The Early Sport P.E. Effectiveness Testing Protocol

Conducted at:
Silver Mesa Elementary School
Jordan School District
State of Utah
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Report by:
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Background

There is no standardized nor generally agreed upon methodology in the U.S. to test the effectiveness of grade school P.E. programs. This has led to a plethora of claims as to the relative value of P.E. programs with widely divergent methodologies. The original standard of P.E. effectiveness was set in the late 1950's when the President's Council on Physical Fitness and Sports established guidelines for awarding its certificates. Based on long established military models (from which this country's first P.E. programs were developed), these standards emphasized muscular strength (push-ups, sit-ups, pull-ups, etc.), ball throwing, and running (the one mile run). More recently, the Council added lifestyle awards (for engagement in regular physical activities like basketball, rollerblading, etc.).

Classic, "old style" P.E. routinely emphasizes the teaching of team sports, and is often criticized as "rolling out the ball" P.E. By contrast, what has become known as the "New P.E." places its emphasis on children engaging in a wide variety of lifelong physical activities during P.E. (like rock wall climbing, weight training, and cardiovascular machines) rather than team sports. Considerable debate rages over the relative physical value to children from these competing teaching practices. With fewer and fewer grade schools having any type of regular P.E. at all (now only 8%, and dropping, according to the CDC), the intramural debate may soon be moot.

Central to this debate is the essential role of P.E. teachers. As budgetary cuts have eliminated thousands of P.E. teacher positions nationwide, grade schools are forced into choosing to have no P.E. at all, or asking regular classroom teachers or unpaid volunteers to assume that role, in spite of their admitted lack of proper training.

While all these issues are being played out, the nation is getting fatter. Childhood obesity rates have tripled, and overweight rates have doubled in the last 20 years. What was once known as the "Deadly Quartet" of metabolic diseases, now called the metabolic syndrome (upper body obesity, glucose intolerance/type 2 [adult onset] diabetes, hypertension, and hypertriglyceridemia/cardiovascular disease) have now become major childhood diseases, with type 2 diabetes being the fastest growing childhood disease in America. This year the Centers for Disease Control and Prevention projected that a child born in 2000 has a 1 in 3 chance of getting diabetes in their lifetime, 1 in 2 if non-Caucasian.

What is known about all of these diseases is that they are lifestyle related, with the lack of regular exercise a major contributing factor. While the steady decline of physical activity away from schools is contributing to these accelerating Early Chronic Disease (ECD) problems, the role of schools in helping to correct them, while assumed to be of significance, has never been directly addressed in the literature.

In the Spring of 2003, Early Sport Foundation and Early Sport Properties, Inc., which have created a free P.E. program for regular elementary school teachers to administer to their students, conducted a P.E. effectiveness protocol test at Silver Mesa Elementary, Jordan School District, State of Utah. The purposes of this protocol test were:

(1) Developing and testing a standardized method of evaluating the effectiveness of P.E. programs based upon the use of medically recognized bio-markers for the detection of ECD.
(2) Determining whether a P.E. program designed to maintain elevated heart rates (50% or more of a class period) can effect positive changes in recognized bio-markers for detection of ECD.
(3) Measuring the effectiveness of the Early Sport program as a first test of this protocol.

The basic assumption of this protocol test is that, while there are many important reasons for the conducting of regular P.E. classes in elementary schools, one major factor must be the prevention or attenuation of ECD syndrome in children. By this standard, all P.E. programs can, and should be measured, and compared, no matter whether "old" or "new" P.E., or whether taught by a P.E. professional or classroom teachers or volunteers. In fact, with data showing the ECD prevention values of P.E. programs, additional financial resources could be

justifiably directed toward the reestablishment of P.E. programs in elementary schools — justifying it in both political terms (reducing present and future medical costs to governments), and human terms (reducing the cost of lost lives, wages, and human potential, while improving quality of life and lengthening it).

Summary

The Early Sport P.E. Effectiveness Testing Protocol was designed to demonstrate the health benefits for children (3rd and 6th Grade elementary students) of regular physical activity in school, by maintaining a significantly elevated heart rate (between 135–190 bpm) for most (50%+) of the P.E. lesson period.

