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Fitness and Health of an Inuit Community: 20 Years of Cultural Change

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ABSTRACT

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The impact of cultural change on working capacity, lung function, growth and development, body composition, and strength has been assessed by collecting physiological, anthropometric, and health data on the Inuit living at Igloolik, NWT (69° N, 81° W). Data was collected at three stages of "acculturation", in 1970, 1980, and 1990. All tests conformed to the standard protocol established for the International Biological Program. In 1970 we saw 148 males and 118 females aged 9 to 66; ten and twenty years later the original investigators used the same methods and equipment to test 201 males and 143 females aged 9 to 76 in 1980; and 222 males and 161 females aged 10 to 75 in 1990.

In 1970 the Iglulingmuit showed an exceptionally high level of aerobic fitness, a very limited amount of subcutaneous fat, and a superior leg strength. Our studies suggest that these characteristics were not due to any constitutional advantage, but rather reflected the high level of habitual physical activity demanded for survival in a hostile environment. Specific sources of energy expenditure included frequent walking over rough terrain, ice, and snow; in the women, daily carriage of young children in the traditional "amauti"; and in the men a high average energy expenditure while hunting (average energy cost of 15 to 16 MJ/day, compared to some 8-10 MJ for the average office worker) interspersed with periods of intense physical exertion. The practical importance of the physical activity associated with hunting was clearly illustrated by the average 35% difference of physical working capacity between the most active hunters and the settlement workers.

In 1980 we found that in 10 years the predicted maximum oxygen intake had decreased by an average of 10 and 12% in men and women respectively. Further evidence that there had indeed been a decline of personal fitness came from a consideration of such variables as body mass, subcutaneous fat, and leg strength. While increases in total body mass were small, the adults showed substantial and highly significant increases in subcutaneous fat over the decade. Both men and women also showed a significant decrease in leg strength. The combination of these factors indicates that there had been a substantial replacement of lean tissue by fat from 1970 to 1980. The only groups that had apparently been spared a deterioration of personal fitness were the young boys and girls of the village.

The results of the 1980 lung function tests were essentially similar to the findings from 1970. However, it was disturbing to note a substantial increase in cigarette consumption, particularly among adolescents and young adults. The proportion of self-reported cigarette smokers among those over the age of 14 years had increased from 64% of males and 85% of females in 1970 to 81% of males and 93% of females in 1980. Moreover, the average daily cigarette consumption by the smokers had risen from 11.8 in the men and 7.4 in the women to 20.2 in the men and 12.0 in the women.

RÉSUMÉ

Condition physique et santé des Inuit d'Igloolik : 20 ans de changement culturel

Nous avons évalué les incidences du changement culturel sur la capacité de travailler, les fonctions respiratoires, la croissance, la constitution et la force des Inuit d'Igloolik, dans les T.N.-O. (69° N, 81° O), à partir de données sur leur santé ainsi que de données physiologiques et anthropométriques. Nous avons recueilli ces données à trois moments de "l'acculturation", soit en 1970, en 1980 et en 1990. Les tests employés répondaient au protocole normalisé qui a servi dans le cadre du Programme biologique international. En 1970, l'échantillon se composait de 148 hommes et 118 femmes âgés entre 9 et 66 ans. Dix et vingt ans plus tard, nous nous sommes servis des mêmes méthodes et appareils pour tester à nouveau les habitants. En 1980, l'échantillon regroupait 201 hommes et 143 femmes âgés entre 9 et 76 ans; en 1990, 222 hommes et 161 femmes âgés entre 10 et 75 ans.

En 1970, les Igluligmuit avaient une endurance cardiorespiratoire exceptionnellement élevée, peu de graisse dans les tissus sous-cutanés et une force de la jambe qui était supérieure à la moyenne. Nos recherches révèlent que ces caractéristiques n'étaient pas imputables à des traits physiologiques mais bien au niveau élevé d'efforts physiques que les personnes déployaient simplement pour survivre dans un milieu hostile. Parmi les activités particulières qui exigeaient beaucoup de force, on comptait la marche fréquente dans des terrains accidentés, sur la glace et dans la neige. Dans un climat pareil, les femmes portaient leurs jeunes enfants dans le traditionnel "amauti" à longueur de journée et les hommes dépensaient beaucoup de force à chasser (en moyenne 15 à 16 MJ/jour, contre environ 8 à 10 chez la moyenne des employés de bureau); activité qui exigeait en outre des efforts intenses à des moments précis. La différence entre la capacité du travail physique chez le chasseur très actif et l'employé de bureau se situait autour de 35 %, ce qui montre clairement l'importance de l'effort physique pour chasser.

En 1980, soit dix ans plus tard, nous avons constaté que l'endurance cardiorespiratoire maximale prévue avait baissé en moyenne de 10 % chez les hommes et de 12 % chez les femmes. En nous appuyant sur des facteurs tels que le poids corporel, la quantité de graisse dans les tissus sous-cutanés et la force de la jambe, nous avons pu observer que la condition physique des personnes dépérissait. Les adultes avaient pris peu de poids, mais la graisse s'était accumulée de façon très appréciable dans leurs tissus sous-cutanés. Nous avons également noté un affaiblissement appréciable de la force musculaire des jambes chez les hommes et les femmes. Toutes ces constatations montrent que, de 1970 à 1980, les tissus sous-cutanés sont devenus beaucoup plus gras. Seuls les jeunes garçons et les jeunes filles du village semblaient avoir maintenu leur bonne forme physique.

Les résultats des examens fonctionnels respiratoires réalisés en 1980 s'apparentaient à ceux de 1970. Nous avons toutefois remarqué une augmentation inquiétante du nombre de fumeurs, surtout chez les adolescents et les jeunes adultes. La proportion d'individus âgés de plus de 14 ans qui se sont déclarés fumeurs est passée de 64 % chez les hommes et de 85 % chez les femmes, en 1970, à 81 % et 93 %, respectivement, en 1980. De plus, la consommation moyenne par jour est passée de 11,8 cigarettes chez les hommes et de 7,4 chez les femmes à 20,2 et 12, respectivement.

CONTENTS

FOREWORD

Our primary objectives in preparing this document are:

1. to meet our reporting obligations to the Circumpolar and Scientific Affairs Directorate, Department of Indian Affairs Canada; and,

2. to provide a compendium of our research findings from 1970, 1980, and 1990.

While this report is accurate and fairly detailed, it does not constitute a final or definitive analysis of our results. Such analyses are now in preparation and will be submitted as separate scientific papers to the relevant professional journals in the near future. One such paper has already been published:

Shephard, R.J. and Rode, A. (1991). Right-branch bundle block in circumpolar Inuit. Arct Med Res; 50:120-126.

ACKNOWLEDGEMENTS

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Additional funding was provided by the Department of Indian and Northern Affairs (INAC), Yellowknife, for the salaries of several Inuit trainee-technicians who received formal on-the-job training while assisting us with our field work.

Financial support from the Circumpolar and Scientific Affairs Directorate, INAC, Ottawa made it possible for two Siberian scientists to join our project in Igloolik for 6 weeks in preparation for a replication of the Igloolik study in an analogous village in the Russian Arctic.

We are grateful for the support given by the Science Institute of the Northwest Territories through its excellent facilities at the Igloolik Research Centre. Mr. John MacDonald (the Co-ordinator of the Centre), and his staff were always there when help was needed. We are particularly grateful for the large fibreglass water tank built by Mr. MacDonald and his staff for our total body density measurements. We are also indebted to Mr. MacDonald for some of the community data found in this report.

We also wish to thank Ms Stella Van Rensberg, Director, Health Legislation and Policy, GNWT, for supervising the financial administration of our HWC grant. Finally, we wish to acknowledge Mr. Walter Slipchenko, Director, Circumpolar Affairs, Government of the Northwest Territories, for his assistance and enthusiastic support throughout this project.

SECTION 1. BACKGROUND AND SUMMARIES

Background to the Present Study

The Igloolik Health and Fitness Project has its roots in a comprehensive battery of cross-sectional data collected under the auspices of the Human Adaptability section of the International Biological Program (IBP). The IBP was inaugurated by the International Council of Scientific Unions in 1964 and was completed in 1974. The main focus of the program was defined as "the biological basis of productivity and human welfare" (1). The reason for its establishment was the recognition that the rapidly increasing human population called for a better understanding of the environment as a basis for the rational management of natural resources. The general aims of the Human Adaptability Section were:

a) To make comprehensIve surveys of human adaptability in a wide variety of climates, terrains, and social groups;
b) to increase understanding of the biological basis of adaptation;
c) to study populations undergoing rapid acculturation; and,
d) to apply this knowledge to problems of health and welfare.

We were part of an international team studying indigenous populations in the circumpolar world (2) and our particular project dealt with human growth and development, body composition, and physical fitness; one of us also served as international coordinator of projects relating to human physiological work capacity (3).

The Igloolik Health and Fitness Project

In 1970/71 we accumulated comprehensive baseline data on the fitness, lifestyle, and health of the Inuit living at Igloolik, NWT. At that time, the community could still be regarded as relatively traditional in its reliance upon hunting, trapping, and fishing. Working dogs for teams outnumbered people and the snowmobile was just beginning to make an appearance. Although there had been substantial federal intervention in the region from the mid-1960's, it was not until 1969 that the last families moved from hunting camps into more permanent accommodation in Igloolik. In co-operation with the IBP, the settlement of Igloolik was selected as representative of traditional Canadian Inuit life, and we collected a large body of information using internationally agreed methodology (3).

Because of the quality of data collection, the Canadian Human Adaptability study was a relatively large and expensive undertaking, operating for some five years in what was inevitably a very high-cost environment. To our knowledge there have been no formal follow-up studies to date examining the impact of cultural change upon the baseline state of this population. Nevertheless, in 1980/81 a grant from the Department of Indian and Northern Affairs allowed us to conduct a pilot study to assess the extent of changes in a few selected variables taken from our original 1970/71 study. In 1988 we received a grant from Health and Welfare Canada to repeat our 1970/71 study, making a more comprehensive evaluation of the effects of 20 years of cultural

Cross-sectional studies of available genetic markers and of activity patterns within the community suggest that these characteristics were not due to any constitutional advantage, but rather reflected the high level of habitual physical activity demanded for survival in a hostile environment. Specific sources of energy expenditure included frequent walking over rough terrain, ice, and snow; in the women, daily carriage of young children in the traditional "amauti"; and in the men a high average energy expenditure while hunting (average energy cost of 15 to 16 MJ/day, compared to some 8-10 MJ for the average office worker) interspersed with periods of intense physical exertion.

The practical importance of the physical activity associated with hunting was clearly illustrated by our findings of a negative gradient of physical working capacity and physical fitness from full-time hunters, to partially acculturated Inuit, to the Inuit who had accepted relatively permanent commercial or government employment. There was an average 35% difference of physical working capacity between the most active hunters and the settlement workers.

1980 Summary

In 1980/81 we completed a very useful pilot study, applying a short list of measurements to 344 volunteers aged 9 to 76 years. Of these, 140 Inuit participated in both the 1970/71 and the 1980/81 studies. We found that in 10 years the predicted maximum oxygen intake had decreased by an average of 10 and 12% in men and women respectively. Further evidence that there had indeed been a decline of personal fitness came from a consideration of such variables as body mass, subcutaneous fat, and leg strength (7).

While increases in total body mass were small, the adults showed substantial and highly significant increases in subcutaneous fat over the decade. Both men and women also showed a significant decrease in leg strength. The combination of these factors indicates that there had been a substantial replacement of lean tissue by fat from 1970 to 1980. The only groups that had apparently been spared a deterioration of personal fitness were the young boys and girls of the village. The similarity of the 1980 data for young people to the results observed in 1970 is good evidence that the loss of fitness in the older subjects was a true phenomenon and could not be explained by some undetected methodological error or change of measuring technique which had occurred over the decade.

The results of the 1980 lung function tests were essentially similar to the findings from 1970 (8). However, it was disturbing to note a substantial increase in cigarette consumption, particularly among adolescents and young adults. The proportion of self-reported cigarette smokers among those over the age of 14 years had increased from 64% of males and 85% of females in 1970 to 81% of males and 93% of females in 1980. Moreover, the average daily cigarette consumption by the smokers had risen from 11.8 in the men and 7.4 in the women to 20.2 in the men and 12.0 in the women.

SECTION 2. MAJOR LIFESTYLE AND CULTURAL CHANGES 1970-1990

The population data for Igloolik (Tables 1 and 2, Fig. 1) show some interesting changes from 1970 to 1990, specifically: a) a 40% decrease in the number of children under the age of 5 years; and, b) a 90% increase in people over the age of 65 years.

Material Culture, Lifestyle, and Fitness

Some of the most influential negative changes affecting personal fitness include increased mechanization, decrease in hunting activity, and the arrival of regular television programming and video cassette recorders including home video games such as Nintendo. Positive changes include the construction of infrastructure promoting fitness and sport such as a gymnasium, a swimming pool, and a curling and skating rink.

Mechanization. In 1970 there were only 30-35 snowmobiles in Igloolik. Most of the winter and spring travelling was done by dog team assembled from the 500 or so dogs that were kept by the local hunters. There were approximately 20 motor boats equipped with outboard engines, mostly in the 10-20 HP range. In 1970, there were no private cars, trucks, all-terrain motorcycles (ATC) or bicycles.

