport competitions because of religious reasons. This school does not have PE class either because of lack of teachers. Also, this school used to have a sport day per year, but the last one was two years ago. All stated by the principal. For the other schools the division is as follow: term 1 track and field, term 2 rugby and netball, term 3 soccer, and term 4 no sports due to exams (**Appendix 1**). In addition the villages have their own teams in rugby, netball and soccer which compete in inter-village competitions. These are held after school competitions, mainly during the school break in December to January.

The Vava’u Sports Committee (VSC) is a newly started organization (February 2014) from initiative of the Tonga Association of Sports and National Olympic Committee (TASANOC). Tonga will host the Pacific Games, a quadrennial multi-sport event, in 2019 [39, 40]. VSC was started up together with other sport committees to recruit sport men and women from all

of Tonga to represent in the Pacific Games in 2019, according to multiple sources. TASNOC will provide VSC with equipment for sports including rugby, netball, soccer, cricket, tennis, table tennis, volleyball, weight lifting, boxing, swimming and rowing. All sports except the two latter ones are already established in Vava'u. Swimming and boxing were introduced in the protocol because the current king wished to have sport competitions as a part of his birthday celebration in July 2014. By the time data was collected the committee was still waiting for canoes from the TASNOC and had not yet started training for swimming either. Lack of equipment was identified by the president of the VSC in boxing, weight lifting and rowing, while the other sports mainly needed financial support to run the competitions and collect the prize money. Depending on the sport, every team might have to pay a registration fee to compete. This would be about 50 pa'anga, which might not be negligible for some students when put in contrast to the average monthly income of 1,505 pa'anga (840 USD) for rural households in Tonga [36]. Just to practice there is no fee associated with any sport.

Soccer is considered especially well supported because of the Vava'u Football Association, an NGO funded by FIFA approximately ten years ago, which organize division one, two and women. Although financial support from FIFA and a high reported appreciation for soccer by the students, soccer competitions have been cancelled the last year due to unknown reasons, according to multiple sources. The president of VSC sees different advantages with different sports. Cricket is a sport where both old and young ones can play together, even though it is only played by males. Boxing and cricket is especially played in outer villages while the rest of the sports are more or less popular all over the islands.

Barriers and Facilitators

From student SSIs, student FGDs, and teacher SSIs ten respective twelve themes for barriers respective facilitators of PA emerged from the data (**Table 1-4**). The barriers were identified as: 1) student factors, 2) lack of time, 3) cultural issues, 4) sportswear and equipment, 5) school facilities, 6) church limitations, 7) teacher issues, 8) movement & fitness issues, 9) knowledge and attitudes, and 10) governmental factors. The facilitators were identified as: 1) favorable attitudes, 2) health benefits, 3) appearance benefits, 4) financial incentive, 5) career opportunities, 6) parental factors, 7) TongaHealth impact, 8) aerobics instructors, 9) church aspects, 10) school possibilities, 11) governmental possibilities, and 12) diet suggestions.

Barriers were by students mostly identified on an environmental level, like lack of equipment and facilities. But as an example of an individual factor, one student stated shyness as the reason for not playing sports. Teachers mostly identified barriers on a more general Social-Ecological level, with cultural issues and unqualified PE teachers. Facilitators were mostly identified on an individual level, revolving around a positive attitude towards sports. The suggestions proposed were mostly on a more general community and societal level.

From both students and teachers similar barriers were mentioned, which include students busy studying, cultural issues separating boys and girls from playing sport together, and shortage of sportswear, equipment and school facilities to do sports.

The traditional Tongan culture builds upon complicated layers of respect and status, rights and obligations, and this involves the idea that the relationship between brothers and sisters should be filled with spatial avoidance and restraint [41]. But, which may seem obvious, this is not a homogenous set of ideas. For example one teacher actually wanted boys and girls to

play sports inseparable, as a way to build relationships and make friends. According to a local government official, the local government staff used to have aerobics classes once a week last year but it was discontinued for unknown reason. When data was collected the government staff practiced traditional dancing for the celebration of the birthday of the king in July 2014. This could be interpreted as priority given to traditional cultural values on behalf of continuous PA efforts.

Table 1. Barriers for PA identified by students. M= male. F= female.

Barriers	Comments
Personal factors	SSI, F, 15 years: 'I feel scared, ashamed and shy. Because of the look of the people [she does not like the attention sport participation would bring, author's note]'
Lack of time	FGD, F: 'For many people the lives focus on study.'
Cultural issues	FGD, F: 'In our mentality Movement & Fitness is only for the children, so putting that in form 6, we think it puts us back to our childhood.'
Sportswear and equipment	FGD M, FGD girls: 'Lack of equipment, balls, shoes, goals.'
	FGD, M: 'Some come with the shoes, some can't afford them.'
	FGD, M: 'The school should provide the shoes, sport equipment to use.'
Inadequate school facilities	FGD, M: 'Sometimes the pigs come to the field and pick [root, author's note] the ground.'
	FGD, M: 'We need a park, people to sit there, walk around, prepare a place for people to do that.'
Church limitations	FGD, M: 'Every Sun we have bible studies, but in a special day we have sport. Maybe twice a year.'

	FGD, F: '(teacher) I asked if Free Church of Tonga supports sport, they said no. Then I said what about December, because they do sports then. '
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Table 2. Barriers for PA identified by teachers. M= male. F= female.

