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**REPORT ON THE LEVELS OF  
AEROBIC FITNESS OF  
YEAR 9 AND YEAR 10  
STUDENTS AT  
LINWOOD COLLEGE**

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## Executive Summary

This report details the method of measuring the Aerobic Fitness of Year 9 and Year 10 Linwood College students using the internationally standardized Queens College step test. It details the efforts taken to ensure consistency and accuracy of these measurements and the results obtained. Barriers to learning, medical ones in particular, were to be targeted in 2006 at Linwood College as part of an ongoing study by LANE – (Literacy And Numeracy Empowerment project)

The Collaborative for Research and Training in Youth Health and Development would have a team of health professionals examining the Eyes, Ears, Nose and Throat, and a Dental check and Linwood College would examine the Demographics, Aerobic Fitness, Health measurements, HEADSS assessment for mental health and academic performance and pastoral care of the students.

Rather than just testing the year 9 and year 10 students, which may become a negative experience, Linwood College turned it into an Expo on Health and made it a positive experience with a number of freebies and pamphlet takeaways. This was achieved in addition to the assessments of the students and the following exhibited. NZ Blood Service, Cancer Society, Auhi Kore / Smokefree, Diverse café / 198 Youth, Heart Foundation, Sports & Rec Kaiwhakahaere, Mental Health Foundation, Sport Canterbury.

The Aerobic Fitness is one facet of this larger study and produced some surprising results when compared to the results quoted in An Analysis of the Usefulness and Feasibility of a Population Indicator of Childhood Obesity. Ministry of Health, 2006. Wellington.

Some 30% of New Zealand students are reported to be obese.

Obesity is related to exercise and aerobic fitness levels.

This Linwood College study places 72% of the student population in the Superior or Excellent fitness category and 87% in the Superior, Excellent or Good fitness categories. At first reading this could suggest that Linwood College students are much fitter than the New Zealand student population.

What this probably really means is the BMI charts used in the Obesity study which are for European, North American students are not equipped to take cognisance of the Maori and Pacifica makeup of our population and that some research needs to be done on standardising some charts specifically for New Zealand children.

It does raise some other issues for SPARC, the Ministry of Education, the Ministry of Health and others charged with our children's health and wellbeing. Perhaps the children are not as unfit or obese as the official message is being painted and some other research needs to be done elsewhere to either confirm the picture portrayed at Linwood or to confirm that Linwood students are indeed fitter than those in the rest of New Zealand.

**It recommends that the Health authorities need to take notice of the conflict detailed in this study in using the Cole or CDC BMI charts and do a specific study of New Zealand children that takes recognition of our ethnic diversity. This is important for clinicians to make effective use of such information.**

## **Background**

The future of our society is dependent on the health, wellbeing and educational achievement of the young people of today. It is therefore important that society promotes and enables young people to be healthy, happy, well educated and productively employed. The study of the effects of early economic inactivity on young people has identified a link between early inactivity with a high probability of inactivity at a later stage (Maloney, 2004). Maloney initially defined economic inactivity as "...occurring when an individual is not enrolled in education or training, and not working in the labour market" Consequences of this economic inactivity or non-participation are negative both for the young person and wider society (Flemming, Kainuku-Walsh, Denny, Watson 2004).

In his address to the inaugural Council Meeting on 27<sup>th</sup> October 2004, Mayor Garry Moore said. "I'd like to give some new guarantees. To our young people I'd like to guarantee that: in this city they will get to certain levels of literacy and numeracy. If you can read and count then you've got a very good start in life. This, however, cannot be undertaken by our schools on their own. There are squads of retired people out there who could really spend some of their time teaching one of our future ratepayers how to read or count.

There is a great deal of anecdotal evidence about the abilities, or lack of, of our youth. For Christchurch we need to find out what the problems are. Young people with these problems fall into one or more of three categories – never been taught or learnt, not enough teaching to enable skill retention, or unable to be taught through mental or physical or emotional conditions. The education system can identify and perhaps deal with those in its care, but we all know that schools never have enough staff, funding or time to support all students' individual needs. Other Government agencies appear to be stretched or just not coping. The youth that don't fit into those categories, and those who do, need extra support to reach the literacy and numeracy benchmarks that society demands to enable them to be a positive contributor to our great city."