By 1990, there were 160-170 snowmobiles, 9 privately owned cars and light trucks, 78 ATC's, and 216 bicycles. In 1990, we counted 90 boats and motors with engines sizes ranging from 40 to 200 HP; most were in the 50 to 90 HP range. In 1990, hunting areas could be reached in a few hours, in contrast to the full day needed for even a short round trip to the floe edge by dog team in 1970. Even very short "trips" between houses, to the local stores, church, school, etc., are now commonly made by snowmobile or ATC. Igloolik supports a successful single vehicle commercial taxi service, even though no house in the village is more than 1000 metres from the centre of town.

A negative and serious side-effect of increased mechanization has been an alarming increase in injuries and deaths due to accidents. Powerful snowmobiles, ATC's, and motorboats have been involved in many serious accidents. In the most recent tragedy, 3 adults and 4 children perished in the summer of 1991 when their motorboat practically disintegrated upon impact with floating ice on a trip from Igloolik to Hall Beach. The size of the motor powering that boat was a major contributing factor to the tragedy.

Increased mechanization has not only decreased the need for physical effort directly, but it has also reduced the need for physical activity in many indirect ways. The replacement of dog teams by snowmobiles is one important example. The care, feeding, and running of a dog team demands much physical work and, at times, intense physical exertion. Providing the large quantities of seal and walrus meat needed to feed a dog team requires much physical effort. A summer walrus kill is only the beginning; subsequently the carcass is butchered (the meat is sewn into its own skin, resulting in "sausages" weighing 50-60 kgs), loaded into boats, and then unloaded and buried in gravel, to be dug up as needed. In winter, the slabs of frozen meat have

In 1990 there were 168 housing units in Igloolik: 133 were managed by the Igloolik Housing Association (a predominantly Inuit group with a white manager and with financial support from the GNWT), 15 were occupied by government employees, and 20 were privately owned houses. Sixteen of the privately owned homes belonged to Inuit. Twenty-two of the 133 Housing Association units were still using the "honey-bucket" system of sewage disposal, but even these had central heating, hot and cold running water and were equipped with a fridge and stove.

Transportation and Communication. In 1970, Igloolik had a recently established Schedule C air service to Iqaluit (Frobisher Bay) twice a week; night landings were tricky on an airstrip lit by oil flares. In 1990, the airport included permanent landing lights controlled from ground or air, local weather advisory for pilots, and a small terminal. There was a class 2 regularly scheduled air service to Iqaluit 5 times a week, to Yellowknife 3 times a week, as well as a service to Nanisivik, Arctic Bay, Pond Inlet, and Hall Beach at least once a week. The aircraft to Yellowknife also served Pelly Bay, Gjoa Haven, Spence Bay and Cambridge Bay.

In 1970, communication with the outside world was by radio-telephone or via one of the HF radios maintained by the Hudson's Bay Company and the Catholic Mission. Communications were uncertain at best, because of the unpredictable atmospheric conditions which dictated reception and/or transmission. In 1990, Igloolik had direct dial telephone access to most of the world via satellite: for example, a telephone call to our colleagues in Novosibirsk, USSR was a direct-dial call from Igloolik that went through in a few seconds. The reverse, incidentally, does not work from Novosibirsk although it is now a simple matter to call Igloolik from anywhere else in the Western world.

Medical Care. In 1970 one Nurse Practitioner and a local interpreter served the community from a well equipped but small (2-trailer) Nursing Station which was designed for out-patient use only. By 1990 Igloolik had a modern five-bed nursing station with a 2-bed pediatric unit. The professional staff included two Nurse Practitioners, a Nurse/Midwife, and an Inuk Health Educator. The Station also included a fully equipped dental clinic staffed by a full-time dentist and assistant, and a small lecture room for health education classes. Physicians and other medical specialists visited Igloolik at least once a month as part of a regular rotating schedule with other settlements.

Education. In 1970 the school in Igloolik taught kindergarten to grade 8, following an English language curriculum developed largely by "experts" outside the Territory. The system was administered from Yellowknife, with little input from parents in the community. By 1990, a locally elected Education Committee participated directly in all decisions affecting education in Igloolik. Today, the school offers classes from kindergarten to grade 12 and the first four years of school are taught in Inuktitut. Attendance in the lower grades is good, but in the final years of schooling does not average more than 65%. Igloolik also has an Adult Education Centre offering academic upgrading and a variety of other more practical courses through its affiliation with Arctic College in Iqaluit. On-site training programs are also conducted by the Igloolik Research Centre, which was opened in 1975.

were virtually unknown among the Inuit. Violence was rare and theft, break-ins, and burglary were practically non- existent. Unfortunately, break-ins and theft are now reported regularly. Shoplifting is reportedly a serious problem for the managers of both the Co-op and Northern stores. By 1990, Igloolik has had its episodes of murder, suicide, rape, and family violence. Substance abuse, particularly among the young, has included practically the whole range of volatile materials and "soft" drugs.

On the positive side, the creation of an Alcohol Education Committee in the mid-1970's introduced a measure of control over the import of alcohol into the community and thus some control over repeat or new offenders. There are no bars or local liquor outlets in Igloolik. Every alcohol order destined to a liquor outlet in Iqaluit or elsewhere in the Territories must be accompanied by a time-limited seal of approval from the Committee or the order cannot be filled. Alcohol imports from other parts of Canada also require a local alcohol permit.

The "police force" of 1970 comprised one white RCMP officer and a Special Constable, an Inuk. Currently, 2 white officers and a Special Constable are much more heavily committed.

Language and Other Influences. In 1970, Inuktittut was the dominant language among the adults of the community. The school and the Hudson's Bay Company store had begun operations around 1930 and 1965 but most of the adults had received little or no formal education. Few understood English, and communication with the non-native community was mainly via informal interpretation by teenagers who had attended residential schools mainly at Chesterfield but some also in Ottawa. By 1990, the majority of young adults were able to speak a useful amount of English.

In 1970, hardly any of the Iglulingmuit had relatives living in the larger centres of the NWT or elsewhere in Canada; moreover, contact with the few that did was limited by relatively poor communications. By 1990, nearly every family in Igloolik had, was related to, or knew someone living in one of the large centres in the NWT or a city in southern Canada. This introduced another direct, and more personal, conduit to the lifestyles, mores, and events of the "outside" world. Today many of the Inuit (particularly those who hold government jobs and thus receive subsidized travel benefits) travel South regularly for holidays and visits with friends and relatives.

In 1970, political activity by the Inuit was limited largely to fielding candidates for the Village and Territorial Councils. Since then, the Inuit have embraced politics more than willingly and used the political system with considerable skill. The recent approval-in-principle for the creation of Nunavut is a testament to that skill.

Table 2. Igloolik 1990. Population by age and sex.

Age Group	Male		Female	
	Number	Per Cent	Number	Per Cent
80-85	1	0.11	1	0.11
80-84	1	0.11	0	0.00
75-79	1	0.11	3	0.32
70-74	5	0.54	3	0.32
65-69	2	0.22	3	0.32
60-64	5	0.54	4	0.43
55-59	8	0.86	7	0.75
50-54	15	1.61	14	1.51
45-49	16	1.72	19	2.04
40-44	18	1.94	12	1.29
35-39	27	2.90	13	1.40
30-34	27	2.90	26	2.80
25-29	42	4.52	36	3.87
20-24	54	5.81	45	4.84
15-19	59	6.34	59	6.34
10-14	62	6.67	74	7.96
5-9	82	8.82	70	7.53
0-4	60	6.45	56	6.02

SECTION 3. METHODS

1. Informed Consent

Only volunteers were tested, in accordance with a protocol approved by the Igloolik Hamlet Council and the University of Toronto Committee on Human Experimentation. As in 1970/71 and 1980/81, all tests and procedures were explained in Inuktittut and/or English and volunteers were asked to sign consent forms (choice of Inuktittut or English) confirming that they understood the procedures and agreeing to participate. In addition to the above, children were required to get written permission from both parents before they were accepted for testing.

2. Questionnaire and Subject Identification.

The questionnaire required information on:

a) Name, age, and date of birth, which was checked against school, government, or Health Centre records.

b) Smoking history, stating age at which smoking started and the approximate daily tobacco consumption.

c) Health history, indicating whether subjects had experienced major illnesses or disease. With the consent of the subjects and the Baffin Regional Health Board, the answers to these questions were verified and amplified as necessary by comparisons with the medical records held at the Igloolik Health Centre.

d) Occupation. All subjects were questioned as to occupation and activity patterns. Hunting activity was verified by independently asking three village elders ("retired" hunters) to indicate which of our subjects were full-time or part-time hunters.

3. Body Composition

a) Height and Body Mass. Height was measured to the nearest 0.5 centimetre and mass to the nearest 0.1 kilogram, using clinical scales calibrated against known standards.

b) Skinfold thickness was measured on the right side of the body, using a Lange skinfold caliper (Cambridge Scientific Instruments). The three sites recommended by the IBP Handbook (10) were measured:

Residual Volume (RV) was calculated from the forced vital capacity (FVC), assuming that the residual volume was approximately 25% of the FVC for males corresponding in age to our sample (20-35 years old). The FVC was measured as described on page 26.

A square water tank (1.3 m x 1.3 m) 1.9 m high was constructed from fibreglass cloth and resin. Once the tank was filled with water, it remained as a closed system. Water was drawn via a pipe from the bottom of the tank by an electric pump, passed through an electric hot water tank, and returned to the bottom of the weighing tank by a second pipe. This re-circulating process was activated by a switch as required to maintain the water temperature in the range of 30-32 degrees centigrade. Commercial swimming pool disinfectant was added at the intervals and dosages recommended by the manufacturer.

Standard construction scaffolding was erected surrounding and extending about one meter above the tank and a wooden deck was built around the top of the tank. A ladder was fastened to an inside wall of the tank, reaching from the bottom of the tank to the top of the deck and extending to the top of the scaffolding where it was also secured. Centred over the tank and spanning the top of the scaffolding was a wooden bean (10cm x 10cm and 2.5 m long) from which we suspended the scale and the subject-weighing chair. The "chair" was a simple swing, constructed from lightweight aluminum and consisting of a seat (60 cm x 18 cm x 1 cm), two uprights (120 cm x 4 cm x 2 mm) and a crosspiece (60 cm x 4 cm x 1 cm) at the top. An eyehook provided the link to a small lightweight block and tackle and the autopsy scale. The submerged weight of this assembly was 2.11 kg.

The underwater weighing procedure was as follows:

a) The subject climbed down the ladder into the tank until he was neck deep in water.

b) He was asked to squeeze out any air that was trapped in his swimming trunks.

c) He was then asked to duck under water and squeeze out any air trapped in his hair.

d) While still on the ladder, the subject practised ducking under water, exhaling fully, and surfacing at our signal of several sharp raps on the side of the tank. After several such practice trials, the subject transferred to the weighing swing which was suspended from a chain 10 cm beside the scale. This was a "holding" position. The height of the swing was then adjusted, so that the seated subject was neck-deep in water.

e) The swing and subject were then moved by the experimenter and suspended from the weighing scale; the height of the swing was again adjusted until the seated subject was chin-deep in water, with his hands below the water line, holding the sides of the swing.

c) the items were rinsed in running water and dried overnight at 70-80° C in a drying oven.

Eight sets of valve boxes and connecting tubing were required to maintain a rotation which allowed the testing of 6-8 subjects a day.

6. Lung Function

The one-second forced expiratory volume (FEV), maximum mid- expiratory flow rate (FMF), and forced vital capacity (FVC) were measured using a 13.5 litre Stead-Wells spirometer, fitted with a lightweight bell. Seated subjects were allowed two practise attempts, followed by three definitive trials. Results were reported as the average of three good trials.

Disposable mouthpieces and noseclips were used and connecting tubing was sterilized as described above. As an additional precaution, active sterilizing agent was added to the water seal around the bell. The equipment was routinely dismantled and cleaned, and the water seal was replaced at least once a week (more frequently when the testing schedule allowed).

7. Hemoglobin Levels

The international cyanmethemoglobin method was used (8,9). Samples of capillary blood (20ul) were transferred immediately to Drabkin's reagent, and the optical density was read by spectrophotometer at 540mu, results being related to standard preparations purchased from a scientific supply company.

SECTION 4. BODY COMPOSITION, STRENGTH, AND FITNESS IN ADULTS

Anthropometry and Strength in Men

Tables 3 to 8 summarize the cross-sectional changes (1970-1990) in body mass, subcutaneous fat, and grip and leg extension force for men aged 17-79 years. These changes are shown graphically in Figures 2 to 5.

No significant changes in stature were seen from 1980 to 1990 and the secular trends in height reported from cross-sectional analysis of the 1970 data (4) appear to have ceased. Comparing subjects from the same age group in 1970 and 1990 all the men showed changes in body mass. although none of the differences were statistically significant. However, taken together with the changes in subcutaneous fat and muscle force, the changes of body mass show interesting trends in all age groups.