Barriers	Comments
Personal factors	M: 'As a man you can't face a woman in the rugby like the tackle, a man is more powerful than a woman.'
Lack of time	M: 'They should do two times a week [sport classes, author's note]... if we do more time in school we don't have time to do the study. But at home maybe we gonna make them do every day.'
Cultural issues	M: 'I think culturally it is not acceptable, yet, it is not acceptable that girls participate in highly rigorous activity, being in the same activities as boys, we don't have women's rugby here, but we do have women's soccer and other non contact sports.'
	F: 'In our Tongan way, in our culture, the boys and girls, brothers and sisters or first cousins, we don't believe to get together in the same activities. Our faka'apa'apa [respect, author's note], our culture.'
	M: 'I think netball is a culture, it depends on the Tongan mind, they think this for the woman this for the man, so with that mind it effect the boys not do the netball, they thought the netball is only for the girl.'
	M: 'Tongans believe that when it comes to the exam time there shouldn't be any physical activity of any sort for the kids to participate in, so he directs all his energy and concentration and so forth into the exams.'
Sportswear and	M: 'We don't have any resources like rugby ball and netball ball. We don't

equipment	<p>have any resources.'</p> <p>M: "I have netball balls, I have rugby balls. Some of the stuff is in my house, I keep it there because where I see them. Actually most of the athletics gear is here, in this room [Science room, author's note].'</p>
Inadequate school facilities	<p>M: 'The hall doesn't give them enough space because in order to be spaced out appropriately for aerobics you can only fit 350 in the hall but with a population of 600 it was just too many.'</p>
Teacher issues	<p>M: 'There is a guidebook, but some vocabulary, some of the terms I don't know what it means. I have to search it on the internet [he does not understand the syllabus and the teacher's guidebook for Movement & Fitness classes, author's note].'</p> <p>M: 'I'm one of the teachers who teach Movement & Fitness at school but to be honest I haven't had any formal training in that subject.'</p> <p>M: 'Teachers aren't prepared to teach Movement & Fitness, I think it is too skilled oriented, the syllabus, and without the gear and proper motivation the teachers just aren't teaching it'.</p> <p>M: 'Sometimes we blame too much the syllabus and the sports gear when in fact it is just a personal, moral obligation of the teacher.'</p>
Movement & Fitness issues	<p>M: 'The syllabus is too orientated towards skills and athletics and I would have liked them to just build it upon physical activity, importance of physical activity, rest and recovery, fluid intake, nutrition and stuff, and then build from there, what they have done is actually pretty much just start with athletics.'</p> <p>M: 'I am handling the time table. It's quite hard with the program I'm using to move all Movement & Fitness to the last period, I'm still working around</p>

	how to do it ... Teachers prefer them in the afternoon, kids prefer them in the afternoon.'
Knowledge and attitudes	F: 'Lots of people don't know the negative effects of not doing exercise, most people know it but they don't care.'
	M: 'As soon as they leave high school, get married and settle down, both the incidence and rate of obesity and overweight and heart problems rise exponentially ... eating habits kick in and physical activity just can't keep up.'
	F: 'They don't have the knowledge I think, maybe they can understand overweight is not good for health, but they don't know.'
Governmental factors	M: "It would be a big uproll about including Movement & Fitness for the higher grades in school, a lot of paper work to be done.'

When it comes to lack of equipment students and teachers, without any gender differences, identified shoes, balls, rackets and goals as the main items necessary but lacking. At the 36th Inter-Collegiate Athletics Competition in March 2014 a majority of the students were noted to compete without shoes. Based on off-school hour observations, bicycles are not very prevalent, which could be to the relatively high cost (around 300 pa'anga, compared to the average monthly income of a rural household in Tonga of 1,505 pa'anga [36]), or the geographically hilly setting of Neiafu. Vava'u High school had aerobic classes every Wednesday afternoon for the whole school last year until a few weeks before the exams. But because the school hall is too small to fit everyone, this year only the sport teams are invited to participate. The responsible teacher stated a good solution would be for the aerobics instructors to come twice a week or if the classes were optional. The schools all have big grass fields used for sports, but the tropical climate [23] restricts daytime use. Prolonged, excessive exercise needs to be carried out either in the early hours, late afternoon, or under a

roofed structure or a large tree to not risk overheating. The grass fields seem to be open off school hours without restrictions, except for one school where this could not be estimated. This school is well equipped with gym and tennis court, but has according to a principal from another school a strong policy from the religious denomination ruling. Another barrier, noticeable to the author, was how the *tupenu*, an over-the-knee wrap cloth skirt and common clothing for men and women as well as a part of the school uniform, restrict motion.

Barriers mentioned by teachers were mostly on a community and societal level with: unqualified PE teachers, a complicated syllabus for PE classes, and a lack of motivation by both the general population and by the government. At one of the schools the teachers are assigned to PE class when they do not have enough lectures in their regular subjects, and in general the teachers have not had any formal training in PE. The syllabus and the teacher's guide are quite extensive, a couple of hundred pages [29, 42, 43], and they use a terminology that is hard to understand, according to many teachers. The documents focus on sport achievements and theoretical concepts of sports rather than the concept of health. This was stated by one of the interviewed teachers and the statement is agreed upon by the author of this report after having reviewed the documents. Regarding lack of motivation, a government official stated: "Men want to be healthy to get a nice wife, when married they lose motivation". One school used to have one hour of PA per week for the whole school, but this was cancelled this year. The principal said everyone, not only the best, are encouraged to compete in in-the-house competitions during term 1 to 3, which was considered enough in promoting PA.