Silver Mesa Elementary was selected in a mixed middle class neighborhood in a bedroom community adjacent to Salt Lake City, Utah. With the full cooperation of Jordan School District, (with 74,000 students, one of the 50 largest districts in the country; Dr. Barry Newbold, Superintendent; Julie Christofferson, District P.E. Coordinator), Silver Mesa (Denise Orme, Principal) volunteered to have its students participate in the test. The school had a total enrollment of 477; with 80 students in three 3rd Grade classes, and 82 in three 6th Grade classes. Study and Control groups were randomly selected from these, with equal numbers of students in each.

After the appropriate parental consent was provided (see Parental Consent Form attached), every participant had blood drawn by certified phlebotomists (services donated by IASIS Healthcare Corporation) at baseline and following the five weeks of the Early Sport daily physical activity program. Individual blood profile data was obtained (with lab analysis by IASIS) for both the Study group and the Control group.

Integral to the Testing Protocol, analysis was provided for the following blood components:

- **Total Cholesterol:** A known risk factor for coronary heart disease when greater than 180mg/dL[1].
- **Triglycerides:** Abnormalities are linked to decreased clearance of VLDL[2]. A level over 250 mg/dL is considered to be a major risk factor for Type 2 diabetes[3]. Hypertriglyceridemia, defined as at least 200 mg/dL, is associated with an increased risk of cardiovascular heart disease mortality[4].
- **HDL-C:** Low levels of this protective cholesterol raise risks of cardiovascular disease by impairing endothelial (blood vessel) wall function[5]. Higher HDL levels remove excess cholesterol to the liver[6] and are considered to be cardioprotective[7]. HDL may have direct antioxidant and anti-inflammatory effects on the vessel wall[7]. HDL cholesterol below 35 mg/dL is considered to be a major risk factor for Type 2 diabetes[3].
- **LDL-C:** High levels increase the deposition of cholesterol in the arterial wall and the risk of heart disease and a reduction in protective HDL[1]. LDL is the main cholesterol-carrying lipoprotein.
- **VLDL-C:** Obese children usually have elevated concentrations of serum triacylglycerol – a surrogate measure of VLDL cholesterol – and low concentrations of HDL cholesterol. Occlusive disease is associated with concentrations of large VLDL[2].
- **Chol/HDL Ratio:** Non-HDL cholesterol has been suggested as more predictive of cardiovascular risk than LDL cholesterol alone[9]. The lower the Cholesterol to HDL ratio, the lower the heart disease risk.
- **HbA1c:** An indicator of elevated blood sugar, which is an indicator of diabetes risk (when greater than 6.5%), and cardiovascular disease risk[8].
- **CRP:** Raised levels are associated with higher HbA_1c levels[9], cardiovascular disease risk[10], and ischemic heart disease risk[11]. Elevated CRP is a “powerful independent” risk factor for diabetes[12]. “CRP has emerged as one of the most powerful predictors of cardiovascular risk.”[13] Overweight children have higher concentrations of C-reactive protein and higher white blood cell counts, indicating low-grade systemic inflammation, which may predict future cardiovascular disease and diabetes[14].

In addition to blood profiles, the Testing Protocol had each student tested, both pre- and post test period, on the proprietary "TriFit" machine (donated by Polar Electro, Inc.) which measured and recorded weight, arm strength (biceps), and flexibility (sit and reach). (The blood pressure device was unavailable at pre- and post test.) Height was also measured.

Cardiovascular endurance performance was measured by the Testing Protocol at baseline and again post-program by having all students (Study subjects and Controls) run for 10 minutes around a course measuring 150 yards, and marked every 10 yards. Instructions on regulating pace (135–190 bpm, each participant wore a heart rate monitor [HRM]) to be able to run continuously for the allotted time were given, with walking or stopping when necessary also cited as options.

Heart rate monitors (donated by Polar Electro, Inc.) were also placed on each Study participant in every P.E. lesson. These recorded individual heart rate data, which was downloaded to individual files in a central data base. Students were encouraged to regulate their physical activity during classes so as to remain within their target heart rate range for as much of the P.E. lesson as possible (lower limit 135 bpm, upper limit 190 bpm — monitors on the students' wrists were set to beep and flash whenever a wearer's heart rate was outside the target zone.)