Denny, Clark and Watson (2004) have pointed out that students who are failing in education also have exceptionally high health needs and research suggests that the earlier students receive appropriate health interventions the greater the effect on the students' educational opportunities. This study of Linwood College students is based on a rationale that ill health may result in non-participation and aims to identify rates of problems among the year 9 and 10 students of Linwood College by measuring their aerobic fitness.

### **Queens College Step Test**

Fitness can be measured by the volume of oxygen you can consume while exercising at your maximum capacity.  $VO_2$  max is the maximum amount of oxygen in milliliters, one can use in one minute per kilogram of body weight. Those who are more fit have higher  $VO_2$  max values and can exercise more intensely than those who are not as well conditioned.

The physical limitations that restrict the rate at which energy can be released aerobically

are dependent upon:

- the chemical ability of the muscular cellular tissue system to use oxygen in breaking down fuels
- the combined ability of cardiovascular and pulmonary systems to transport the oxygen to the muscular tissue system

## **Method**

### **Participants**

All year 9 and year 10 students at Linwood College were individually invited to participate in this project. Parents were informed through the official school newsletter that it was happening and that they had the opportunity of not allowing their child to participate. Each parent was also sent an individual consent form with information sheet detailing what was to happen.

This project was part of an overall Health assessment programme held in February 2006 and only six out of 450 parents declined permission for their child to take part. Students also had the opportunity to decline to participate at any stage and a number did not complete the assessment.

### **Procedure**

Two professionally qualified Physical Education teachers were trained to administer the assessment. This was to ensure the assessments were all consistently administered.

Electronic heart rate monitors were used and calibrated prior to the assessment as well as at the conclusion to ensure consistent, standardized results were obtained.

An area in the weights room was set aside so that only those doing the test were visible to anyone. Small groups of three at a time were put through the assessment in form groupings, so that the students were comfortable with other peers that they knew.

The assessments were done during their Physical Education periods so that no one knew from outside what was done. All of these procedures followed the Ethics guidelines from Otago University Medical School and the guiding principles for conducting research with human participants at the University of Auckland.

Results were recorded on a specially designed sheet that only had the students Education enrolment identity number on it, not their name. This ensured that individual students could not be identified. A specialist data entry person recorded the entries on a prepared database. Access to this database is restricted to the researcher and to the Deputy Principal. The individual result sheets are filed in a secure unit and will be destroyed in accordance with Ethics requirements.

This internationally recognised and standardised test requires participants to step up and down to a 41cm high bench for three minutes.

Heart rate is taken and measured using McArdle (1972) protocols

- Put the heart rate monitor on the student – they can place it on their chest and you need to clip it on at the back. They put the watch on. Check that you get a reading.
- Students have to sit down for 1 minute and REST.
- Record the student’s resting heart rate (RHR) after 1 minute of rest by reading the number on their watch.
- Set the metronome to 88 beeps for girls and 96 beeps for boys.
- The students step in time to the beeps for 3 minutes. On standard bench that is exactly 41 cm high.
- Immediately after the 3 minutes the students sit down and at the end of 20 seconds look at their watch to record their pulse.
- Record the appropriate columns on the sheet.

VO<sub>2</sub> is estimated using the following formulae:

$$\text{MALES VO}_2 \text{ (mL/kg/min.)} = 111.33 - (0.42 \times \text{beats per minute})$$

$$\text{FEMALES VO}_2 \text{ (mL/kg/min.)} = 65.81 - (0.1847 \times \text{beats per minute})$$

#### FITNESS CATEGORIES BASED ON QUEENS COLLEGE STEP TEST

FITNESS CATEGORY	FEMALE ( 13 – 19)	MALE ( 13 – 19)
SUPERIOR	42+ mL/kg/min.	56+ mL/kg/min.
EXCELLENT	39 – 41 mL/kg/min.	51 – 55 mL/kg/min.
GOOD	35 – 38 mL/kg/min.	46 – 50 mL/kg/min.
FAIR	31 – 34 mL/kg/min.	39 – 45 mL/kg/min.
POOR	25 – 30 mL/kg/min.	35 – 38 mL/kg/min.
VERY POOR	< 25 mL/kg/min.	< 35 mL/kg/min.