Facilitators were mostly identified on an individual level, revolving around a positive attitude towards sports, and the suggestions proposed were mostly on a more general community and

societal level. Both students and teachers realized the importance for youth to play sports and gave examples of the potential benefits in different aspects of life; from avoiding diseases, being able to work, for example climb the coconuts, and feeling happy. One teacher also shared how students learn other subjects more quickly when they combine the lectures with short breaks for movement or gesture games. This observation is supported by the suggestion that the attention span is optimal for 15-20 minutes, and change-up activities involve the students and increase the attention [44]. All students and teachers stated parents as being supportive for their children to conduct sports. As noted by a teacher the youth get exercise by helping out with domestic chores at home, but seen from another perspective by a principal from another school the children were sometimes overused by parents and had no time to play, but instead helped with getting coconuts, feed the pigs, make food, etc. In one FGD a boy stated fishing was his main sport activity, which could be due to helping out his family with food supply. The UNICEF report 2006 “Tonga, A Situation Analysis of Children, Women and Youth” supports the fact that children, with barely any gender bias, are involved in non-economic activities in the household [7]. The use of adolescents in domestic chores is also supported by McCabe *et al* through sociocultural studies done as a part of the OPIC project [5].

Table 3. Facilitators for PA identified by students. M= male. F= female.

Facilitators	Comments
Favorable attitudes	FGD, M: 'Physical activity mean for me to be happy.'
Health benefits	FGD, M: 'Physical activity is to keep the body healthy, be able to move around when they are old age.'

Appearance benefits	SSI, F, 15 years: 'Physical activity is to be healthy, to look beautiful.'
	FGD, F: 'Physical activity is good appearance, fit. Not too fat, not too slim, but in the middle.'
	FGD, M: 'Physical activity is to be strong for the body when there is time for rugby.'
Financial incentive	SSI, F, 15 years: 'They could have something like going to Tongatapu [main island, author's note] to represent the school, for a competition.'
	FGD, M: 'The church could have awards, prizes.'
Career opportunities	FGD, M: 'We suggest continuing on to form 5 and 6 because in that way we can get good sport people.'
	FGD, M: 'The school should market the best rugby player overseas.'
Parental factors	SSI, F, 15 years: 'Having aerobics at home would be good.'
TongaHealth impact	FGD, M: 'Aerobics are held in some of the schools, in some of the villages.'
Aerobics instructors	FGD, M: 'In December, Free Wesleyan church has rugby, Free Church of Tonga have the athletic sports including the relay.'
Church aspects	FGD, M: 'A suggestion would be to develop youth sport centers in the churches.'
	FGD, M: 'The church could arrange some program for exercise. To include all of church, and not only zumba, other sports too.'
School possibilities	FGD, M: 'To continue with the sports. Sometimes the school does the program but sometimes the school doesn't do it, we have to follow up continuously.'
	FGD, F: 'Sports week would be good.'
	FGD, F: 'The school should have some people to be trained to come and lead

	the people. There is no active promotion of the sport because there is lack of persons to do the training.'
	FGD, F: 'We need to invite all the teachers. Some teachers get sick because they don't exercise.'
	FGD, M: 'Get a good sport men, teachers, you know trainers, for school.'
Diet suggestions	SSI, F, 15 years: 'During the sport, the students should only drink water, no added sugar.'
	SSI, F, 15 years: 'When the students are playing sports they need to eat correct food, like sandwich, not junk food like yams and pork and chicken cause that food will give them a heavy weight and not keep them healthy.'
	FGD, M: 'I propose to have a good snack after sports, some kind of fruit or vegetable.'

Table 4. Facilitators for PA identified by teachers. M= male. F= female.

Facilitators	Comments
Favorable attitudes	M: 'I strongly believe that students need to be given time to do physical activity.'
	F: 'I think they should do sports every day, like 30 min a day.'
	M: 'We just got to reminding kids from an early age, primary school through high school, the importance of physical activity and an active lifestyle.'
	F: 'I think the most important to have a healthy weight is to prevent from diseases nowadays.'
	M: 'I believe boys and girls should do sports together, because they build relationship, make friends, like those things. They minimize the problems

	that happen, like rape and all those things. That's why I think it should be combined.'
Health benefits	F: 'I wasn't like this before, I was you know skinny. I can compare the difference of having a healthy body and an overweight body ... I feel lazy all the time.'
	F: 'If I do gesture game using body it's really good for the students ... Sometimes I'm surprised so quickly they can catch many new things.'
	M: 'Not only justify for the body. You can do climbing in the coconuts, work in the home. Sleeping. Wake up early. Doing work. That's what I define a person having healthy weight.'
Parental factors	F: 'Adults always use children to go and buy something, then children have to walk around and it's good exercise for them.'
TongaHealth impact	M: 'I applied for the grant about a month ago and I got an email ... to confirm an order and part of the stuff ... was the stuff I had quoted for.'
Governmental possibilities	M: 'Government should especially support the primary school and the secondary school.'
	F: 'I think the school should ask the government to provide more facilities for them.'
	F: 'I suggest the government should do some program on the TV or the radio so most people will learn more about what will happen if they don't do exercise. I have seen some advertising in the radio, it's like a phrase, they just play the music. They should talk, like explaining the reason why people should exercise, the positive effects of doing exercise, and the negative effects if they don't do exercise.'
	M: 'Government should advise people to do it, say no to the Tongan way.'