The Early Sport P.E. program used at Silver Mesa consisted of 3rd and 6th graders having a daily (4-5 times per week, 30-40 minutes each lesson) series of lessons and games, each with warm-up, flexibility, and strength components, described and illustrated in detail on individual lesson cards. The games fall broadly into three groups; the non-competitive play of Large Ball Games, Small Ball Games, and EarlyGoals Circuit Activities. In addition to allowing individuals to participate and progress at their own pace, an objective was to provide students with the opportunity to acquire the skills necessary for an active lifestyle and participation in many sports. (Early Sport teaches individual sport skills, but not the playing of the sports themselves.)

Overriding the skills acquisition aspect is the Early Sport goal of encouraging individuals to maintain an elevated heart rate throughout the lesson, (as indicated by staying in the heart zone noted above), that would improve cardiovascular endurance.

Protocol Test Outcomes

As noted above, the purposes of the protocol test were:

(1) Developing and testing a standardized method of evaluating the effectiveness of P.E. programs based upon the use of medically recognized bio-markers for the detection of ECD.
(2) Determining whether a P.E. program designed to maintain elevated heart rates (50% or more of a class period) can effect positive changes in recognized bio-markers for detection of ECD.
(3) Measuring the effectiveness of the Early Sport program as a first test of this protocol.

The results of this protocol test show that, even over as short a time period of five weeks, significant changes (improvements) in cardiovascular endurance and blood chemistry profiles can be measured by the protocol. The selected measures can be relied upon as impartial and direct indicators of the effectiveness of a P.E. program, by showing their impact on Early Chronic Disease (ECD) risk factors.

This study postulated a direct link between student time-in-heart-zone and ECD risk factors. The Early Sport program was designed to keep participant heart rates in the target zone of 135–190 bpm for 50%+ of the class period. The automatically recorded HRM data from the study show that the Early Sport P.E. program was effective in meeting this goal: The 3rd graders were in the target heart zone 62.3% of the time (average heart rate 146), and the 6th graders were in the zone 71.0% of the time (average heart rate 149) during the five

weeks of the program. The protocol test also showed that just five weeks of the Early Sport program was effective in lowering the ECD risk profiles of elementary students (see **Outcomes** below). The program was especially effective in lowering the ECD risk profiles of those students most at risk to ECD (see pages 13 and 14, below). This study shows a strong positive correlation between time-in-zone and ECD risk factors.

6th Grade Outcomes

Most 6th Grade Study Group individuals showed significant improvements in cardiovascular endurance and blood chemistry profiles:

- The 6th Grade Study Group ran, on average, 696 yards further in the ten minute run, after 5 weeks, while the Control Group ran 335 yards further after 5 weeks, while staying within the target heart range.
- Several of the average post-test blood chemistry measurements improved significantly among the 6th Grade Study Group as compared with the Control Group:
  - Total Cholesterol fell 6 x more in the Study Group (-2.83 vs -0.45 mg/dL)
  - HDL Cholesterol reduction was 8 x greater in the Control Group (-0.28 vs -2.36 mg/dL)
  - Reduction in HbA_1c readings was twice as great in the Study Group (-0.10 vs -0.05)
  - The fall in C-Reactive Protein level was 3 x higher in the Study Group (-0.02 vs -0.06)

3rd Grade Outcomes

Several anomalous results were noted with the 3rd Grade Study participants. While there were notable individual improvements in both cardiovascular endurance and blood chemistry profiles, on average, blood profile changes in the Study Group were less favorable than those of the Control Group. However, the Study Group's cardiovascular endurance improved more than that of the Control Group:

- The Study Group covered, on average, 73 yards more after 5 weeks, whereas the Control Group ran 51 yards further.
- The Control Group had a greater average Total Cholesterol drop (-11.92 vs -8.04) than the Study Group, which was an unexpected anomaly, probably due to uncontrolled dietary factors.

Conclusions

(1) This study clearly demonstrates the protocol is an impartial and direct indicator of the effectiveness of a P.E. program. It also has an ability to measure changes from short term programs. Some shortcomings in the application and administration of the protocol were identified and are discussed below.

(2) The study shows that regular (daily) P.E. which emphasizes the maintenance of heart rates in a recognized training zone (135–190 bpm) yields both biometric (blood analysis) and anthropometric (physical measurements) improvements. Most notable was the marked improvement in average cardiovascular endurance of the 6th Grade group, and some outstanding changes of individuals within the group. The 3rd Graders had more mixed results, but also registered significant individual improvements, especially those most at risk to ECD.