The very small gain of body mass (0.3 kg or less than 0.5%) in the men aged 17-19 years was statistically insignificant, but this group showed highly significant changes in subcutaneous fat and strength. There was a 11.1 mm or 63% increase ($p<0.001$) in total skinfold thickness. Grip force was lower by 53.4 N or 12% ($p=0.027$) and leg extension force was lower by 293.3 N or 37% ($p<0.001$). Taken together, these changes (stable body mass, increased fat, and diminished muscle force) indicate that there has been a substantial replacement of muscle mass by fat. The men aged 20-39 years showed a similar but more distinct trend. In this group, there was a decrease in body mass combined with a substantial increases in subcutaneous fat and a significant decrease in muscle force. In the men aged 20-29 years, mass decreased by 2.3 kg or 3.4%, accompanied by a highly significant ($p<0.001$) increase in total skinfold thickness of 14.B mm, or 87%. Grip force decreased by 38.1 N, or 8% ($p=0.018$) and leg extension force fell by 327.8 N, or 37% ($p<0.001$).

The men aged 30-39 years exhibited a similar mass loss, fat increase, strength loss pattern. For the 30 year olds, the mass loss was 3.0 kg or 4.5%, with an increase in total skinfold thickness of 14.0 mm or 74% ($p=0.002$). Grip force diminished by 33.2 N, or 7% and leg force fell by 289.8 N, or 35% ($p<0.001$).

The men aged 40-79 years showed a somewhat different pattern, but the overall trend to increased fat and decreased strength was essentially similar to the 17-39 year old men. After the age of 40 years the men showed the more common combination of increases in both mass and subcutaneous fat. The 40-49 year old men showed a gain in mass of 6.7 kg, or 10% accompanied by an increase in total skinfold thickness of 30.6 mm, or 188%. Grip force showed an anomalous 28.2 N, or 7%, increase, but the drop in leg force was consistent with the losses in other age groups, showing an 18% decrease of 107.9 N. In the 50-59 year old men, the gain in mass was 3.0 kg, or 4%, together with a 23.5 mm or 100% increase in total skinfold thickness. Grip force decreased by 89.1 N or 23% ($p=0.006$) and leg extension force fell by 294.2 N, or 38% ($p=0.005$).

Table 3. Anthropometry and strength in men aged 20-29 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	24.5 3.2 34	24.2 2.6 38	24.6 2.6 70
HEIGHT (cm)	166.1 5.0 34	164.9 6.5 38	164.3 5.0 70
BODY MASS (kg)	67.3 7.4 34	64.7 6.9 38	65.0 6.8 70
SUM 3 SKINFOLDS (mm)	16.6 4.9 34	21.4 # 9.3 38	31.1 #* 15.7 69
HAND GRIP FORCE (Newtons)	493.6 69.4 34	521.5 67.0 38	455.5 #* 79.2 70
LEG EXTENSION FORCE (Newtons)	884.2 167.9 34	751.3 # 166.4 38	556.4 #* 148.1 69

Values shown are means, standard deviations, and sample sizes.

Significantly different from 1970 (#); from 1980 (*).

Table 5. Anthropometry and strength in men aged 40-49 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	43.7 2.8 8	44.8 2.8 18	45.0 3.4 16
HEIGHT (cm)	163.5 2.5 8	164.6 6.2 18	162.7 4.1 16
BODY MASS (kg)	67.7 7.3 8	72.8 13.1 18	74.4 10.6 16
SUM 3 SKINFOLDS (mm)	16.3 3.6 8	30.2 # 22.5 18	46.9 # 30.9 16
HAND GRIP FORCE (Newtons)	413.3 51.5 8	457.8 80.6 18	441.5 92.1 16
LEG EXTENSION FORCE (Newtons)	707.6 118.6 8	668.2 131.9 18	599.7 # 123.2 16

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#).

Table 7. Anthropometry and strength in men aged 60-69 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	66.1 5.6 2	64.0 2.0 6	65.3 3.4 7
HEIGHT (cm)	162.5 7.8 2	161.9 6.9 6	159.7 4.1 7
BODY MASS (kg)	67.4 1.6 2	70.4 17.6 6	69.6 12.6 7
SUM 3 SKINFOLDS (mm)	33.0 1.4 2	25.8 13.4 6	37.4 24.2 7
HAND GRIP FORCE (Newtons)	323.7 111.0 2	359.7 84.8 6	235.4 * 53.2 7
LEG EXTENSION FORCE (Newtons)	789.7 367.7 2	625.9 103.7 5	437.2 100.4 7

Values shown are means, standard deviations, and sample sizes.

Significantly different from 1980 (*).

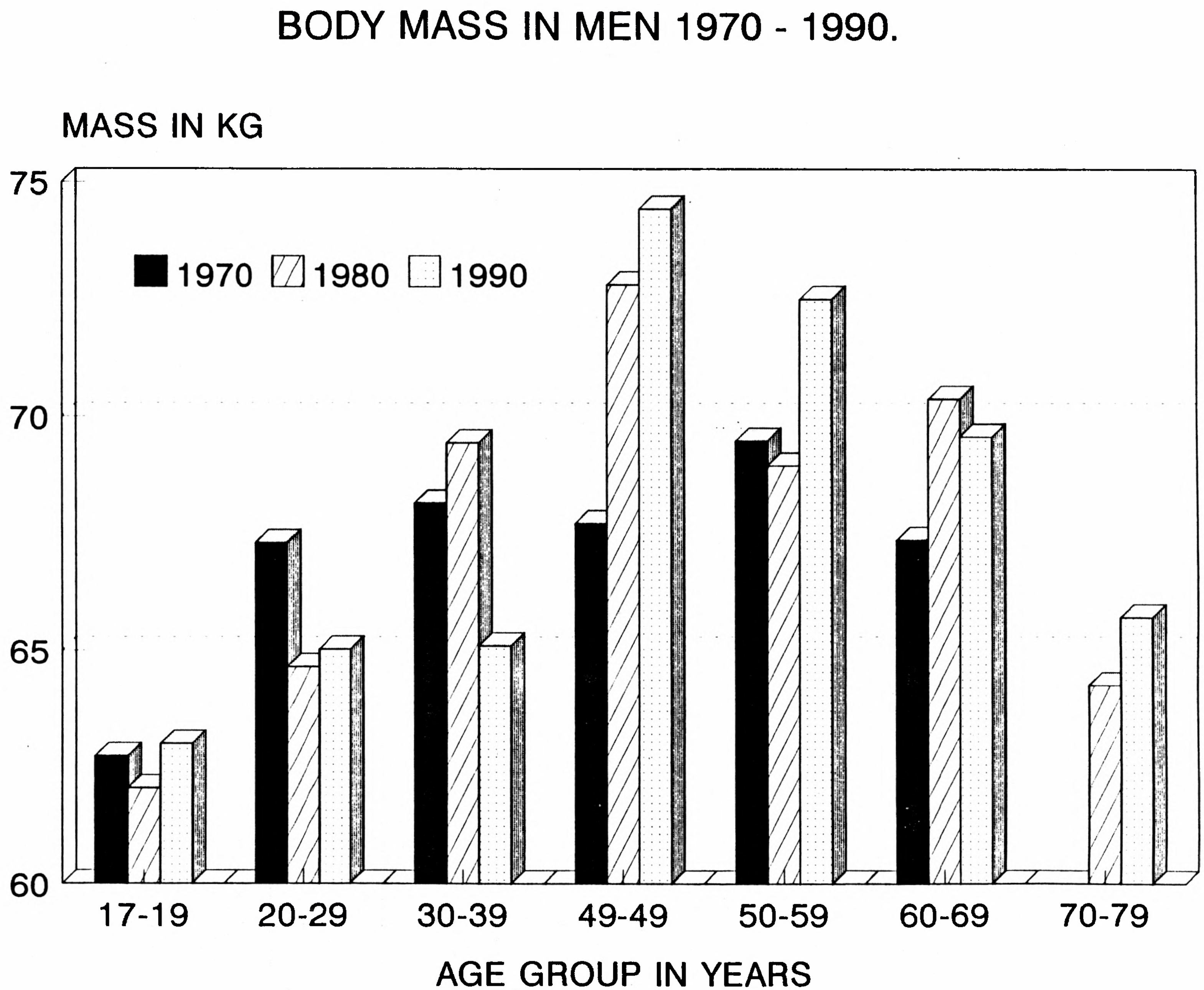

Figure 2. Body mass in men aged 17 - 79 years.

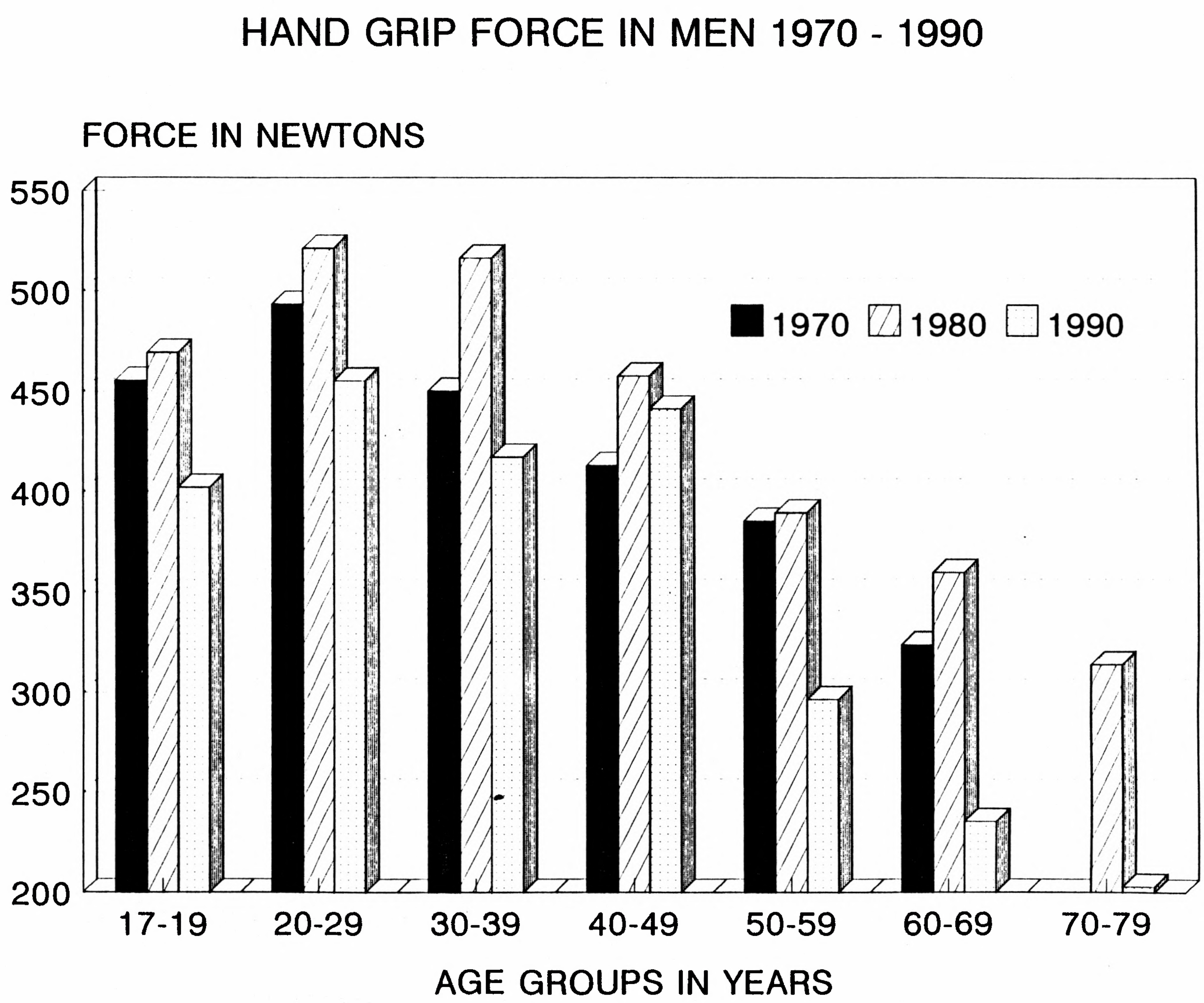

Figure 4. Dominant grip strength in men aged 17 - 79 years.

Anthropometry and Strength in Women

The cross-sectional changes (1970-1990) in women for weight, subcutaneous fat and strength are summarized in tables 9 to 13 and the corresponding graphs are illustrated in figures 6 to 9.

Comparing data for subjects of similar age in 1970 and 1990, the youngest women (17-19 years) show the smallest changes in mass with an increase of 0.5 kg (1%) accompanied by a significant ($p=0.002$) increase in subcutaneous fat of 21.3 mm (73%). These young women showed a highly significant ($p<0.001$) decrease in grip force of 78.1 N (29%). Decreases in leg extension force were also highly significant ($p=0.001$) with losses of 202.4 N (33%).

As in the men, the 20-29 year old women exhibited a decrease in body mass accompanied by a substantial increase in subcutaneous fat and a significant loss of strength. The loss of mass in these women was 2.2 kg (4%) together with a highly significant ($p<0.001$) increase in total skinfold thickness of 19.7 mm (77%). The losses in strength were also highly significant ($p<0.001$) with grip and leg forces falling by 56.4 N (20%) and 263.6 N (40%) respectively.

The women aged 30-69 years showed a slightly different pattern of change, but the overall trend to increased fat deposits and losses in strength were similar to those seen in the younger women. After age 30, (a decade earlier than in the men) the women showed the more common combination of increased weight accompanied by increased subcutaneous fat, as opposed to the weight losses and fat gains seen in the 20 year old women.