	<p>M: 'I have asked TongaHealth to help refurbish our changing room, which will also become our sport center so I can put all the sports gear there. The only reason I have the sports gear in the science lab is because I can see it, I can lock up these rooms so it's quite secure. I have also asked for some like table tennis, stuff kids can rent out during lunch and use and then bring it back afterwards.'</p>
	<p>F: 'I think, suddenly, they can't improve many things ... they should decide several few sports ... So if government does something, prepare the equipments and demonstrate to teachers.'</p>
<p>School possibilities</p>	<p>M: 'The teachers should have more training. I haven't faced any accident but this is what I'm thinking of the future. If any accident happens, I'm the teacher sitting there, I should know the muscles, what movement.'</p>
	<p>F: 'I think to improve Movement & Fitness should be moved to the last period. Because some students have it after lunch or early in the morning and the rest of the day they fall asleep during class.'</p>
	<p>M: 'I think if we can't supply the facilities, like the shower and all those things, I think we should put Movement & Fitness in the afternoon ... After that they go home.'</p>
	<p>M: 'Aerobics was mandatory [once a week for the whole school last year, author's note]. I would have loved if it was optional, or the trainers could come around twice a week, because it was just too many in one session.'</p>
	<p>M: 'They should put in teachers that have more knowledge. During the professional development they should get some professionals in the field to come and train us on how to teach the kids.'</p>
<p>Diet</p>	<p>M: 'I think Tongans are naturally quite active and to reduce the incidence I</p>

suggestions	think it's the eating habits, not so much physical activity.'
	M: 'I think eating habits, that's the biggest downfall.'

TongaHealth is well known among all participants, mainly heard through the radio and TV. Some individuals had also heard about TongaHealth from staff at the local hospital, from school, and at shops. For example, 30 minutes of PA per day, which is the amount of PA recommended by TongaHealth, is well known by all students in the FGDs. The aerobics instructors trained through the organization are also well known, and they conduct classes in some of the villages and schools.

School possibilities identified include to move PE class to the last period, professional development for PE teachers, the development of sport centers in the churches or schools, optional PE classes for interested students, aerobics trainers to come more than once a week, to continuously having sports without interruptions, and including a sport week.

The reason to move PE class to the last period would be because the students cannot take a shower and some students get unfocused and tired after PE class, according to a teacher. The reason why PE classes are spread out is because of administrative issues with the schedule, but the teacher that is responsible for the schedules state awareness of the fact that both students and teachers prefer the PE class in the last period. Two schools have applied for grants from TongaHealth, and during the data collection period one grant got approved. The school is about to start up a sport center where students can rent equipment like balls and rackets for the lunch break. Regarding a sport week, that is already implemented by another school. The sport week happens in November after the exams and before the school break.

Students were almost universally positive towards extending PE classes to higher forms, in the present situation only form 1 and 2 in the secondary schools have PE classes. Of the total 65 students interviewed 63 students would like to include PE class in at least form 4.

Suggestions from FGD regarding PE classes include a frequency of two to three times per week, with a range from once per month to every day, with a time range of 30-60 minutes at the end of the school day. No gender differences were noted in the suggestions. Earlier research has stated difficulties in extending PE classes in schools because of curriculum needs [10], which was identified by both students and teachers as a barrier. A cultural issue stated by some students was the idea that PE class belongs to the childhood.

In the present situation, schools have sport teams that practice in the school area after the school day is over. This is done without continuity, the sport teams only practice for a certain time in advance of local competitions. When students were asked in SSI if the school does enough to promote PA eleven replied yes, five replied no, and three gave no answer. One school has shorter periods, 50 minutes instead of 60 minutes, which gives them an extra period per day. The last period of the day in this school is used as an optional period when students choose from sports, culture, music, glee and drama subjects to participate in.

Teachers stated a need for the government to increase the financial support for sports, and to make the “healthy lifestyle” programs that air in TV and radio more educating. Physical appearance seems to be an incentive for students to be healthy. McCabe *et al* found that Tongan male adolescents focus more on strength, while the female adolescents focus more on beauty [5]. This seems to be the case in this study as well, even though the sample size was too small to be conclusive. Students also identified financial incentives, suggesting increased prize money in local competitions. Prize money could lead to increased PA with the main

incentive to win a prize rather than to improve health, which would not have a long-term effect. This was the experience from early attempts in Tonga to address the NCD increase. National weight loss competitions, endorsed by the late king who also participated, showed no differences in body size perception and attitudes among participants and non-participants, suggesting that the effects would not last [7].

The students also identified the opportunities of a professional sport career and scholarships, especially for playing rugby overseas. From one school two students from the year before were in college in New Zealand on rugby scholarships, according to the principal. The champions from the inter-collegiate track and field competition used to go to the main island Tongatapu to compete in the national competition. This was cancelled in 2011, but the inter-collegiate competition got extended to three instead of two days, according to a teacher. In 2014 during the data collection period, for the first time, one school sent their champions to the main island for national competition in track and field. This was financially supported by a fundraising concert where parents were invited to various cultural performances by the students.

Religion

Students were asked if the churches supported and should support PA, and the answers were both affirmatory and negative. This could be the result of the compartmentalization of PA, with a focus on competitions, mainly during the school break, instead of an even distribution throughout the year. For one denomination the lent season involves daily church programs for the youth, restricting the free time for possible sport participation. Suggestions from students were to develop a youth sport center in the churches or in the schools and to have sport programs also on Saturdays. Other thoughts were to involve all age groups and to have a variety of sports to choose from.