(3) The effectiveness of the Early Sport P.E. program is shown in this study. It achieves its two major goals of keeping student heart rates in the zone 50%+ of the class time, and positively impacting the ECD health risk profile of participants. It does this while providing ability-appropriate, skills-based physical activity to children of all capabilities. Students found Early Sport's non-competitive approach to P.E. to be fun and to their liking.

All students in the Study Groups appeared to enjoy the changed philosophical approach to physical activity which encouraged non-competitive participation and progress at each individual's level. As an indication of the program's design to enable meaningful participation by students of all abilities, about two weeks into the program, there was a 'mini rebellion' by a small group of athletically capable 3rd Grade boys. Being used to dominating their P.E. classes, and finding themselves no longer quite so dominant, they registered their dissat-

isfaction. All remained in the program after counselling on the desirability of everyone being able to participate and their not having to always be 'the best' or 'the winner.'

(4) The use of HRM technology is not a requirement of the Early Sport program. It was employed in the study to accurately record the time each student spent in the target zone while in class. Still, almost without exception, both Study Groups found the adoption of heart rate technology not only interesting, but also motivating. The idea of maintaining heart rate within a particular range had universal appeal and the great majority of students made a concerted effort to remain in their training range.

Early Sport enthusiastically endorses the addition of HRM's to the Early Sport program, and firmly believes all elementary school P.E. programs ought to use HRM's (where budgets allow), both to validate their program and to educate and motivate their participants. Using objective, real-time feedback to each child on their physical efforts, as provided by heart rate monitors, allows achievement of the goal of improved cardiovascular endurance without either over-stressing the child or allowing excessive recovery time to negate the benefit.

(5) Given the burgeoning ECD problem of America's youth, the data from this study present a powerful and convincing rationale for the regular (3-5 times per week) inclusion of P.E. in elementary schools. It also presents the idea that, whether a P.E. class is led by a classroom teacher or a P.E. specialist, whether "old" or "new" P.E., a key outcome of every P.E. program must be showing it has a positive and ongoing benefit on ECD health risk profiles. To be sure, there are other reasons for P.E. programs. But, in these times of tight education budgets and the subsequent elimination of funds for P.E., the ability to achieve real, measurable, provable progress in combating ECD must be the seminal criterion upon which all P.E. programs must be measured. If the very real, immediate peril to the lives and health of our school children from ECD is not a sufficient motivator to restart P.E programs, surely the other reasons for them will fail also.

Study Limitations

Despite the absence of an ability to influence dietary intake during the course of the study, the regular physical activity had measurable results in endurance performance and blood chemistry profiles, if not uniformly across all Study Groups. Results were very significant in some individuals, especially those most at-risk. However, during the course of conducting the Test Protocol, we identified some shortcomings which need to be addressed when it is used again:

- While measurable improvements in both cardiovascular endurance and blood chemistry profiles were recorded in the short five weeks of the program, significantly longer study periods should be used in the future. Longer periods are expected to show greater improvements in all the measures taken. Also, greater differences between Study-Control group performances would be expected if the study period were conducted during the Winter (this study was conducted in late Spring), when children are generally less active, barring an in-school P.E. program.
- Fasting plasma glucose (FPG) was not addressed as part of the blood analysis. As a marker of possible metabolic abnormality, it would have been an additional, useful indicator of risk.
- Students using HRM's must be given adequate training before using them the first time. They must also have sufficient experience using them while running and otherwise physically active before data obtained from them is used for testing or evaluation purposes.
- Heart rate transmitters, which fit around the chest, are generally too large for use by many third grade students. These students, once they learn to keep them fitted properly, use the HRM technology enthusiastically.
- The reliability of subjects using the individual lap count feature on their heart rate monitors when running a course consisting of short laps:
  - Using the HRM lap feature proved unreliable as children could press the lap button more than once after each completed lap.

reliable, but more cumbersome.