In the 30-39 year old women, gains in body mass were relatively small (1.5 kg or 3%), but they were accompanied by large (36.6 mm or 132%) and highly significant ($p<0.001$) increases in subcutaneous fat. Losses in strength were also highly significant. Respective losses in grip and leg force were 53.4 N, or 19%, ($p=0.004$) and 241.1 N, or 37% ($p<0.001$).

The 40-49 year old women followed a similar pattern of weight gain, fat accumulation, and strength loss. A significant ($p=0.008$) gain in mass of 11.2 kg (20%) was accompanied by a highly significant ($p<0.001$) increase of 64.4 mm (307%) in total skinfold thickness. Grip force decreased significantly ($p=0.034$) by 55.1 N, or 21% and there was a highly significant ($p<0.001$) loss in leg force of 262.8 N, or 41%.

The 50-59 year old women showed a substantial but statistically insignificant gain in body mass of 9.8 kg (16%), together with a large but marginally significant ($p=0.061$) increase in subcutaneous fat of 47 mm (82%). Strength losses were highly significant ($p<0.001$) with grip and leg forces decreasing by 80.4 N (31%) and 314.1 N (45%), respectively.

The oldest group of women (60-69 years) showed losses in body mass, fat, and strength. Respective decreases in mass and fat of 3.6 kg (6%) and 3.3 mm (4%) were statistically insignificant. Grip force fell significantly ($p=0.005$) by 81.0 N or 42% and leg force showed an insignificant 11% decrease of 44.1 N.

Table 10. Anthropometry and strength in women aged 30-39 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
AGE (yr)	33.5 2.6 12	35.2 3.2 23	34.5 2.6 16
HEIGHT (cm)	155.3 4.8 12	153.3 4.6 23	153.8 5.5 16
BODY MASS (kg)	57.6 7.1 12	59.7 6.9 23	59.1 11.6 16
SUM 3 SKINFOLDS (mm)	27.7 19.1 12	44.4 # 16.8 22	64.3 #* 26.4 16
HAND GRIP FORCE (Newtons)	279.6 39.3 12	283.2 42.8 23	226.2 #* 48.4 16
LEG EXTENSION FORCE (Newtons)	643.3 159.0 12	526.8 # 131.2 23	402.2 #* 83.0 15

Values shown are means, standard deviations, and sample sizes.

Significantly different from 1970 (#); from 1980 (*).

Table 12. Anthropometry and strength in women aged 50-59 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	54.5 3.5 6	54.9 3.0 6	54.1 3.1 12
HEIGHT (cm)	150.7 1.2 6	150.5 4.3 6	150.8 3.9 12
BODY MASS (kg)	62.4 11.5 6	54.3 5.7 6	72.2 * 20.0 12
SUM 3 SKINFOLDS (mm)	57.0 37.4 5	33.7 22.6 6	104.0 # 45.5 12
HAND GRIP FORCE (Newtons)	257.0 21.3 5	220.7 # 32.1 6	176.6 #* 42.1 12
LEG EXTENSION FORCE (Newtons)	692.6 54.1 5	416.9 # 51.1 6	378.5 # 110.3 12

Values shown are means, standard deviations, and sample sizes.

Significantly different from 1970 (#); from 1980 (*).

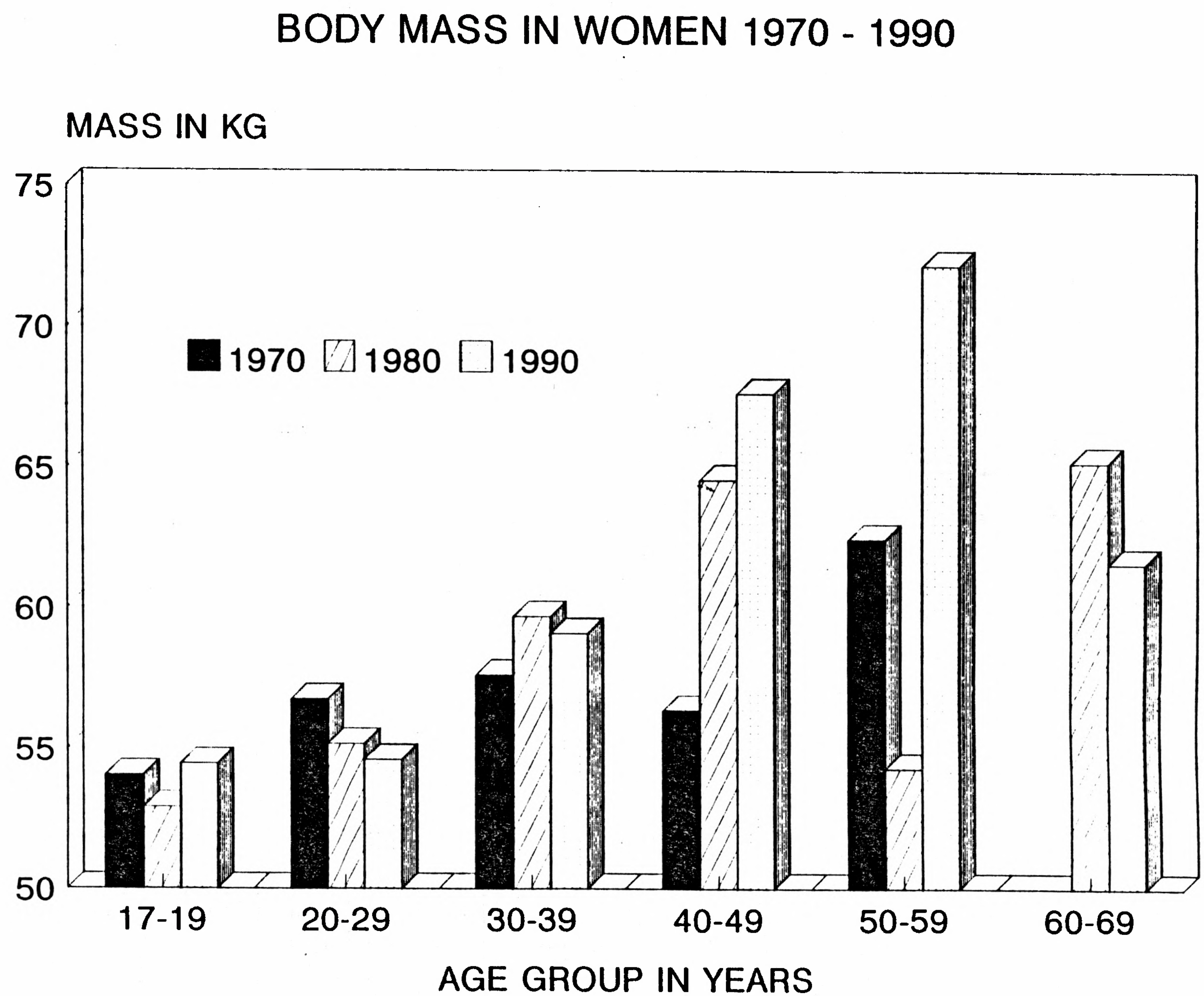

Figure 6. Body mass in women aged 17 - 69 years.

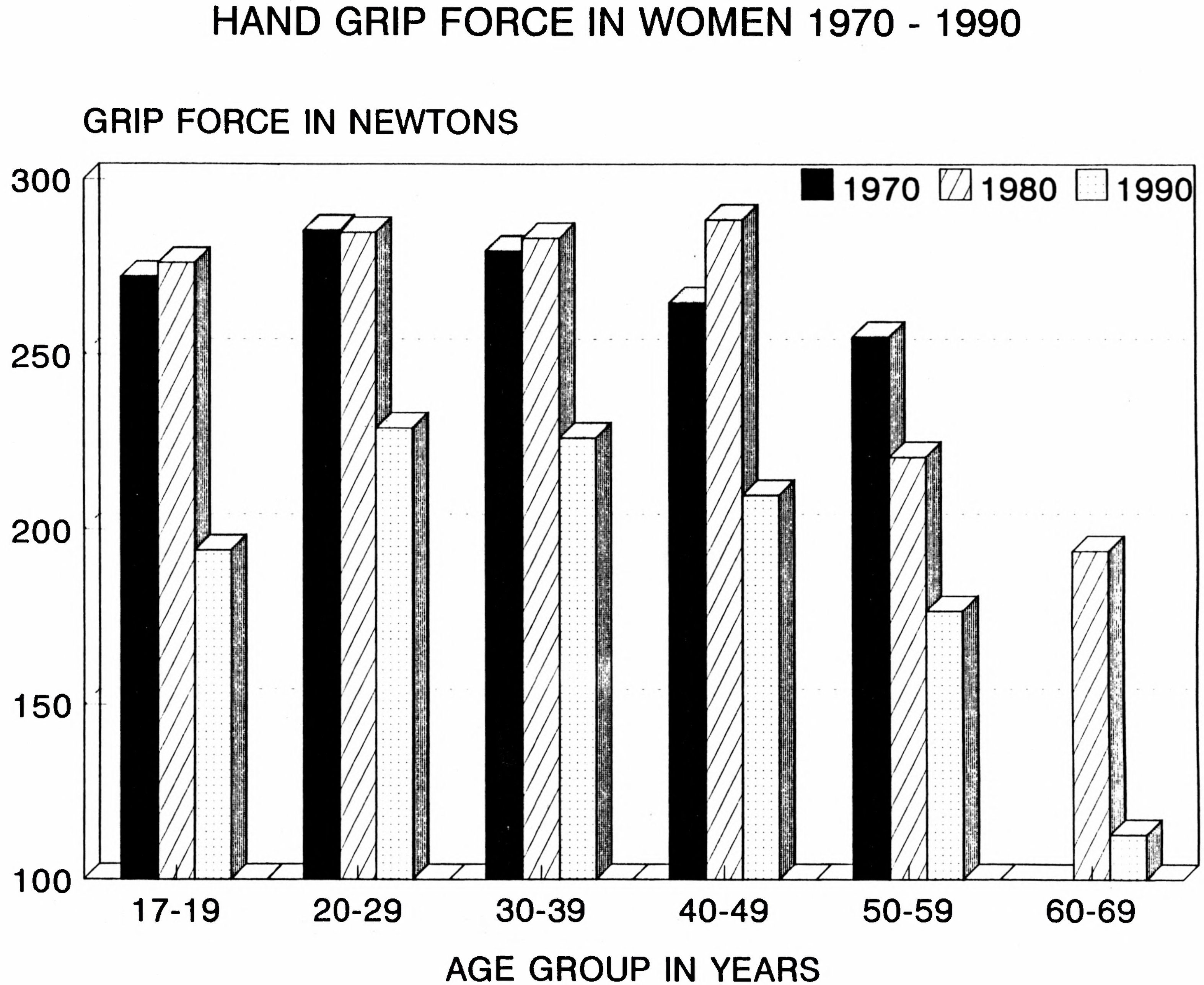

Figure 8. Dominant hand grip strength in women 17 - 69 years.

Body Density and Total Body Fat in Men

Fifty-one men aged 18-36 years were weighed under water, in order to determine body density and total body fat. Summary data (Table 14) describes body mass, subcutaneous fat totals, body density, and the percent body fat. Table 15 shows the regression equations that we developed for the prediction of body density (and hence the % body fat) from skinfold measurements, together with the equations previously developed by Durnin and Womersley (15) for a white population of comparable age. Table 15 also shows the results of predictions using total skinfold thicknesses of 15, 25, and 35 mm to estimate the body density and the % fat in the Inuit men and comparable groups of Caucasian men.

It has been shown (15) that one of the best estimates of body density from skinfold totals is obtained using a linear regression of body density against the logarithm of the total skinfold thickness. We therefore formulated linear regression equations to estimate body density from the logarithm of the sum of three skinfolds:- the triceps, the subscapular, and the suprailiac fold. The prediction equation has the general form:

$$Density = K - b(Log \sum 3 Skinfolds)$$

The constants K and the slope b for Inuit of different ages and the prior results for comparable samples of Caucasian men are shown in Table 15.

The prediction equation for 18-19 year old Inuit men is very similar to that of the Caucasian men aged 17-19. However, the body densities of 20-29 year old Inuit men are lower than in white men at skinfold totals of 15 and 25 mm, suggesting that a larger proportion of total body fat is carried internally by the Inuit men than by the Caucasians or that the bone density is lower in the Inuit. At higher skinfold totals (35 mm) this difference is not evident. At skinfold totals of 15 and 25 mm, the total body fat of Inuit men aged 20-29 years as predicted by the newly established formula and by Siri's equation (11) was 11.0 and 14.1 % respectively. For Caucasian men of comparable age, the predicted total body fat is 6.3 and 12.1 % at skinfold totals of 15 and 25 mm respectively. At skinfold totals of 35 mm, the predicted total body fat is 16.1 and 16.0 % for 20-29 year old Inuit and Caucasian men respectively.

For Inuit men aged 30-36 years, the predicted total body fat for a given skinfold total is higher than in a comparable group of 30-39 year old Caucasian men. At skinfold totals of 15, 25, and 35 mm the predicted values for total body fat in Inuit men are 12.3, 18.4, and 22.5 % respectively; for Caucasian men aged 30-39, the predicted values of fat at the same skinfold thicknesses are 10.3, 15.5, and 19.1 % respectively.