Most of the few still active aerobics instructors in Vava'u, trained from TongaHealth, are members of a small religious denomination. The pastor strongly supports PA and believes the spiritual health can be nurtured with the physical health. The church has for the last two years received grants from TongaHealth for sound equipment, about 30 yoga mats, building material for three table tennis tables and some table tennis gear. The church also has some weight lifting gear free for anyone to use. The sound system is provided to schools for free, example during the inter-collegiate track and field competition. The church has aerobics classes four days a week, which start and end with a pray and are open for anyone. They also have had several classes out in schools, in villages and at companies. This is provided for free for the beneficiaries, the aerobics instructors get a symbolic amount of money from TongaHealth. The pastor states the support from the community is low but growing, that it takes time to build trust. Some people are shy to dress like sportsmen and for some older people PA is considered a waste of time. The plan is to extend the aerobics classes to a central location, preferably by the market at the harbor of Neiafu, for a set time every week to increase the awareness of the event among people. To reach the youth the pastor suggested to have aerobics at school time, or to have separate aerobics classes with different intensities, with the higher intensity attracting younger participants, outside of school hours. The pastor requested financial support two years ago from the associated denomination in New Zealand. The pastor requested about 15,000 pa'anga (8,000 USD) for a pickup car, but had by the data collection period not achieved any money. The church has multiple sound systems, and with a bigger car they could reach more villages by dropping off multiple aerobics instructors in different villages at the same time.

According to one of the principals, another religious denomination has an aerobics instructor trained by TongaHealth as well. This year the instructor started with aerobics classes twice a week. The classes are announced in the church, and held in the denomination's school hall if the weather allows. If it is too hot the class is held outside the church in the open air instead.

Socioeconomic status

All of Tonga, except the city centre of the capital Nuku'alofa, is by the Statistics Department of Tonga considered rural setting [21], making all of Vava'u a rural setting. Socioeconomic status (SES), measured by parent's occupation, was analyzed in regards to the degree of participation in the study between the different schools who participated. The result of parents' occupations was that most fathers worked in farming, with no discrimination made between self-subsistence and commercial farming. The mothers stayed at home in most cases, taking care of domestic chores and weaving to produce the traditional handicraft worn for formal occasions. The students' parents' occupation was divided into either the traditional occupation described above, which was considered a lower SES marker, or into a group consisting of all other occupations, considered a higher SES marker.

For the two schools where FGDs were carried out the majority of the mothers worked as weavers/housewives, but only one of the schools had a majority of the fathers working as farmers. Therefore this school was considered to have students from lower SES backgrounds. The FGDs in this school resulted in less data. The students were quieter, which possibly could be a combination of a more noisy setting, shyness and being unaffected by the subject discussed. The teacher who helped with translating in the FGDs was, as a result or a cause to this, more dominant and made own remarks to the questions asked to students. According to this teacher, the school was known for accepting all students, even those with lower grades, which was not the case with other secondary schools in the area. Regarding SSIs the boys

gave less elaborated answers compared to the girls, but no difference was obvious when comparing SES and English proficiency. This means that higher SES was not obviously connected to a higher English proficiency. Traditionally SES is measured with occupation, education and income data. Only estimating SES with occupation data is a blunt tool and especially in Tonga additional cultural aspects might have needed to be considered, for example the fact that the eldest son is the sole inheritor of the family estate [28].

Diet factors

Even though diet was not included in the study, participants emphasized the importance of a healthy diet, one teacher stating: “eating habits, that's the biggest downfall”. This focus is shown in the scientific reports about obesity and Tonga [3, 4, 6-8]. One of the principals stated laziness makes people buy junk food instead of using healthy, local resources from sea and land. This principal stated to encourage parents to give students breakfast. The traditional Tongan diet consisted of one heavy meal per day, according to multiple sources. The principal would like to see the parents make sandwiches for the students to eat during lunch instead of letting them eat junk food and candy, mainly bought from the school canteen. According to the principal not all students have parents who can afford the children to buy junk food from the canteen and because of this some children do not eat any lunch at all.

Suggestions

Obesity interventions often use weight markers as endpoints for success, but research shows increased levels of PA, regardless of fatness, increase health benefits in a linear pattern [10, 12]. This supports the importance of interventions to increase PA, with a focus on fitness rather than fatness. Some suggestions for policymakers are:

- **Focus more on fitness than fatness in interventions;** translate positive attitudes and emphasize the importance of continuity of PA throughout the day.

- **Continue the grants from TH.** “It takes time to build an audience”, as stated by a pastor, and by financially encouraging carefully chosen driving spirits, local projects in the community could be more set to prevail.
- **Establish sport centers at schools.** Literature review supports the fact that increased availability of sport equipment increase the level of PA carried out during breaks [45].
- **Revise the syllabus for PE class.** The syllabus and teacher’s guide for PE was introduced in 2012 [29, 42, 43]. From PE teachers’ aspect it seems to be too comprehensive and complicated to follow. The current syllabus and teacher’s guides focus on sports and achievements. A suggestion would be to shorten the several hundred pages long documents, and lay the focus on PA and healthy behaviors (which could include diet). This would be in line with the NCD Strategy for 2010-2015, page 7 [32].
- **Professional development for PE teachers.** The PE teachers suggested opportunities for professional development in PE, which also is a recommendation in the NCD strategy for 2010-2015, page 7 [32]. The “Promoting Physical Activity in the Pacific Island Communities” from SPCs 2-1-22 program consists of a manual and a workbook and was developed for week-long workshops in 2004 and 2005 to help participants promote a more physical active lifestyle in their local communities [46, 47]. Because of the geographical distribution of scattered islands in Tonga, and time and cost constraints, a modified version with a less scientific and more practical approach could be an efficient way for individual distance studies for the PE teachers.