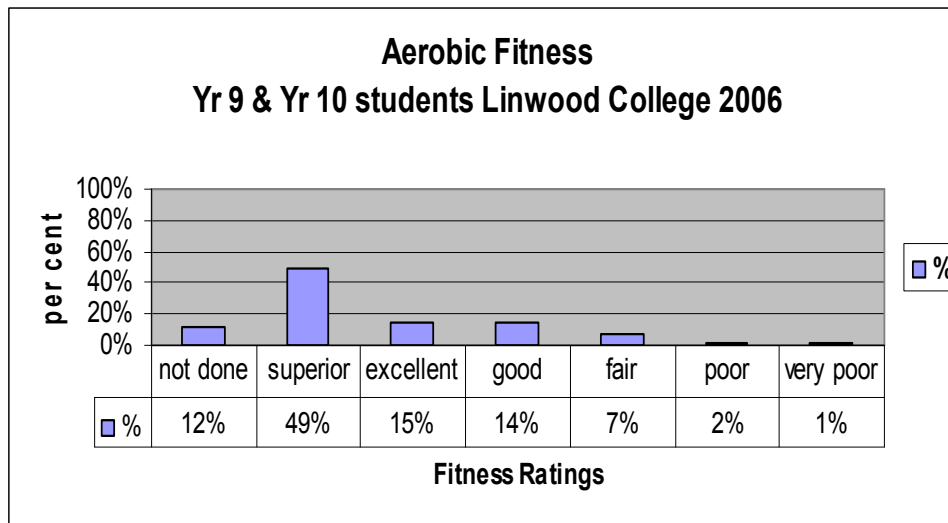
## Queens College Step Test

Beats (15 seconds)	Beats (1 minute)	VO <sub>2</sub> Max (ml/kg/min) FEMALES	Rating Females	VO <sub>2</sub> Max (ml/kg/min) MALES	Rating Males
10	40	58.422	Superior	94.53	Superior
11	44	57.6832		92.85	
12	48	56.9444		91.17	
13	52	56.2056		89.49	
14	56	55.4668		87.81	
15	60	54.728		86.13	
16	64	53.9892		84.45	
17	68	53.2504		82.77	
18	72	52.5116		81.09	
19	76	51.7728		79.41	
20	80	51.034		77.73	
21	84	50.2952		76.05	
22	88	49.5564		74.37	
23	92	48.8176		72.69	
24	96	48.0788		71.01	
25	100	47.34		69.33	
26	104	46.6012		67.65	
27	108	45.8624		65.97	
28	112	45.1236		64.29	
29	116	44.3848		62.61	
30	120	43.646		60.93	
31	124	42.9072		59.25	
32	128	42.1684	57.57		
33	132	41.4296	55.89	Excellent	
34	136	40.6908	54.21		
35	140	39.952	52.53		
36	144	39.2132	50.85	Good	
37	148	38.4744	49.17		
38	152	37.7356	47.49	Fair	
39	156	36.9968	45.81		
40	160	36.258	44.13		
41	164	35.5192	42.45	Poor	
42	168	34.7804	40.77		
43	172	34.0416	39.09	Very Poor	
44	176	33.3028	37.41		
45	180	32.564	35.73		
46	184	31.8252	34.05		
47	188	31.0864	32.37		
48	192	30.3476	30.69	Very Poor	
49	196	29.6088	29.01		
50	200	28.87	27.33		

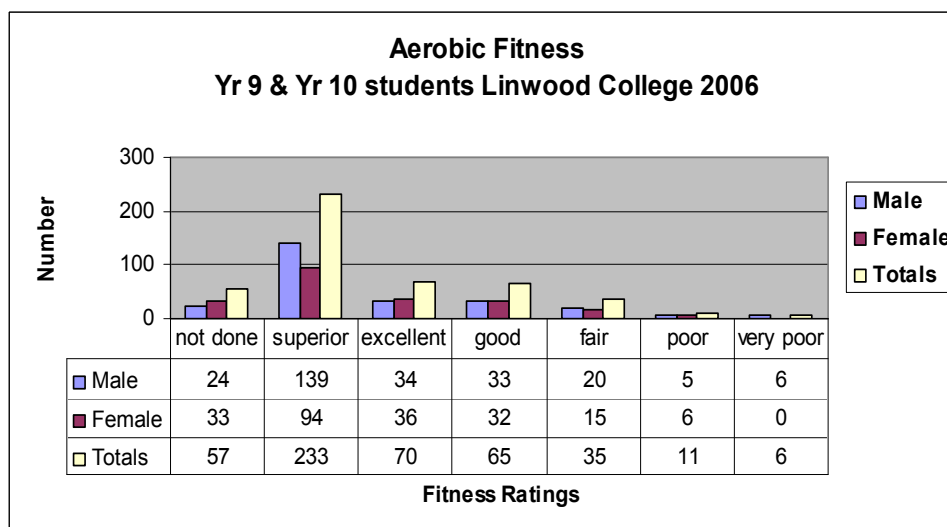
## RESULTS

Linwood Students results.