The values for total body fat in 18-19 year old men (average 14.8% as in Table 14) appear to be very low, given an average skinfold total of 38.2mm for that group. This somewhat anomalous result is due to the small (N = 5) and highly skewed distribution of body composition in that group:- the skinfold totals for the five subjects were 14, 17, 19, 51, and 90 mm corresponding to respective densities of 1.0826, 1.0845, 1.0743, 1.0592, and 1.0270 g/cc.

Table 15. Regression equations for estimating body density from total skinfold thickness in Inuit men with comparable data for Caucasian men.

$$Density = K - b(Log\Sigma 3 Skinfolds)$$

AGE GROUP (years)	EQUATION	SUM OF 3 SKINFOLDS (mm)	DENSITY (g/cc)	PERCENT FAT
18-19	K = 1.1609 b = -0.0652	15 25 35	1.0842 1.0698 1.0603	6.6 12.7 16.9
20-29	K = 1.1111 b = -0.0318	15 25 35	1.0737 1.0667 1.0620	11.0 14.1 16.1
30-39	K = 1.1444 b = -0.0627	15 25 35	1.0707 1.0568 1.0476	12.3 18.4 22.5
(Durnin) 17-19	K = 1.1555 b = -0.0607	15 25 35	1.0841 1.0707 1.0618	6.6 12.3 16.2
(Durnin) 20-29	K = 1.1575 b = -0.0617	15 25 35	1.0849 1.0713 1.0622	6.3 12.1 16.0
(Durnin) 30-39	K = 1.1393 b = -0.0544	15 25 35	1.0753 1.0633 1.0553	10.3 15.5 19.1

Data for white men from Durnin and Womersley (15).

Table 16. Lung function and predicted aerobic power (VO2max) in men aged 20-29 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
FORCED EXPIRATORY VOLUME (LITRES, BTPS)	3.99 0.55 33	4.34 # 0.47 38	4.43 # 0.56 69
FORCED VITAL CAPACITY (liters, BTPS)	5.09 0.53 33	5.27 0.61 38	5.36 # 0.63 69
FEV/FVC (%)	78.4 6.9 33	82.6 5.2 38	82.8 # 4.8 69
FORCED MID-EXPIRATORY FLOW (l/sec, BTPS)		4.65 0.92 37	4.79 1.03 69
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	3.92 0.78 34	3.43 # 0.53 38	3.31 # 0.56 69
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	58.4 10.1 34	53.2 # 6.7 38	51.1 # 8.8 69
HEMOGLOBIN (g/l)	159.5 8.9 32	157.5 9.0 37	159.0 8.4 64

Values shown are means, standard deviations, and sample sizes.

Significantly different from 1970 (#).

Table 18. Lung function and predicted aerobic power (VO2max) in men aged 40-49 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
FORCED EXPIRATORY VOLUME (Litres, BTPS)	3.23 0.78 8	3.34 0.70 18	3.34 0.61 16
FORCED VITAL CAPACITY (liters, BTPS)	4.41 0.88 8	4.43 0.73 18	4.12 0.56 16
FEV/FVC (%)	72.8 6.7 8	75.3 8.3 18	81.0 6.7 16
FORCED MID-EXPIRATORY FLOW (l/sec, BTPS)		3.16 1.37 18	3.49 1.26 16
PREDICTED AEROBIC POWER, V02max (l/min, STPD)	3.52 0.72 8	3.20 0.61 17	3.06 0.46 16
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	51.6 5.8 8	45.1 # 7.9 17	41.5 # 6.4 16
HEMOGLOBIN (g/l)	153.6 7.4 8	158.2 6.9 17	149.2 6.0 10

Values shown are means, standard deviations, and sample sizes.

Significantly different from 1970 (#).

Table 20. Lung function and predicted aerobic power (VO2max) in men aged 60-69 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
FORCED EXPIRATORY VOLUME (Litres, BTPS)		2.99 0.25 6	2.57 0.44 7
FORCED VITAL CAPACITY (Liters, BTPS)		4.08 0.32 6	3.37 0.54 7
FEV/FVC (%)		73.5 3.67 6	76.3 4.11 7
FORCED MID-EXPIRATORY FLOW (l/sec, BTPS)		2.50 0.39 6	2.34 0.75 7
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	2.56 0.75 2	2.38 0.59 6	2.34 0.56 6
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	37.9 10.3 2	34.7 9.7 6	33.9 5.0 6
HEMOGLOBIN (g/l)		150.0 6.5 6	142.0 9.6 7

Values shown are means, standard deviations, and sample sizes.

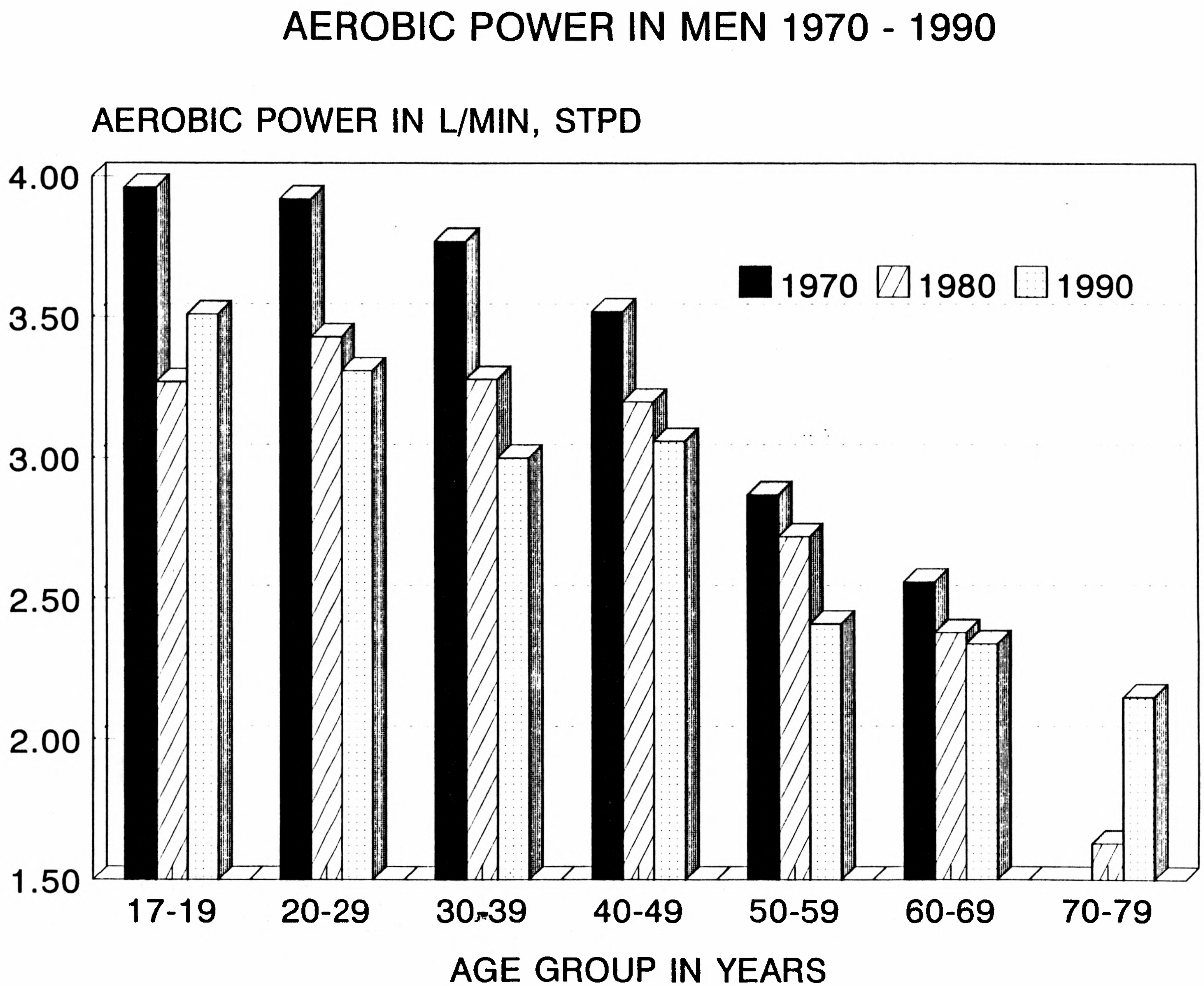

Figure 10. Absolute aerobic power in men aged 17 - 79 years.

Aerobic Power in Women

The cross-sectional changes in aerobic fitness in women aged 17-19 years are summarized in Tables 22 to 26 and Figures 12 and 13 illustrate the differences.

Comparing subjects of similar age in 1970 and 1990 (Figures 12 and 13), we can see that the pattern of changes in the women is similar to that seen in the men: - with the exception of the 60-69 year old women, all other age groups from 17-59 years showed substantial decreases of absolute and relative aerobic power from 1970 to 1990.

The 17-19 year old women showed a significant ($p=0.032$) 14% decrease in absolute aerobic power of 0.36 l/min. There was a similar and significant ($p=0.024$) 15% loss of relative power of 7.5 ml/kg.min.

The 20-29 year old women showed similar losses of aerobic fitness, with a highly significant ($p<0.001$) 19% decrease of 0.51 l/min in absolute terms; and a highly significant ($p<0.001$) 15% loss of 7.1 ml/kg.min in relative power.

Losses in aerobic power in the 30-39 year old women were even more marked. Absolute power showed a significant ($p=0.003$) 23% decrease of 0.60 l/min and relative values had a highly significant ($p<0.001$) 16% loss of 11.1 ml/kg.min.

The 40-49 year old women followed a similar pattern, with a 10% decrease of 0.23 l/min (statistically not significant) in absolute power and a highly significant ($p=0.002$) 25% loss of 10.1 ml/kg.min in relative values.

The decreases in fitness in the 50-59 year old women were very similar to those of the 40-49 year olds: - absolute power showed an insignificant 16% decrease of 0.36 l/min, whereas relative aerobic power showed a highly significant ($p=0.001$) 24% loss of 8.7 ml/kg.min.

We did not test any 60-69 year old women in 1970, but in 1980 and 1990 there were 3 and 2 volunteers respectively in that age range.

From 1980 to 1990 the absolute aerobic power in 60-69 year old women remained essentially unchanged at 2.07 vs. 2.09 l/min respectively. Relative power showed a small but insignificant increase, with values of 31.3 and 34.0 ml/kg.min for 1980 and 1990 respectively.

Table 23. Lung function and predicted aerobic power (VO2max) in women aged 30-39 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
FORCED EXPIRATORY VOLUME (Litres, BTPS)	2.69 0.50 17	3.05 # 0.51 23	3.12 # 0.55 16
FORCED VITAL CAPACITY (liters, BTPS)	3.50 0.54 17	3.80 0.56 23	3.66 0.52 16
FEV/FVC (%)	76.9 7.6 17	80.3 6.5 23	85.0 #* 5.6 16
FORCED MID-EXPIRATORY FLOW (l/sec, BTPS)		3.18 1.06 23	3.84 1.19 16
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	2.66 0.47 12	2.30 # 0.39 22	2.06 # 0.50 16
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	46.3 6.3 12	38.8 # 6.0 22	35.2 # 6.8 16
HEMOGLOBIN (g/l)	144.4 7.1 17	145.2 8.8 22	140.8 10.9 14

Values shown are means, standard deviations, and sample sizes.

Significantly different from 1970 (#); from 1980 (*).

Table 25. Lung function and predicted aerobic power (VO2max) in women aged 50-59 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
FORCED EXPIRATORY VOLUME (Litres, BTPS)	2.34 0.47 5	1.82 # 0.28 6	1.90 0.58 12
FORCED VITAL CAPACITY (Liters, BTPS)	3.13 0.45 5	2.51 # 0.23 6	2.53 # 0.50 12
FEV/FVC (%)	74.6 6.8 5	72.2 7.3 6	74.1 11.4 12
FORCED MID-EXPIRATORY FLOW (l/min, BTPS)		1.43 0.54 6	1.77 1.00 12
PREDICTED AEROBIC POWER, V02max (l/min, STPD)	2.31 0.46 5	1.79 0.34 5	1.95 0.56 12
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	36.4 2.0 5	33.5 3.8 5	27.7 #* 6.7 12
HEMOGLOBIN (g/l)	140.4 6.4 5	148.2 8.9 5	148.0 7.3 9

Values shown are means, standard deviations, and sample sizes.

Significantly different from 1970 (#); from 1980 (*).