- Motivation of the Control Groups, especially that of the 6th Grade, seemed variable.
  - – Some individuals apparently resented being randomized to the Control group.
  - – In some, the pre- and post-program endurance run effort was limited as a protest.
  - – In others, a supreme effort was forthcoming, presumably to "prove a point."
- Time constraints led to rushing procedures and some mistakes in anthropometric data collection.
  - – The possibility of uniformly calculating BMI was lost as some children were mistakenly measured wearing shoes during baseline data collection.
- A time delay in 6th Grade baseline blood draw:
  - – Due to an extended period needed for the 3rd Grade baseline blood draw, the baseline blood draw of the 6th Grade was not commenced until mid-morning and completed late-morning, on a chilly day. This resulted in peripheral blood vessel constriction, blood draw difficulties, and perhaps skewed blood profiles due to over-long fasting periods.
  - – The problem was resolved in the second blood draw by moving the 6th Grade blood draw time to 8:30 am on a different day from the 3rd Grade.
- An inability to collect blood pressure data due to equipment failure.
- There is research data to indicate that relying solely on an exercise regimen, without any concurrent dietary modification, blunts the degree of change in biometric outcomes and anthropometric measures[15,16]. To have been able to intervene in prevailing dietary practices would almost certainly have favorably influenced outcomes.

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Notable Individual Outcomes
6th Grade Test Subjects Registering Significant Improvement:

Study Subject #2:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	6/2
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1800-1740	133-151	159-78	40-42	61-93	32-16	3.31-3.58	4.9-4.8	0.1-0.1	

This subject showed no major change in endurance performance, but registered a significant rise in a very low Cholesterol to reach middle range. However *a very high Triglycerides level fell to within normal range*. HDL, however, remained quite low. There was also a significant (50%) rise in LDL, but VLDL fell by the same magnitude . Cholesterol to HDL Ratio rose slightly, HbA_1c fell modestly and C-Reactive Protein remained low.

Study Subject #4:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	6/4
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	450-1540	150-139	68-80	45-41	91-83	14-16	3.29-3.42	5.2-5.0	0.2-0.1	

This individual *markedly improved endurance performance*, and registered *a fall in total Cholesterol to below normal*. Triglycerides rose, but HDL fell further towards low end. The *LDL fraction fell towards the low end*, and VLDL remained quite low. Cholesterol to HDL ratio rose slightly and HbA_1c fell modestly to remain under Non-Diabetic range. C-Reactive Protein fell modestly.

Study Subject #10:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	6/10
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	900-1840	142-116	76-68	65-58	62-45	15-14	2.2-2.0	5.5-5.4	0.1-0.1	

This subject had a *major improvement in endurance performance (900-1840 yds)*, while registering a *significant fall in an already low total Cholesterol*, and an *improvement in Triglycerides.* HDL also declined slightly. The *LDL Cholesterol fraction fell substantially to extremely low*. VLDL also fell slightly. A very low Cholesterol to HDL ratio fell slightly and a borderline high HbA_1c fell modestly to remain just under Non-Diabetic range. C-Reactive Protein remained unchanged.

Study Subject #12:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	6/12
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1800-1670	130-119	55-71	49-45	71-60	11-14	2.97-2.64	5.1-5.0	0.1-0.1	

Although this student's superior endurance performance did not improve (1800-1670 yds), an *already low total Cholesterol fell further to very low*.Triglycerides rose, however, and HDL fell slightly. *The LDL fraction fell to very low* while VLDL rose modestly. *Cholesterol to HDL ratio fell significantly*. HbA_1c fell slightly to remain under Non-Diabetic range. C-Reactive Protein remained unchanged.

Study Subject #16:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	6/16
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	450-2260	151-134	126-63	43-47	83-75	25-13	3.53-2.87	5.2-4.7	0.3-0.1	

The recorded baseline endurance performance of this outstanding athlete is probably anomalous (450-2260), reflecting a recording error, but *the fall in total Cholesterol level was very significant, as was the precipitous drop in Triglycerides.* HDL improved slightly. *The LDL fraction was low, and fell further* and *VLDL almost halved to very low*. The *Cholesterol to HDL ratio fell quite substantially. HbA_1c fell very significantly* to remain well under Non-Diabetic range. *C-Reactive Protein also fell significantly.*

3rd Grade Test Subjects Registering Significant Improvement:

Study Subject b:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	3/9/b
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1460-1740	148-139	38-79	62-58	80-65	8-16	2.42-2.39	5.3-4.8	0.1-0.1	

This subject, whose endurance performance improved *began with very low Cholesterol and reduced it further to extremely low.* Triglycerides rose from very low to medium, and there was a small decrease in HDL level. *LDL registered a significant drop to very low,* though VLDL increased slightly while still remaining modest. Cholesterol to HDL ratio fell slightly. *HbA_1c fell significantly (5.3-4.8%) to remain well within Non-Diabetic range*. C-Reactive Protein remained low.