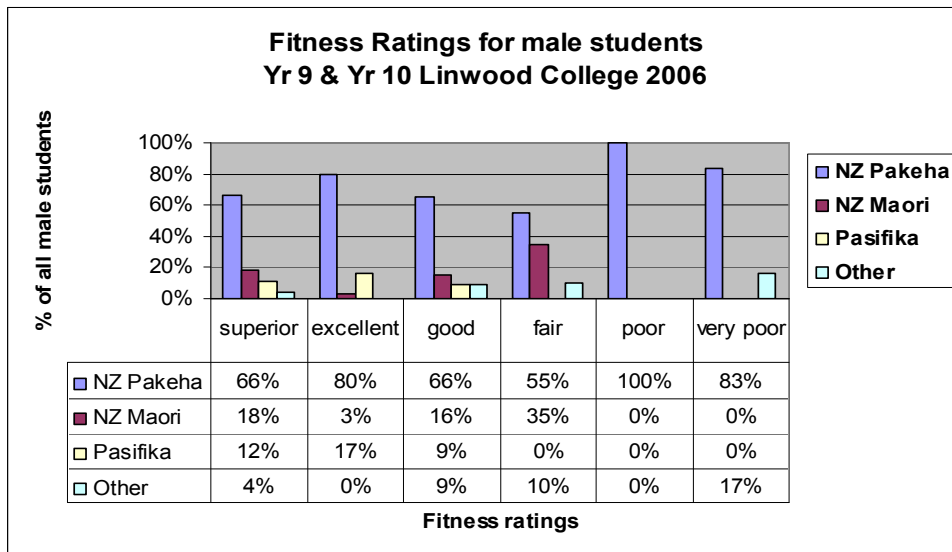
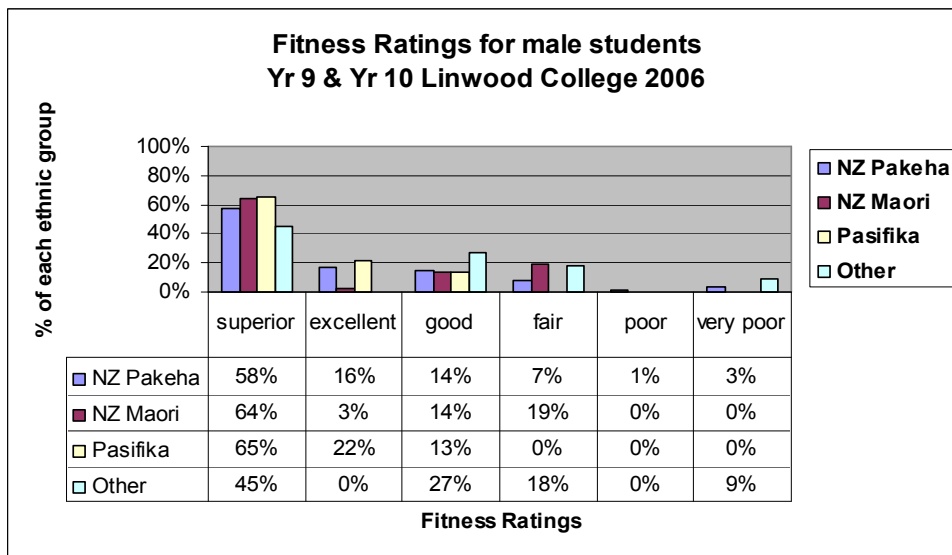
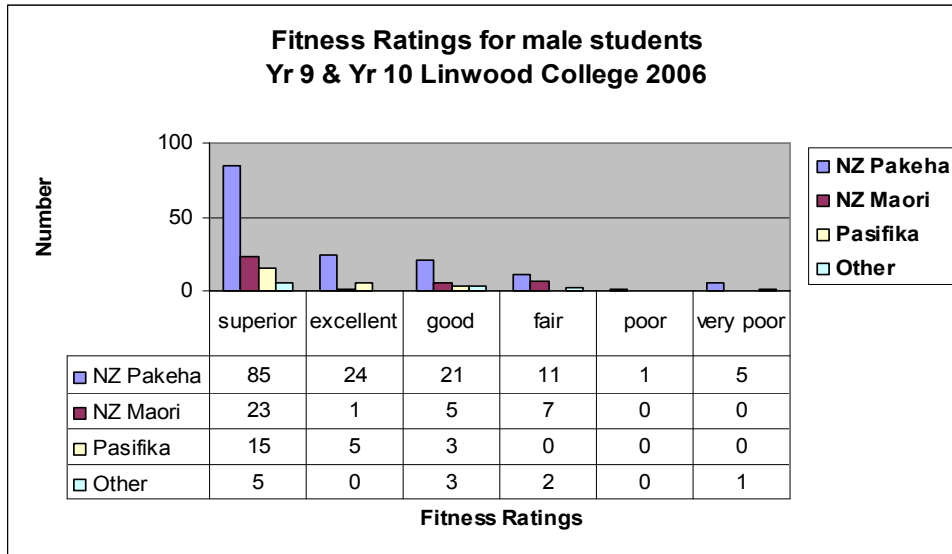
Gender	Not done	Superior	Excellent	Good	Fair	Poor	Very Poor
Male	24	139	34	33	20	5	6
Female	33	94	36	32	15	6	
Totals	57	233	70	65	35	11	6
%	12	49	15	14	7	2	1
%Adjusted to those who completed		<b>55</b>	<b>17</b>	<b>15</b>	<b>9</b>	<b>3</b>	<b>1</b>