Limitations

This is an explorative study and the conclusions are also limited by the small sample size. The study included various selection methods for SSIs for the students. A general challenge was to find students proficient in English. The secondary schools have a fee and are not compulsory.

Although secondary schools have a high enrollment rate the drop-out rate is also high [7]. This is a potential problem; some students, presumably from a lower SES, were most likely excluded because of the selection methods. Some of the students might have been absent from school due to Chikungunya, the mosquito-borne viral disease which struck Vava'u during the field work. Students' relations to teachers could have affected the answers in FGDs, where teachers were used as translators. At one FGD a teacher told the students that the church does support PA when the students stated that the church did not. Reaching puberty was most likely not a confounder in this study.

The students' English proficiency was underestimated and therefore the interview protocol was halfway through the field work modified to improve communication. Most notably "physical activity" was replaced with "sport" and therefore limited the study field. PA is a broader concept which includes formal (organized) sports, informal sports and domestic chores. The participation rate was higher in FGDs compared to SSIs for students. No further non-participation analysis was conducted but non-participation seemed to be evenly distributed between genders.

Conclusions

The information this study provides about the current barriers and facilitators of PA among adolescents in Tonga supplements the already existing knowledge in the field and has found confirmation from larger studies [4, 5, 7, 20, 31].

In this study PA barriers were by students mostly identified on an environmental level. By teachers the PA barriers were mostly identified on a community and societal level, and literature review support that adults' PA barriers are mainly found on a community and societal level, with sociocultural factors being the most prominent. It seems like the

spontaneous games of childhood are not replaced by organized sports in adulthood. A hypothesis from the discrepancy of identified PA barriers between students and teachers are that adults are more affected by cultural factors than adolescents. This could be due to a lack of acceptance for sport participation for adults or the establishment of family with the associated responsibilities. An alternative hypothesis is that cultural factors affect adolescents to a lesser extent because of an increased awareness of the importance of PA among adolescents. This might be a transition to a healthier society. These hypotheses could be tested in further qualitative research.

The Tongan youth undergo rapid changes in lifestyle, which possibly is attributed to cultural expectations being challenged by increased influence from Western attitudes. The knowledge of healthy living, including PA, seems to be high among youth and adults, which could be the result of government interventions. But the importance of healthy living is a quite new phenomenon for Tonga and is sometimes in conflict with cultural beliefs and values. To use the words of one of the teachers in the study: “we know but we don’t understand”. The term health is known but not yet fully accepted as an integrated part of everyday life. A government official states that the general population usually think of TongaHealth as project with an expiry date instead of a stable, long lived organization. This attitude also reflects in the fact that sports for youth are short termed projects, with focus on competitions and achievements instead of the health benefits. All this could be regarded as a lack of motivation and a lack of understanding the benefits PA produce.

Tonga has an increase of early-onset NCDs which is of a particular concern with its young population. Regional organizations and the Tongan government have recognized the issue and have as an example initiated PA interventions together with religious denominations and

village organizations. To address the increase of NCDs qualitative studies could be used to explore and find suitable factors reachable for possible interventions. RAR is a flexible research approach and has proven to be effective in this aim. This study has solely focused on PA and therefore a similar study with a diet focus is recommended. It would complement the scientific platform used to assess factors that influence overweight and obesity among adolescents in Vava'u. The obesity situation for adolescents is similar around Tonga and therefore conclusions could possibly be extrapolated to the whole nation, possibly even to other Polynesian countries if care would be taken to cultural differences.

Recurrent surveillance of risk factors and prevalence rates for NCDs are done by Tonga Department of Statistics and WHO [14, 17, 48], and the continuation is highly recommended. The obesity epidemic is a global issue with many layers, in Tonga sociocultural factors have been found especially important. A combination of qualitative and quantitative data would help policymakers to plan effective interventions.

Populärvetenskaplig sammanfattning

Fysisk inaktivitet räknas av Världshälsoorganisationen som den globalt sett fjärde största orsaken till sjukdom och död genom att bidra till utvecklingen av fetmarelaterade sjukdomar. Örikena i södra Stilla havet är värst drabbade och i Tonga är mer än 90 % drabbade av övervikt och fetma. Framförallt hos ungdomar sker en kraftig viktuppgång och minskning av fysisk aktivitet. Information om kunskap, attityder och beteenden samlades från elever, i snitt 15 år gamla, och lärare på en ö med omkring femton tusen invånare. Informationen samlades genom individuella intervjuer och gruppdiskussioner.