AEROBIC POWER IN WOMEN 1970 - 1990

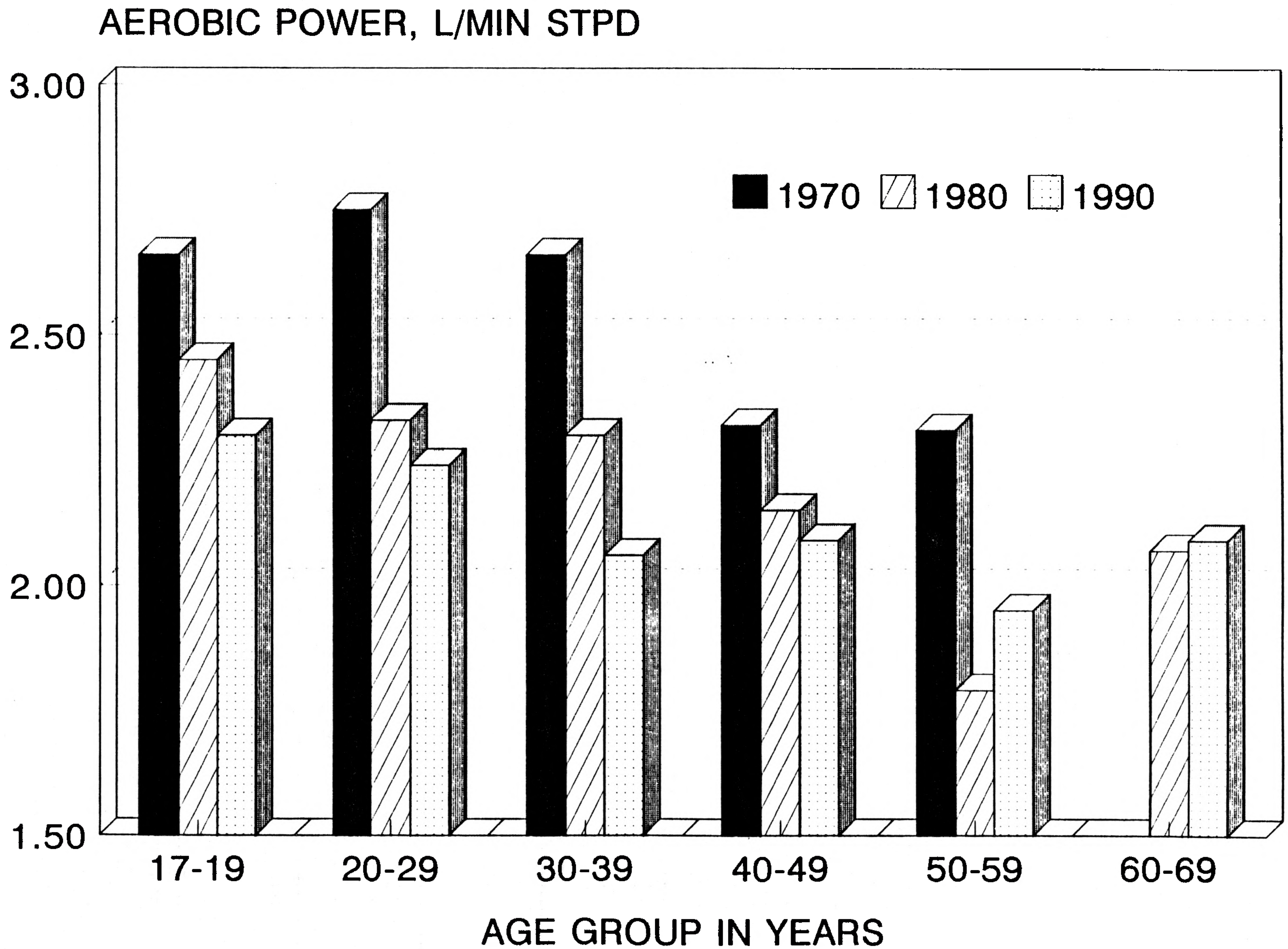

Figure 12. Absolute aerobic power in women aged 17 - 69 years.

Right-Branch Bundle Block in Iglulingmuit

Prevalence of right-branch bundle block. In 1970, Hildes and his medical team (16) reported the prevalence of right-branch bundle block (RBBB) for the Igloolik community as 30% in men and 13% in women; abnormal records were noted in a total of 25 of the 115 subjects on whom they obtained resting electrocardiograms. In keeping with the view that their sample was biased towards the sickest segment of the Igloolik community (2), only 13 of the 25 subjects identified as having RBBB volunteered for our fitness testing sessions. In six of these cases, the resting heart block was complete, and in the remaining seven cases it was incomplete. It would appear from these two samplings of the adult population (by the physicians and physiologists respectively) that in 1970 the true prevalence of RBBB at Igloolik was 25/500, or 5% of the subjects, rather than the 25/115 reported by Hildes et al (1). The apparent prevalence dropped further, to about 2.6%, in those volunteering for exercise testing. As might be anticipated, the anomaly was particularly apparent in resting leads AVR, V4R, V1, and V2. The physiologists uniformly recorded their electrocardiograms from CM5 leads, giving a signal which approximates the unipolar V5 lead in overall appearance. Perhaps in part for this reason, only two subjects showed definite RBBB during the fitness testing sessions, although in three others there was a suspicion of QRS broadening or notching, for a total of 5 of the 13 detected on the 12-lead tracing.

In 1980 there were again 5 individuals where the CM5 exercise records showed RBBB, but in 1990 the number had risen to a surprising 29 (19 men and 10 women, 8.3% of those undergoing exercise testing).

Correlates of RBBB. Our findings are summarized in Table 27 and 28. In 1980, four of the five subjects with RBBB were men over the age of 50 years, the exception being a boy of 15 years who had undergone cardiac surgery as a baby (Table 27). However, the age distribution of the subjects with RBBB had changed greatly by 1990, with 17 of the 29 cases (12M, 5F) being under 40 years of age; only 7 men and 5 women were 40 years of age or older.

In 1980, the average skinfold thickness for the 5 men with RBBB was only 7.2 mm, all of the individuals concerned being extremely thin. However, by 1990 the average skinfold reading had risen to 14.3 mm in the men and 20.7 mm in the women with RBBB. Taking as an arbitrary optimum of body fat an average reading of 11 mm in the men and 15 mm in the women, 9 of the 19 men and 7 of the 10 women would now be classed as having an excess of body fat, and some were extremely obese.

In 1980, the FEV and FVC of those with RBBB averaged 2.44 and 3.29 litres respectively, a ratio of 0.742. Based on the prediction equations of Anderson et al (17), normal values for height (average 161.3 cm) and age (average 53 years) would have been somewhat higher, at 2.90 and 3.95 litres respectively, with a ratio of 0.734; however, the deficit in lung volume is attributable almost entirely to very low values in one subject. In 1990, the corresponding figures were 3.64/4.32, ratio 0.843, in men of average height 159.5 cm and average age 32.8 years (anticipated normal values 3.54 and 4.20 litres, ratio 0.843); and 2.82/3.32, ratio 0.849, in women of average height 149.1 cm and average age 37.3 years (anticipated normal values 2.19/2.61 litres, ratio 0.839). Moreover, in the 1990 survey, only one man (aged 63 years) showed a low FMF (1.29

Table 27. Physiological correlates of right-branch bundle block. Data for Inuit tested in 1980 and 1990.

Subject	QRS Duration (msec)	Age (yr)	Sum of 3 Skinfolds (mm)	FEV (Litres)
1980 Males				
1	112	80	34	2.29
2	112	62	19	3.21
3	84	51	12	0.78
4	92	59	28	2.31
5*	132	15	15	3.59
1990 Males				
2	140	72	30	2.51
4	76	68	49	2.74
5*	140	24	23	4.46
6	112	42	129	3.61
7	40	63	13	2.07
8	68	30	29	3.97
9	68	29	79	4.98
10	84	41	45	4.03
11	76	41	35	4.12
12	56	26	43	4.25
13	72	18	63	4.19
14	84	47	51	3.46
15	76	29	77	4.07
16	76	16	24	5.00
17	80	20	40	3.63
18	68	13	16	2.69
19	72	18	19	3.71
20	48	12	20	2.17
21	120	14	29	3.42
1990 Females				
22*	68	41	25	2.45
23	52	66	29	1.86
24	60	30	46	3.74
25	60	35	50	2.81
26	56	47	98	1.64
27	64	47	92	3.03
28	44	19	68	3.72
29	52	50	102	2.63
30	60	20	43	3.16
31	52	18	69	3.19

* Cardiac operation as a child

SECTION 5. DYNAMIC LUNG VOLUMES

Cross-sectional data comparing the lung function of men aged 17-79 in 1970 and 1990 are summarized in Tables 29 to 31 and the results are shown graphically in Figures 14 to 16. The corresponding data for women can be seen in Tables 32 to 34 and Figures 17 to 19.

Multiple regression analysis of cross-sectional data was used to develop equations for the prediction of forced vital capacity (FVC), forced expiratory volume (FEV), and forced mid-expiratory flow (FMF) from age and height. The equations for men (1970, 1980, and 1990) aged 20-60 years - with and without a history of respiratory disease - are shown in Tables 35, 36, and 37, together with the predicted values at ages 20 and 60 years for a typical Inuit man of 165 cm height. Equations for women aged 20-60 are shown in Tables 38, 39, and 40, together with the calculated values at ages 20 and 60 years for a woman 155 cm in height.

Lung Volumes in Men

a) Forced Vital Capacity

From 1970 to 1990, forced vital capacity (FVC) increased in the three youngest age groups, 17-39 years, and decreased in the older men 40-79 years. The 17-19 year old men showed an insignificant 2.5% increase of 0.13 litres. Men aged 20-29 years had a significant (p=0.036) 5.3% increase of 0.27 litres and the 30-39 year old group showed an insignificant increase of 0.02 litres (0.4%).

In 40-49 year old men, the FVC decreased insignificantly, by 0.29 litres or 6.6%. The FVC in 50-59 year old men decreased significantly (p=0.026), by 0.81 litres (18%). The average decrease in 60-69 year old men was also significant (p=0.017), with a 17% loss of 0.71 litres. The oldest men, 70-79 years showed an insignificant 8.6% decrease of 0.33 litres.

FVC Regression Analysis

The regression analysis of FVC data showed a pattern of improved lung volumes in the young men and decreases of FVC in the 60 year old men. The ageing coefficient increased by 217%, from 16.5 ml/year in 1970 to 52.3 ml/year in 1990. This reflected the changes seen in the age-grouped statistics (Tables 16-21), where the 20-29 year old men showed a significant (p=0.036) improvement in FVC and the 50-59 year old men had a significant (p=0.026) decrease.

b) Forced Expiratory Volume

From 1970 to 1990, the one second forced expiratory volume (FEV) increased in the four age groups from 17-49 years but decreased in the three older groups, 50-79 years. In the youngest men, 17-19 years, the 4 % increase of 0.17 l/sec was not statistically significant. However, the 20-29 year old men had a highly significant (p<0.001) 11% increase of 0.44

FMF Regression Analysis

FMF data were obtained in 1980 and 1990 only and the regression analysis is summarized in Table 37. From 1980 to 1990, there was an increase in the predicted values for both 20 and 60 year old men. This parallelled the improvement in FMF seen at all ages (20-59 years) as shown in the age-grouped data in Tables 16-19. The ageing coefficient for FMF remained essentially the same, at 58.3 and 56.5 ml/year in 1980 and 1990, respectively.

Lung Volumes in Women

a) Forced Vital Capacity

No definite secular trends in forced vital capacity (FVC) could be discerned in our sample of 17-69 year old women from 1970 to 1990. Except for 50-59 year old women, changes were small and statistically insignificant. The youngest group (17-19 years) showed a small decrease. Small increases were seen in women aged 20-49 and 60-69 years. The only significant (p=0.035) change was in the 50-59 year old women, who showed a 19% decrease of 0.60 litres.

FVC Regression Analysis

The calculated values for 20 and 60 year old women showed an increase in FVC from 1970 to 1980 and then a slight decrease to 1990 (Table 39). As with the men, there was an increase (33.7%) in the ageing coefficient, with values of 27.3 and 36.5 ml/year for 1970 and 1990 respectively. The greater part (26.3%) of the change took place from 1970 to 1980 and the increase was much smaller in the women than in the men.

b) Forced Expiratory Volume

One second forced expiratory volume (FEV) changes in women (Table 38) were similar to those found in the men. FEV was higher in 1990 than in 1970 for women aged 17-49 years, lower in the 50-59 year old women, and again higher for those aged 60-69 years.

The FEV in young women aged 17-19 years was only slightly higher (0.3%) in 1990 than in 1970 and in the 20-29 year old women the change was only marginally significant (p=0.055), with an 8% increase of 0.24 1/sec. The 30-39 year old women showed a significant (p=0.025) 16% increase of 0.43 1/sec. For 40-49 year old women, the 5% increase of 0.12 1/sec was not significant. The 50-59 year old women differed from the trend seen in the other age groups and showed an insignificant 19% **decrease** of 0.44 1/sec from 1970 to 1990. The 60-69 year old women followed the general pattern and showed a statistically insignificant 22% increase of 0.41 1/sec.

Table 29. Forced expiratory volume (Litres, BTPS) 1970-1990 in Inuit men aged 17-79 years.

AGE GROUP (years)	1970	1980	1990
17-19	4.25 0.67 10	4.23 0.57 22	4.42 0.51 31
20-29	3.99 0.55 33	4.34 # 0.47 38	4.43 # 0.56 69
30-39	3.62 0.47 22	3.68 0.76 31	4.00 0.60 24
40-49	3.23 0.78 8	3.34 0.70 18	3.34 0.61 16
50-59	3.41 0.32 5	2.31 # 0.87 10	2.67 # 0.79 10
60-69		2.99 0.25 6	2.57 0.44 7
70-79		2.84 0.78 2	2.77 0.23 3

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#).