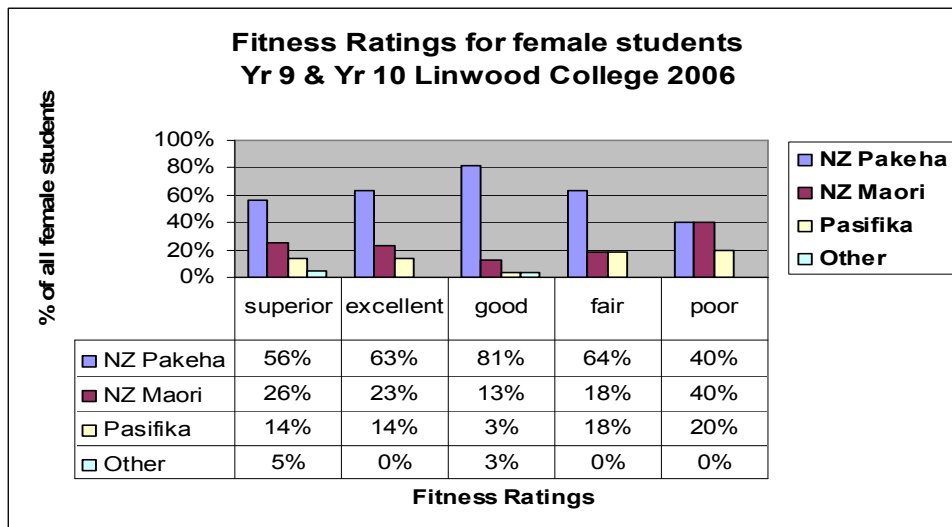
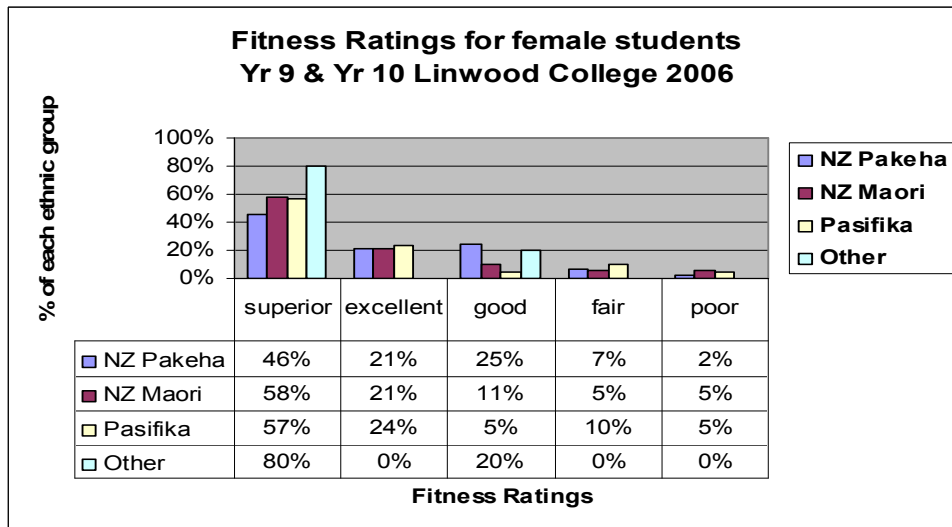
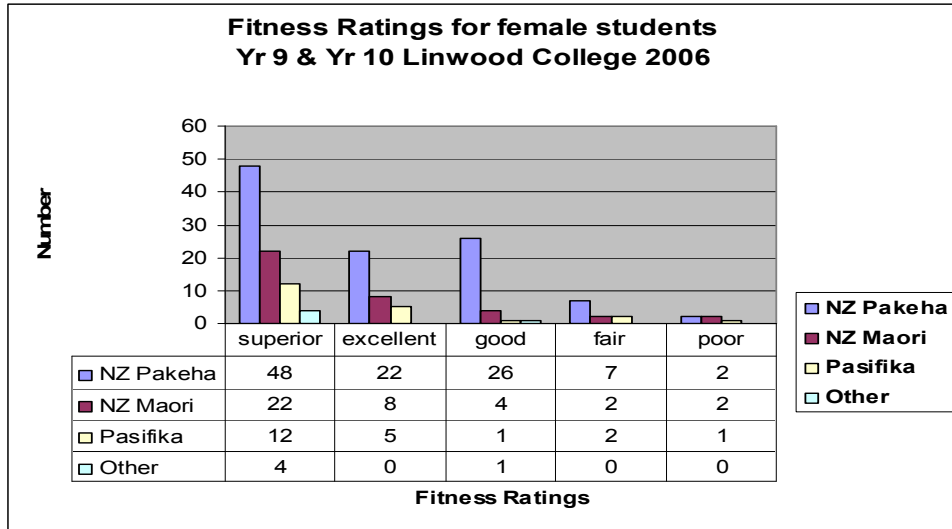
When separated into male / female the results were