Den kristna kyrkan har en viktig ställning i det homogena och hierarkiska samhället i Tonga, med traditionella förväntningar på män och kvinnor. Idrottslektionerna i skolan pågår till cirka tolv års ålder men det finns ett flertal idrottstävlingar för alla åldersklasser i skolan. Rugby spelas av killar, korgboll av flickor, och fotboll av båda könen. Kulturella orsaker anses sedan tidigare som viktiga för uppkomsten av ett stillasittande liv. Dessa identifierades i studien framförallt av lärarna, vilket kan bero på att vuxna påverkas mer av kulturella faktorer. Brist på sportutrustning påpekades som viktiga hinder av eleverna. Möjligheterna till kontinuerlig fysisk aktivitet är starkt begränsade och även fast kunskapsläget kring hälsa är hög bland elever och lärare ligger fokuset på tävlingsprestationer snarare än förbättrad hälsa vad gäller fysisk aktivitet.

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Appendices

Appendix 1: Vava'u secondary schools and school year

Vava'u secondary schools

Vava'u High School- Government: 600 students, 41 teachers. Form 1-6.

Chanel College- Roman Catholic Church: 300 students, 29 staff, form 1-6.

Tailulu College- Free Church of Tonga: 270 students, 31 staff, form 1-6.

Malefahi Siu'ilikutapu College- Methodist (Free Wesleyan Church): More than 400 students, 40 staff, form 1-6.

Mizpah High School- Seventh Day Adventists: 60 students, 7 teachers + 1 administrator, form 1-5.

Saineha High School- Church of Latter Day Saints (Mormon): 500 students, 29 full-time teachers + 4 administrators, form 1-7.

School year

Term 1

January to April. Track and field competition: in-the-house competition for 1 day, and inter-college competition for 3 days.

Term 2

April to June. Rugby and netball competitions every Friday afternoon for about six weeks.

Term 3

July to September. Soccer competition

Term 4

September to November. Exams, internal and national, for form 2, 5, 6 and 7.

School break

December to January

Appendix 2: Initial spatial mapping guide

Initial spatial mapping guide

- Where are schools located?
- Where are playgrounds and sport venues located?
- Where are churches, hospitals and other major government buildings located?
- Are there cycling paths, walking paths?
- How is the educational system set up?

Appendix 3: Information and consent forms- English

Information and consent form to parents and students

Physical activity among adolescents in Vava'u- study

Master Thesis conducted by year 5 medical student Simon Larsson, Sahlgrenska Academy,

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Study purpose

The purpose of this study is to understand more about the lifestyle characterizing the adolescents living in Tonga as well as to know more about their opinion and knowledge of different health issues. We are interviewing people at many levels in the society, such as students, parents, teachers and other representatives such as for example church leaders, physicians and politicians. Participating in this study can lead to results helping policymakers to plan ways to promote a healthy lifestyle among adolescents.

What to do

You will be asked to take part in an interview with questions about physical activity and obesity and we will also record your gender and age (as well as parents' education and occupation). The interview will take place in school time, on school premises with the permission of school staff. The interviews will be conducted by the medical student Simon Larsson from Gothenburg University (Sweden).

What will happen to the information

The interviews will be recorded and transcribed. The interviews will be anonymous and the results will be presented in a summary and it will not be possible to connect you to your answers. A report of the results will be made available for every participating school.

Participation in this study is voluntary and you can withdraw at any time without any negative consequences. If you have any further questions please do not hesitate to contact medical student Simon Larsson or any of his supervisors (see contact details on top of this document).

Consent

I have read and understood the information and consent form and I understand that participation is voluntary and withdrawal can be made at any time without any negative consequences. With this understanding I agree to participate in the "Physical activity in adolescents in Vava'u" study.

Parent name:

Student name:

Parent Signature:

Student signature:

Date:

General information and consent form

Physical activity among adolescents in Vava'u- study

Master Thesis conducted by year 5 medical student Simon Larsson, Sahlgrenska Academy, Gothenburg University, Sweden. Contact information: guslarssi@student.gu.se, +46735434396

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What to do

You will be asked to take part in an interview with questions about physical activity and obesity and we will also record your gender, age, education and occupation. The interviews will be conducted by the medical student Simon Larsson from Gothenburg University (Sweden).

What will happen to the information

The interviews will be recorded and transcribed. The information will be kept confidential and secure and after the presentation of the results all material will be destroyed. The interview will be anonymous and the results will be presented in a summary and it will not be possible to connect you to your answers. A report of the results will be made available for every participating school and health representatives in the community.

Participation in this study is voluntary and you can withdraw at any time without any negative consequences. If you have any further questions please do not hesitate to contact medical student Simon Larsson or any of his supervisors (see contact details on top of this document).

Consent

I have read and understood the information and consent form and I understand that participation is voluntary and withdrawal can be made at any time without any negative consequences. With this understanding I agree to participate in the “Physical activity in adolescents in Vava’u” study.

Name:

Date:

Signature:

Appendix 4: Semi-Structured Interview protocols- students and teachers

Interview protocols

- Let the participant, and in case with student also guardian, read and sign *Information and consent form* translated to Tongan.
- Find an area as quiet and free of interruptions as possible.
- Introduce yourself, explain the purpose of the study and assure the individual's confidentiality.
- Collect demographic information- age, gender (ethnicity unnecessary, 97 % are of Tongan origin) as well as highest level of education and current occupation (do not apply to students, for students instead include grade, school and parents occupation).
- Ask questions in order of appearance.

Probes= follow up questions, for example when, what, where, why. Good for elaboration.

Prompts= things to mention if the interviewee hasn't done so.

Students

- Are you familiar with the words "overweight and obesity"? What do they mean?
- What does it mean for you to be physical active/ inactive?
- Do you think you have a healthy weight? If not, why?
- Which sports are popular in the place where you live? Which ones do you like, if any?
- Do you make any sport or do some physical exercise (cycling, running, swimming, etc.)? How frequently?
- Are there any differences during the year regarding how much you are physical active?