Study Subject c:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	3/9/c
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1820-1810	191-160	41-77	60-53	123-92	8-15	3.2-3.02	5.4-4.9	0.1-0.1	

With endurance performance remaining essentially unchanged this student *began with a high Cholesterol and registered a significant drop.* Triglycerides rose with HDL remaining satisfactory. There was *a significant fall in LDL,* and VLDL remained low whilst registering a minor increase. Cholesterol/HDL ratio also fell slightly. *HbA_1c fell significantly to remain well within Non-Diabetic range.* C-Reactive Protein remained low.

Study Subject d:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	3/9/d
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1220-1220	176-175	114-91	73-81	80-75	23-18	2.41-2.15	5.2-4.9	0.1-0.2	

This student had an unchanged endurance performance and maintained a satisfactory Cholesterol level, but registered *a significant drop in Triglycerides*, and *a rise in an already high HDL*. In addition, *LDL trended downwards, as did VLDL, and Cholesterol to HDL ratio declined further. HbA_1c fell, remaining well under Diabetic Range.* C-Reactive Protein rose modestly.

Study Subject e:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	3/9/e
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1030-1280	133-123	51-57	51-48	72-63	10-11	2.61-2.55	5.0-4.8	0.1-0.1	

This subject *significantly improved endurance performance* and began with *a very low Cholesterol level and progressed to an extremely low level,* while Triglycerides remained low. A moderate HDL also fell slightly. *LDL fell significantly, from low to very low.* VLDL remained in the low range, and the *Cholesterol to HDL ratio remained good.* HbA_1c stayed well under Diabetic Range. C-Reactive Protein remained very low.

Study Subject h:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	3/12/h
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	860-1510	184-147	27-40	78-66	101-72	5-8	2.35-2.21	5.6-5.3	0.1-0.1	

This student's *endurance performance registered a major improvement, and Cholesterol level went from borderline high to low,* although Triglycerides rose from extremely low to low. HDL fell from very high to high, and *LDL fell significantly*. VLDL remained low, and Cholesterol to HDL ratio fell slightly, remaining in the healthy range. *HbA_1c fell further below Diabetic Range (<6.0%)*. C-Reactive Protein remained very low.

Study Subject j:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	3/15/j
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1580-1950	102-106	39-36	52-60	42-39	8-7	1.97-1.77	5.3-5.1	0.1-0.1	

This individual was an outstanding athlete who began with an excellent blood profile, and made further significant improvements. *Cholesterol remained extremely low, as did Triglycerides, with HDL registering a significant increase*. *A very low LDL fell further as did VLDL, and an already excellent Cholesterol to HDL ratio improved further*. HbA_1c stayed well under Diabetic Range and C-Reactive Protein remained very low.

Study Subject k:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	3/16/k
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1220-1300	187-170	74-69	49-60	123-96	15-14	3.79-2.83	5.4-5.1	0.1-0.1	

This subject showed an increase in endurance performance and some modest improvements in Cholesterol level and Triglycerides. *HDL improved significantly, as did LDL, while VLDL remained low. Cholesterol to HDL ratio was significantly reduced*. *HbA_1c fell further below Diabetic Range* and C-Reactive Protein remained very low.

Study Subject l:

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Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	3/17/l
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1500-1540	218-192	74-62	87-80	116-100	15-12	2.5-2.4	5.2-4.9	0.1-0.1	

An athletically capable child, this individual *began with a dangerously high Cholesterol level which was reduced to borderline high*. *Triglycerides also improved somewhat.* Elevated Cholesterol was off-set by maintenance of a very high HDL reading. LDL was satisfactory, and fell slightly, and a low VLDL was also slightly reduced. Cholesterol to HDL ratio was low and fell further. *HbA_1c was satisfactory and trended lower*, and C-Reactive Protein remained very low.

Study Subject m:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	3/18/m
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1320-1680	136-120	96-69	46-41	71-65	19-14	2.95-2.94	5.5-5.2	0.2-0.3	

This subject, which registered a *significant improvement in endurance performance, began with very low Cholesterol which declined further to extremely low*. *Triglycerides also declined markedly*. HDL, however, fell further towards low range. *Both LDL and VLDL were low and fell further*. Cholesterol to HDL ratio remained essentially unchanged. HbA_1c fell modestly further below Diabetic Range. C-Reactive Protein rose slightly.