Table 31. Forced mid-expiratory flow rate (l/sec, BTPS) 1980-1990 in Inuit men aged 17-79 years.

AGE GROUP (years)	1980	1990
17-19	4.27 0.97 22	5.04 * 1.19 31
20-29	4.65 0.92 38	4.79 * 1.03 69
30-39	3.42 1.12 31	4.56 1.06 24
40-49	3.16 1.37 18	3.49 1.26 16
50-59	1.88 1.10 10	2.23 1.23 10
60-69	2.50 0.39 6	2.34 0.75 7
70-79	2.24 1.00 2	2.69 0.41 3

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1980 (*).

LUNG FUNCTION IN MEN 1970 - 1990

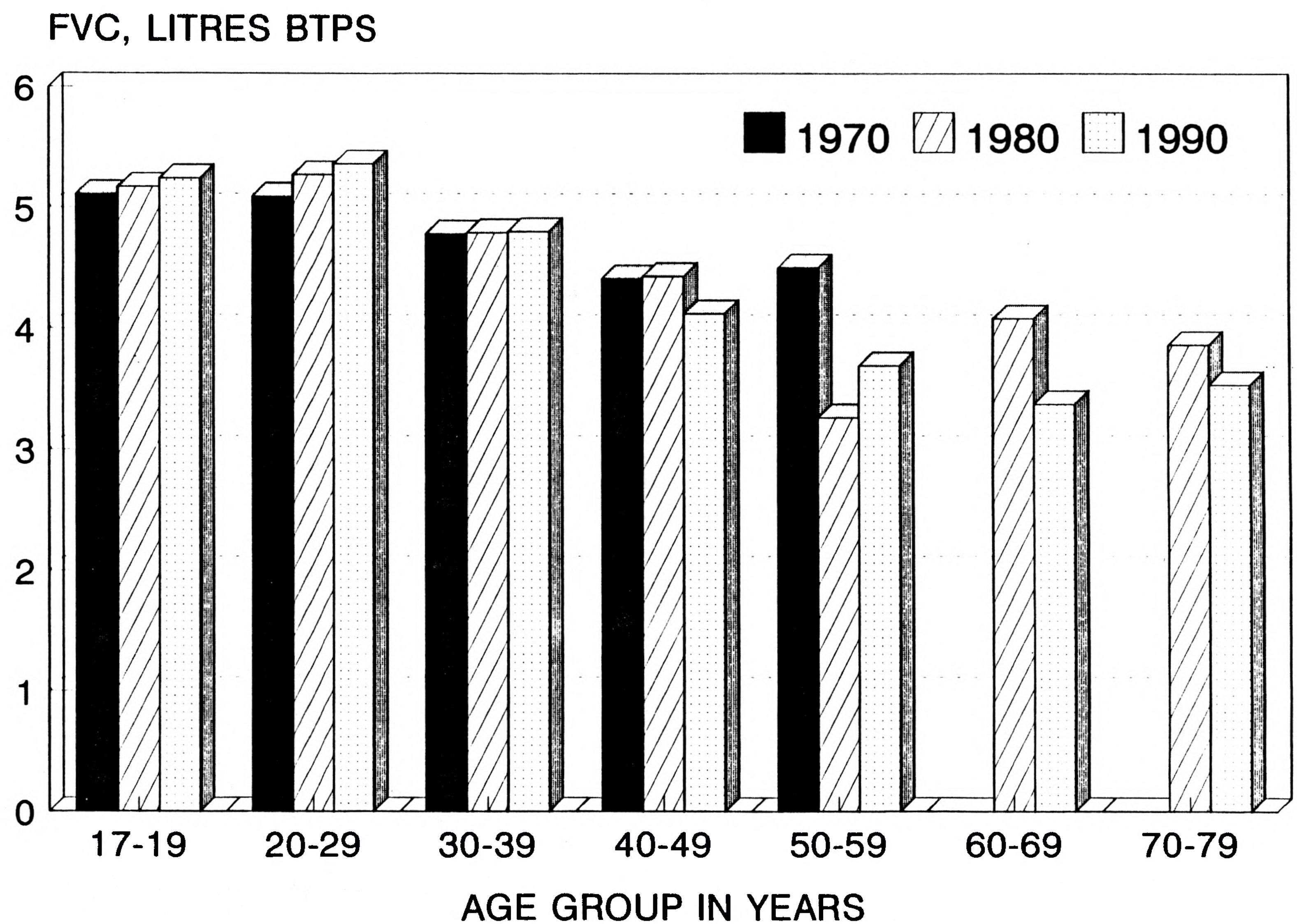

Figure 15. Forced vital capacity 1970-1990
in Inuit men aged 17-79 years.

Table 32. Forced expiratory volume (Litres, BTPS) 1970-1990 in Inuit women aged 17-69 years.

AGE GROUP (years)	1970	1980	1990
17-19	3.37 0.43 6	3.22 0.39 13	3.38 0.37 19
20-29	3.01 0.48 20	3.22 0.44 24	3.25 # 0.45 46
30-39	2.69 0.50 17	3.05 0.51 23	3.12 0.55 16
40-49	2.40 0.30 7	2.48 0.55 17	2.52 0.55 18
50-59	2.34 0.47 5	1.82 0.28 6	1.90 0.58 12
60-69		1.86 0.88 4	2.27 0.58 2

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#).

Table 34. Forced mid-expiratory flow rate (l/sec, BTPS) 1970-1990 in Inuit women aged 17-69 years.

AGE GROUP (years)	1980	1990
17-19	3.68 0.68 13	4.05 0.83 19
20-29	3.51 0.92 24	3.70 0.85 46
30-39	3.18 1.06 23	3.84 1.19 16
40-49	2.33 0.75 17	2.59 0.84 18
50-59	1.43 0.54 6	1.77 1.00 12
60-69	1.47 1.36 4	2.74 1.98 2

Values shown are the mean, standard deviation, and sample size.

LUNG FUNCTION IN WOMEN 1970 - 1990

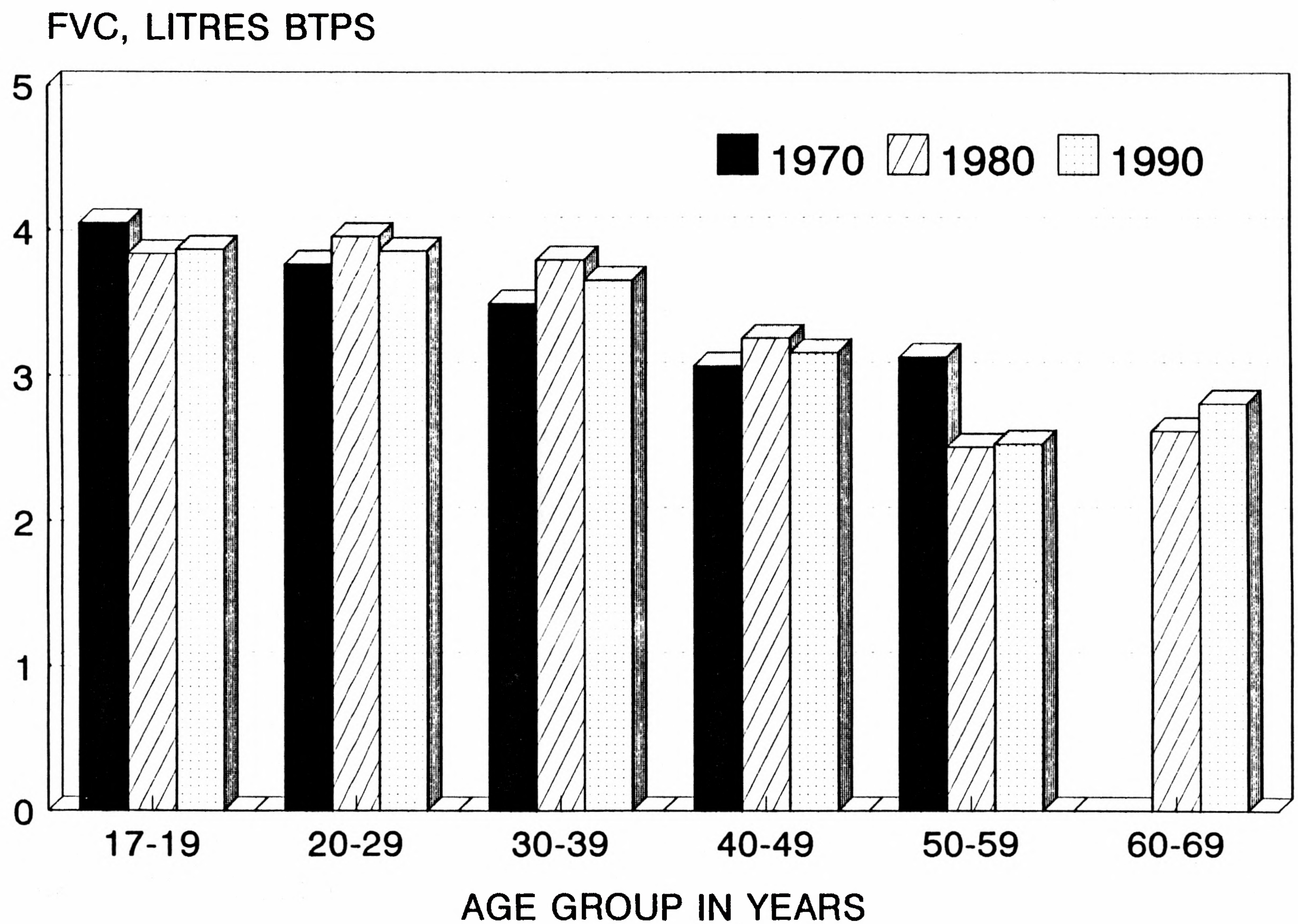

Figure 18. Forced vital capacity 1970-1990
in Inuit women aged 17-69 years.

Table 35. Equations for the prediction of $FEV_{1.0}$ in Inuit men from age (A) and height (H) as calculated by multiple regression analysis, showing typical volumes (L, BTPS) for height = 165 cm.

GROUP AND REGRESSION EQUATIONS FOR FEV		TYPICAL VOLUMES AGE 20	TYPICAL VOLUMES AGE 60
ALL MEN AGED 20 yr+			
N = 69	1970 = -1.6056 - 0.0222A + 0.0369H	4.04	3.16
N = 97	1980 = -3.6879 - 0.0530A + 0.0563H	4.55	2.43
N = 119	1990 = -1.8999 - 0.0511A + 0.0462H	4.71	2.66
HEALTHY MEN AGED 20 yr+			
N = 49	1970 = -0.5631 - 0.0185A + 0.0301H	4.02	3.28
N = 50	1980 = -3.3105 - 0.0365A + 0.0515H	4.46	3.00
N = 70	1990 = 0.0529 - 0.0397A + 0.0327H	4.66	3.07
MEN WITH HISTORY RESPIRATORY DISEASE AGED 20 yr+			
N = 20	1970 = -6.8802 - 0.0309A + 0.0703H	4.10	2.87
N = 47	1980 = 1.0536 - 0.0736A + 0.0309H	4.68	1.74
N = 49	1990 = -4.9283 - 0.0511A + 0.0644H	4.67	2.63

Table 37. Equations for the prediction of FMF in Inuit men from age (A) and height (H) as calculated by multiple regression analysis, showing typical volumes (L/sec, BTPS) for height = 165 cm.

GROUP AND REGRESSION EQUATIONS FOR FMF		TYPICAL VOLUMES	
		AGE 20	AGE 60
ALL MEN AGED 20 yr+			
N = 97	1980 = -2.5456 - 0.0582A + 0.0505H	4.63	2.30
N = 119	1990 = -2.3020 - 0.0563A + 0.0456H	5.10	2.84
HEALTHY MEN AGED 20 yr+			
N = 50	1980 = -3.7910 - 0.0525A + 0.0579H	4.71	2.61
N = 70	1990 = 2.8651 - 0.0461A + 0.0192H	5.11	3.26
MEN WITH HISTORY RESPIRATORY DISEASE AGED 20 yr+			
N = 47	1980 = -0.8662 - 0.0604A + 0.0399H	4.50	2.09
N = 49	1990 = -8.8611 - 0.0548A + 0.0904H	4.96	2.77

Table 39. Equations for the prediction of FVC in Inuit women from age (A) and height (H) as calculated by multiple regression analysis, showing typical volumes (L, BTPS) for height = 155 cm.

GROUP AND REGRESSION EQUATIONS FOR FVC		TYPICAL VOLUMES	
		AGE 20	AGE 60
ALL WOMEN AGED 20 yr+			
N = 49	1970 = 3.5715 - 0.0273A + 0.0057H	3.92	2.83
N = 70	1980 = -4.8833 - 0.0345A + 0.0634H	4.26	2.88
N = 92	1990 = -3.2281 - 0.0365A + 0.0523H	4.14	2.68
HEALTHY WOMEN AGED 20 yr+			
N = 32	1970 = -0.8778 - 0.0265A + 0.0345H	3.94	2.88
N = 24	1980 = -8.4124 - 0.0315A + 0.0861H	4.30	3.04
N = 54	1990 = -4.8693 - 0.0287A + 0.0618H	4.14	2.99
WOMEN WITH HISTORY RESPIRATORY DISEASE AGED 20yr+			
N = 16	1970 = -5.9395 - 0.0079A + 0.0627H	3.62	3.30
N = 46	1980 = -3.5085 - 0.0351A + 0.0545H	4.23	2.83
N = 38	1990 = -0.4711 - 0.0423A + 0.0352H	4.14	2.44

The Effects of Lung Disease in Adults

The effects of a previous history of lung disease upon the cardiorespiratory fitness of Inuit are summarized in Tables 41-44. These tables are based on cross-sectional data, showing results as a percentage of values for healthy men and women of comparable age.