Do you make any sport or physical exercise at school? Do you think that your school does enough to promote physical activity? Are you familiar with the aerobics instructors from the “TongaHealth” program?

Modified version- Students (17/03)

- Can you define physical activity? (if not, use the word “sport” instead of “physical activity” through interview)
- Do you think you have a healthy weight? If not, why?
- Which sports are popular here?
- What sports do you play, if any? How often?
- How often do you play sports, are there differences during the year? (or rephrase- same sports all year or different?)
- Do you play any sports in school?
- Do you think your school does enough to promote sports? If no, what could be done?
- Do you know the TongaHealth (promotion foundation)?
- If yes, what do you know? Do you know about the aerobics instructors?
- Do you have anything you want to add?

Teachers, principals

Prompts- local sport competition?

- In your opinion, is it important that your students spend some time doing physical activity/sport? Why?
- How frequently should they?
- Should male and female do the same sports and spend the same time doing physical activity, or are there any differences?

- Does your school offer physical activity education? Are there physical activity teachers? Do you think they are enough?
- Does your school have the facilities necessary for the students to make sports and physical activity? Which ones? Do you think they are enough?
- Are you familiar with the aerobics instructors from the "TongaHealth Promotion Foundation" program? What do you know about it?
- Do you think that the government should improve the school programs and facilities in relation to physical activity?
- Do you think that many of your students have weight problems? How important is it to have a healthy weight? How would you define a "healthy weight?"
- What should be done in your country to reduce the incidence of overweight and obesity, if anything?

Modified version- teachers, principals (20/3)

Prompts- local sport competition? Aerobics instructors from TongaHealth?

- In your opinion, is it important that your students spend time doing physical activity/sport? Why?
- How often do you think students should spend on sports?
- Should boys and girls do the same sports? Should boys and girls spend the same amount of time doing sports? If differences, what?
- Does your school offer physical activity education? Are there physical activity teachers? Do you think they are enough?
- Does your school have enough facilities (equipment, fields, etc) for sports?
What do you think could be improved?

- Are you familiar with the “TongaHealth Promotion Foundation” program (TongaHealth, give grants, have advertisements about health etc)? What do you know about them (prompt aerobics instructors)?
- Do you think that the government should improve the physical activity programs in school? If so, what should they do?
- Do you think that any of your students have weight problems? If so, how many? How important is it to have a healthy weight? How would you define a “healthy weight?”
- Should anything be done in Tonga to reduce the incidence of overweight and obesity? If so, what? Any other suggestions/ anything else you would like to add?

Appendix 5: Focus Group Discussion guide

Focus Group Discussion guide

- Let the participant, and in case with student also guardian, read and sign *Information and consent form* translated to Tongan.
- Find an area as quiet and free of interruptions as possible.
- Introduce yourself, explain the purpose of the study and assure the individual's confidentiality. Collect demographic information- age, gender, grade, school, (ethnicity unnecessary, 98 % are of Tongan origin).
- This guide should be used as a help in moderating the discussions, the questions do not have to be asked in order of appearance, if questions already have been answered they should be skipped, and if interesting topics emerge the moderator should feel free to deviate from the guide to further explore the theme.

Probes= follow up questions, for example when, what, where, why. Good for elaboration.

Prompts= things to mention if the interviewee hasn't done so.

Inform translator (teacher)- translate sentence by sentence. After they have discussed a question, I will explore the question with a number of students to get a good representation of the student's opinions, so I even include the shy students. I want everyone to take part in the group discussions and not anyone to dominate the group discussions.

Record- location, day and date, form, gender.

Warm-up

To create a relaxed environment.

- *I am here to chat and get your opinions and views about sports and physical activity. I will ask you some questions. They are not hard and I want you to know there is no right or wrong answers. I am interested in your individual opinion, so please speak openly and freely. I want you all to respect and listen to each other even though you have different opinions. What is said in the discussions is confidential and I want you all to respect that. I will record the discussions but it will only be used to help me remember what was said in the group.*

- *I want to start by asking- do you play any sports? (go around the group)*

- *Which sports are popular here?*

- *What does it mean for you to be physical active?*

- *Would you like to have Movement and Fitness class? How would you design it?*

- *Could your school do anything else to promote physical activity?*

- *Are your parent's supporting you playing sports?*

- *Do you know the TongaHealth (promotion foundation)?*

- *If yes, what do you know? Do you know about the aerobics instructors?*

- *(if time permits) Is your church supporting you playing sports? Should they support? What could be done?*

- *Do you have anything you want to add?*

Appendix 6: Structured observation guide

Structured observation guide

Aim: with the help of key informants identify and observe sporting venues and events related to physical activity.

- **Settings** Where does the observation take place? When? What is the physical layout?

What objects are present?

- **People** Who is present? What type of person are they? How old are they? Why are they here? Are there both males and females? Are they engaged in different activities? If yes, what is the reason for that?

- **Activities** What is going on? What are people doing?

- **Signs** Are there any clues that provide evidence about meanings and behaviors?

- **Events** Is this a regular occurrence? Or is it a special event such as a meeting or a disagreement?

- **Time** In what order do things happen? Is there a reason for this?

- **Goals** What are people trying to accomplish?

- **Networks** How do the people present know one another? Is their relationship social or organized on a commercial basis? Does the relationship change over time?