Study Subject n:

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	3/21/n
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1490-1460	165-145	84-62	56-59	92-74	17-12	2.95-2.48	4.9-5.0	0.1-0.1	

Despite a small fall in a good endurance performance, this subject showed a *significant fall in Cholesterol level, and in Triglycerides level.* HDL showed a minor improvement. *LDL fell significantly* and VLDL registered a small improvement. Cholesterol to HDL ratio improved and HbA_1c, rose marginally, but remained under Diabetic Range. C-Reactive Protein remained unchanged at very low.

6th Grade Test Subjects Identified with High Risk Factors

The Testing Protocol was effective in identifying individuals with high ECD risk factors. It is noteworthy that many of the children in whom elevated risk factors are present have no or limited outward appearance of being at risk.

Study Subject #7 (boy):

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	6/7
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1350-2210	186-194	80-62	59-60	111-122	16-12	3.15-3.25	4.9-4.9	0.1-0.1	

This very fit, high-endurance athlete had a *high Cholesterol reading which increased.* Triglycerides, however, fell significantly. A higher HDL level was maintained, but the *LDL Cholesterol fraction increased,* accounting for all of the the Cholesterol increase. A low VLDL declined further, and the Cholesterol to HDL ratio rose slightly. HbA_1c was unchanged to remain well within Non-Diabetic range. C-Reactive Protein also remained low.

Study Subject # 8 (girl):

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	6/8
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	1800-1460	139-132	65-52	32-29	94-93	13-10	4.38-4.6	5.2-5.2	0.1-0.1	

This subject had a lower endurance performance and a very low and falling Cholesterol and Triglycerides level. However, *HDL was very low and falling.* The LDL fraction remained essentially unchanged, and VLDL also fell to a low level (13-10 mg/dL). *Cholesterol/HDL Ratio worsened slightly to borderline high*. HbA_1c remained unchanged (5.2-5.2%) to remain just within Non-Diabetic range (<6.0%). C-Reactive Protein remained low.

Study Subject #14 (girl):

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP	6/14
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL	
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8	
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	
Change	450-1600	255-246	239-224	46-43	161-158	48-45	5.53-5.74	5.2-5.1	0.3-0.2	

This subject had significantly improved endurance performance, but had a *very high Cholesterol level, which fell slightly*. *Triglycerides level was extremely high, and this too fell slightly to remain very elevated*. *HDL was low and falling*. *Both LDL and VLDL were towards the high end of normal, and both remained essentially unchanged*. *Cholesterol to HDL Ratio was above normal range and increasing*. This subject's HbA_1c remained essentially unchanged (5.2-5.1) to remain within Non-Diabetic range, and a somewhat elevated C-Reactive Protein fell slightly.

3rd Grade Test Subjects Identified with High Risk Factors

It is noteworthy that many of the children in whom elevated risk factors are present have no or limited outward appearance of being at risk. The Test Protocol is an important screen for early detection of the risk factors for ECD.

Study Subject a (boy):

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP 3/a/2
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post
Change	1270-1380	186-197	237-181	49-58	90-103	47-36	3.79-3.4	5.3-5.0	0.1-0.1

This subject registered a slight improvement in endurance performance, but *a high Cholesterol level rose to borderline high. Triglycerides were extremely high, and although falling significantly, remained well over normal range.* HDL rose slightly, but *LDL rose. The VLDL fraction fell from very high to high. The Cholesterol to HDL Ratio fell slightly* to remain somewhat elevated. HbA_1c declined to remain below diabetic level, and C-Reactive Protein stayed low.

Study Subject g (girl):

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP 3/g/11
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post
Change	1170-1290	218-195	39-140	90-66	120-101	8-28	2.41-2.94	5.2-4.8	0.1-0.1

This subject showed an improvement in endurance performance, but *began with a very high Cholesterol level which declined to borderline high. Triglycerides increased tremendously from very low to very high, and HDL declined significantly but remained in the upper range*. LDL registered a significant drop, but *VLDL markedly increased.* Due mainly to the HDL decline, Cholesterol to HDL ratio worsened slightly. A moderate fall in HbA_1c remained under Diabetic Range, and C-Reactive Protein remained unchanged at very low.