When separated by ethnicity and gender the results are for boys



For Girls the results are



## Discussion

There was a large group (479) who were eligible to participate in this part of the study. The timing of this study extended into term 2 of the school year and therefore has the transient students who arrived during that time of the year included in the study. Only six students were refused parental consent to participate and 57 or 12% made their own choice to opt out of the study at the time of assessment. These were split male : female in the ratio 24 : 33. There were therefore 422 year 9 and year 10 students who completed the Aerobic fitness assessment.

There are some surprising results when compared to the results quoted in An Analysis of the Usefulness and Feasibility of a Population Indicator of Childhood Obesity. Ministry of Health, 2006. Wellington. In it some 30% of New Zealand students are reported to be obese. Obesity is related to exercise and aerobic fitness levels.

This Linwood College study places 72% of the student population in the Superior or Excellent fitness category and 87% in the Superior, Excellent or Good fitness categories. Only 1 % are very poor, 3% poor and 9 % are fair. No girls were in the Very Poor category and there were only 13% of the students in the Fair and below.

Separating the results into the ethnic categories gives the boys a definite Aerobic Fitness level advantage at the Superior level over the girls but that no one ethnic group is significantly better than another. The boys then drop off in the Excellent category and the Girls are increasing in that category.

In the Report on the Health Measurements of Year 9 and Year 10 students at Linwood College, A Parris 2007 it is reported that 17% of students are in the obese category and 13% of students are in the in overweight category compared to 30% in the obese category as reported in the 2006 Ministry of Health study - An Analysis of the Usefulness and Feasibility of a Population Indicator of Childhood Obesity.

A first reading this tends to suggest that Linwood College students are very much fitter than the New Zealand population. This probably isn't true so given the results found were consistently derived, we need to look at the measure for the obesity charts.

It would appear the BMI charts used in the Obesity study which are for European, North American students are not equipped to take cognisance of the Maori and Pacifica makeup of our population and that some research needs to be done on standardising some charts specifically for New Zealand children.

## RECOMMENDATION

The Health authorities need to take notice of the conflict detailed in this study in using the Cole or CDC BMI charts and do a specific study of New Zealand children that takes recognition of our ethnic diversity. This is important for clinicians to make effective use of such information.

It does raise some other issues for SPARC, the Ministry of Education, the Ministry of Health and others charged with our children's health and wellbeing. Perhaps the children are not as unfit or obese as the official message suggests, and some other research need to be done elsewhere to either confirm the picture portrayed at Linwood or to confirm that Linwood students are indeed fitter than those in the rest of New Zealand.

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