Study Subject q (boy):

Marker	Distance	Cholesterol	Triglycerides	HDL	LDL	VLDL	Chol/HDL	HbA1c	CRP 3/q/13
Unit	Yards	mg/dL	mg/dL	mg/dL	mg/dL	mg/dL	Ratio	%	mg/dL
Normal		140-200	37-148	35-75	62-185	——	0-5	4.0-6.0	0.0-0.8
	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post	Pre Post
Change	1800-1560	169-156	60-206	56-42	100-73	12-41	3.0-3.73	5.0-4.8	0.2-0.1

This individual registered a decline in endurance performance but improved Cholesterol level. However, *Triglycerides rose tremendously to well above normal range*. There was also *a significant fall in HDL.* Paradoxically, LDL level fell significantly, while *VLDL fraction rose significantly*. Consequential to the fall in HDL, *Cholesterol to HDL ratio worsened significantly*. A moderate fall in HbA_1c remained under Diabetic Range, and C-Reactive Protein improved to very low.

The following Disclosure and Consent form was signed by the parents of all the students involved.

Jordan School District
Parent/Guardian Consent Form
Physical Education (P.E.) Effectiveness Testing

Course: Physical Education (P.E.) Effectiveness Testing Teacher: _____

School:_____ Phone: _____

Dear Parent or Guardian,

As you may be aware, childhood overweight and obesity rates are currently epidemic. This is leading to a sharp rise in the number of children with risk factors for heart disease, adult onset diabetes, and hypertension.

An effective way to combat this problem is to have children active for a combined time of at least 30-60 minutes each day. The impact on a child's health of having regular Physical Education (P.E.) classes in school is presently unknown.

Now, due to a unique partnership between Jordan School District, P.E.4 Life, EarlySport, and Jordan Valley Hospital (IASIS), it is possible to study the effects of a regular grade school P.E. program on the health risk factors of our students.

Your child's participation in this program will greatly aid in the evaluation, development and implementation of P.E. programs to halt this epidemic of childhood overweight and obesity rates.

Please read this form carefully, select your option, and return it to the teacher identified above. Thank you.

INFORMATION:

All students in the study classes will be tested at the beginning, and end of the test period of 4-8 weeks. They will be tested as follows:

- Physical performance on eight simple physical activities.
- Height, weight, waist, resting heart rate, and body composition will be measured.
- During P.E. classes a heart rate monitor, consisting of a strap around the child's chest and a wristwatch-like device, may be used. You may see one of these devices at your child's class prior to making your decision. These are commercially available monitors like those sold at many sports stores and used in health clubs.
- A small amount of blood will be drawn from the arm by trained and experienced hospital personnel under the supervision of the school's nurse. A small treat will be given after this is completed.

An experienced, qualified P.E. instructor will conduct regular physical activity classes with all members of two different classes for a period of 4-8 weeks. For comparisons, an additional two classes will be tested, as above, but will not participate in the P. E. classes.

Only the Jordan Valley Hospital (IASIS) personnel will have access to the completed records indicating your child's results. Your child's information will be only added to the class's total (average) information. Complete confidentiality of all your child's data will be strictly enforced, and will not be compared to that of other children, nor shared with school officials or any of the organizations mentioned above, nor with any others.

DISCLOSURE:

The curriculum for this course includes instruction about the topics shown here:

- Running
- Coordination skill development
- Proper nutrition
- Large and small ball catching and throwing
- Warm-up / cool -down / stretching

OPTIONS:
Please read and check one of the following:

___ I GRANT permission for my child, _____ to participate in the scheduled activities as described above.

___ I GRANT permission for my child, _____ to participate in the scheduled activities as described above, except for: ___ Use of heart rate monitors, ___ The drawing of a small amount of blood from the arm. I understand my child will not be singled out for not participating in these activities. Prior to the day these procedures will be performed, I understand I will be notified again these activities will take place, and be given a choice to participate.

___ I GRANT permission for a photograph of my child to be taken in conjunction with the scheduled activities above.

___ Prior to making a decision I will contact you at school within the next 5 days to arrange a time to discuss the planned program and review the procedures.

___ I DENY permission for my child, _____ to participate in this program as described above. I understand my child will be given alternative activities during the time used by this program, and will be provided a safe, supervised place within the school during such times.

Your child cannot participate in this program unless and until this signed letter of permission is returned to the teacher identified on this form. Signed forms will be kept on file by the school for a minimum of one year.

PLEASE SIGN AND RETURN BY APRIL 4, 2003.

I have read this form and have chosen one option as indicated above.

Parent/Guardian Signature: _____

Phone Number: _____ Date: _____

Thank You.