Table 41 shows that the anthropometry of men with a previous history of lung disease is similar in most respects to that of healthy men. The only difference is that on average those with a history of respiratory disease appear to have substantially less subcutaneous fat (83.2% of the norm for healthy men). However, in two disease categories (hilar calcification and fibrosis), the "diseased" group carried more fat. This presumably reflects inactivity subsequent to containment of tuberculosis. If these two groupings are excluded, the "diseased" group carries about 65% of the amount of fat seen in the men free of chest disease.

In terms of lung function and aerobic power (Table 42) the two groups of men were very similar: only FEV and FVC appeared to be slightly lower on average in the men with a medical history (96 and 97% of the norm, respectively). Men with a history of primary TB appear to show the greatest effect, with FEV, FMF, and absolute aerobic power showing respective values of 91, 85, and 93% of those for healthy men.

Results for women are somewhat different. Women with a medical history were not only leaner (83.8%) but they also had a lower body mass (93.2) than healthy women (Table 43). They also had a lower (93.8%) grip strength. Similar to the men, the "diseased" women showed slightly lower values for FEV (92.2%) and FVC (95%); they also had a slightly lower FMF (97.8%) than their healthy peers. Unlike the men, the "diseased" women had a substantially lower (86.2%) aerobic power than their healthy counterparts (Table 44). However, most of the discrepancy between "diseased" and healthy women was due to two women with emphysema. If these are left out, lung function and relative aerobic power were essentially similar in healthy women and those with a previous history of respiratory disease. Even if we remove the women with emphysema, the absolute aerobic power was still lower (88.5%) in the "diseased" group of women.

Table 42. The effects of respiratory disease on lung function and aerobic power. Results are shown as a percentage of values for healthy Inuit men of comparable age.

MEDICAL DIAGNOSIS	N	FEV	FVC	FEV/FVC	FMF	PREDICTED VO2 MAX L/MIN	PREDICTED VO2 MAX ML/KG.MIN
HILAR CALCIFICATION	13	95	97	98	91	101	103
CALCIFICATION	5	100	99	101	106	105	111
FIBROSIS	2	96	94	103	115	114	103
PRIMARY TB	8	91	95	97	85	93	101
PRIMARY TB + CALCIFICATION OR FIBROSIS	11	100	98	102	103	99	106
MEAN		96.4	96.6	100.2	100.0	102.4	104.8
SD		3.8	2.1	2.6	12.0	7.8	3.9

Table 44. The effects of respiratory disease on lung function and aerobic power. Results are shown as a percentage of values for healthy Inuit women of comparable age.

MEDICAL DIAGNOSIS	N	FEV	FVC	FEV/FVC	FMF	PREDICTED VO2 MAX L/MIN	PREDICTED VO2 MAX ML/KG.MIN
HILAR CALCIFICATION	6	93	95	100	84	90	95
CALCIFICATION	7	108	103	106	126	88	96
PRIMARY TB	6	110	106	104	129	87	96
PRIMARY TB + CALCIFICATION OR FIBROSIS	11	97	93	103	112	89	99
EMPHYSEMA	2	63	80	79	38	77	88
MEAN		94.2	95.4	98.4	97.8	86.2	94.8
SD		18.9	10.2	11.1	37.9	5.3	4.1

Table 45. Equations for the prediction of $FEV_{1.0}$, FVC, and FMF from height in Inuit boys aged 9-19 years as calculated by a log-log regression analysis of lung volumes against height, showing predicted volumes for H=150 cm, this being equivalent to an age of 13.7 yr in 1970 and 13.0 yr in 1990.

LUNG FUNCTION AND YEAR		EQUATION	PREDICTED VOLUME
FEV 1970	N = 45	$1.78 \times 10^{-7} H^{3.31}$	2.86
FEV 1980	N = 95	$2.15 \times 10^{-7} H^{3.29}$	3.05
FEV 1990	N = 92	$6.62 \times 10^{-8} H^{3.52}$	3.03
FVC 1970	N = 45	$2.58 \times 10^{-7} H^{3.28}$	3.47
FVC 1980	N = 95	$1.02 \times 10^{-7} H^{3.47}$	3.61
FVC 1990	N = 92	$2.56 \times 10^{-8} H^{3.74}$	3.56
FMF 1980	N = 95	$4.94 \times 10^{-6} H^{2.67}$	3.23
FMF 1990	N = 92	$9.18 \times 10^{-7} H^{3.02}$	3.46

SECTION 6. LIFESTYLES

Hunting Compared to Other Activities

On the basis of our questionnaire and peer ratings we divided our sample of men into 2 groups:- a) full-time hunters (n=24), and b) "others", that is those who were working, studied, or followed other pursuits (n=134). The results of that analysis are summarized in Tables 47 and 48. Unlike 1970 (4), there were very few significant differences of cardiorespiratory fitness between full-time hunters and those who followed other lifestyles.

The 17-19 year old hunters were significantly taller (+8.6 cm, p=0.038) and heavier (+11 kg, p=0.018) than the "others" in their age group. In the 20-29 year old men, the hunters were significantly taller (+4.9 cm, p=0.032) and had a grip strength some 84.4 N greater (p=0.021) than those who did not hunt regularly. The only other significant difference between hunters and "others" was that the relative aerobic power of the 20-29 and 40-49 year old hunters was *significantly lower* than that of men in other occupations. The relative aerobic powers of the 20 and 40 year old hunters were lower by 9.9% (p=0.024) and 24% (p<0.001), respectively.

The Influence of Full-time Employment

We also divided our sample of men into those who held full-time jobs and those who did not. Table 49 and 50 summarizes the results. In most respects, the two groups were essentially similar. The 17-19 and 30-39 year old workers were significantly heavier, by 8.6 kg (p=0.027) and 7.9 kg (p=0.058), respectively. The only other significant difference between employed men and others was that the absolute aerobic power of 50-59 year old workers, at 2.62 l/min, was significantly higher (p=0.041) than that of the "others" in their age group (2.14 l/min).

A similar analysis of the results for the women did not yield any significant differences between those who held full-time jobs and those who were otherwise occupied (Table 51).

The Effects of Sport and Vigorous Exercise

On the basis of our questionnaire, we divided our sample of teenagers and young adults into those who participated regularly in sports (indoor soccer, floor hockey, basketball) or other forms of vigorous activity such as running a dog team or belonging to the local square dance troupe. Tables 52 and 53 summarize the results for the men and the data for women are shown in Tables 54 and 55.

For males of all ages the absolute and relative aerobic powers were substantially higher in those who participated in sports and vigorous exercise than in those who did not take part in any form of regular exercise.

Table 47. A comparison of men aged 17-39 years classified as full-time hunters with those following other lifestyles.

	AGE 17-19 yr		AGE 20-29 yr		AGE 30-39 yr	
	HUNT	OTHER	HUNT	OTHER	HUNT	OTHER
AGE (yr)	18.2 0.7 2	18.5 0.8 29	26.1 1.9 5	24.4 2.6 65	36.5 2.1 5	34.8 2.9 19
HEIGHT (cm)	171.5 2.1 2	162.9* 4.7 29	168.9 6.1 5	164.0* 4.7 65	162.5 6.7 5	164.0 5.7 19
BODY MASS (kg)	73.2 8.1 2	62.3* 5.9 29	73.0 11.9 5	64.4 6.1 65	59.2 10.5 5	66.6 9.8 19
SKIN-FOLDS (mm)	32.0 14.1 2	28.6 11.6 29	40.4 24.2 5	30.4 14.8 64	26.6 17.0 5	34.4 18.5 19
GRIP FORCE (Newtons)	470.9 41.6 2	397.3 59.1 29	533.7 79.0 5	449.3* 76.5 65	361.0 104.0 5	432.6 71.3 19
LEG FORCE (Newtons)	573.9 76.3 2	505.2 134.4 29	627.8 66.9 5	551.3 151.1 64	567.0 250.2 5	531.7 114.8 19
VO2max (l/min)	4.49 0.34 2	3.44 0.61 29	3.35 0.31 5	3.30 0.58 64	2.79 0.42 5	3.06 0.59 18
VO2max (ml/kg.min)	62.0 11.5 2	55.3 8.9 29	46.4 3.4 5	51.5* 9.0 64	47.4 5.1 5	45.6 7.8 18

Values shown are the mean, standard deviation, and sample size.
Significantly different (*).

Table 49. A comparison of men aged 17-39 years classified as full-time workers with those following other lifestyles.

	AGE 17-19 yr		AGE 20-29 yr		AGE 30-39 yr	
	WORK	OTHER	WORK	OTHER	WORK	OTHER
AGE (yr)	19.0 0.7 3	18.4 0.8 28	25.0 2.8 28	24.3 2.5 42	35.0 2.6 14	35.5 3.2 10
HEIGHT (cm)	167.0 4.3 3	163.1 5.1 28	163.8 5.6 28	164.7 4.5 42	164.9 6.0 14	162.1 5.3 10
BODY MASS (kg)	70.8 6.1 3	62.2* 6.1 28	64.7 5.4 28	65.3 7.7 42	68.4 10.2 14	60.5 8.6 10
SKIN- FOLDS (mm)	40.7 19.7 3	27.5 10.1 28	29.9 16.9 28	32.0 15.0 41	37.3 19.9 14	26.5 14.0 10
GRIP FORCE (Newtons)	434.8 65.3 3	400.3 60.5 28	453.2 81.2 28	457.2 78.7 42	440.5 76.3 14	384.6 81.9 10
LEG FORCE (Newtons)	585.7 46.4 3	501.3 135.4 28	554.3 160.9 27	558.2 141.3 42	536.6 80.7 14	542.5 212.9 10
VO2max (l/min)	3.77 0.48 3	3.48 0.67 28	3.34 0.53 28	3.28 0.59 41	3.03 0.47 14	2.96 0.71 9
VO2max (ml/kg.min)	53.5 10.4 3	56.0 9.0 28	51.9 8.2 28	50.6 9.2 41	44.7 6.4 14	48.1 8.3 9

Values shown are the mean, standard deviation, and sample size. Significantly different (*).

Table 51. A comparison of women aged 20-49 years classified as full-time workers with those following other lifestyles.

	AGE 20-29 yr		AGE 30-39 yr		AGE 40-49 yr	
	WORK	OTHER	WORK	OTHER	WORK	OTHER
AGE (yr)	24.9 3.1 13	24.2 2.7 33	34.5 3.0 7	34.4 2.5 9	44.5 3.3 6	46.2 2.7 13
HEIGHT (cm)	153.3 4.5 13	153.1 6.2 33	154.3 5.4 7	153.3 5.9 9	155.7 5.9 6	152.1 5.8 13
BODY MASS (kg)	54.9 7.0 13	54.5 7.9 33	59.8 10.9 7	58.5 12.9 9	71.9 7.8 6	65.7 13.6 13
SKIN-FOLDS (mm)	49.0 23.9 13	43.7 16.6 33	62.9 24.7 7	65.3 29.2 9	88.8 47.1 6	82.2 37.8 13
GRIP FORCE (Newtons)	235.4 71.3 13	226.6 54.3 33	236.4 49.2 7	217.8 49.0 9	223.7 52.4 6	208.0 66.6 13
LEG FORCE (Newtons)	419.9 101.0 13	379.7 84.3 32	421.8 102.0 7	385.5 63.8 8	424.8 72.5 6	364.9 119.7 13
VO2max (l/min)	2.14 0.42 13	2.29 0.44 33	2.28 0.42 7	1.89 0.52 9	2.18 0.34 6	2.07 0.31 12
VO2max (ml/kg.min)	39.3 7.3 13	41.7 6.1 33	38.5 5.5 7	32.7 6.9 9	30.5 4.3 6	31.2 5.0 12

Values shown are the mean, standard deviation, and sample size.

Table 53. The effects of sport and vigorous exercise. A comparison of active and sedentary males aged 20-39 years.

	AGE 20-29 yr		AGE 30-39 yr	
	SPORT	OTHER	SPORT	OTHER
AGE (yr)	24.0 2.3 16	24.7 2.7 54	35.1 2.4 3	35.2 2.9 21
HEIGHT (cm)	164.9 3.6 16	164.2 5.3 54	162.2 3.6 3	163.9 6.1 21
BODY MASS (kg)	63.8 3.5 16	65.4 7.6 54	66.4 3.7 3	64.9 10.8 21
SKIN-FOLDS (mm)	26.5 13.4 16	32.5 16.2 54	28.0 13.9 3	33.5 18.9 21
GRIP FORCE (Newtons)	460.1 68.8 16	454.2 82.5 54	415.0 63.1 3	417.9 85.6 21
LEG FORCE (Newtons)	578.8 210.9 16	539.6 145.2 54	627.8 157.0 3	526.8 144.2 21
VO2max (l/min)	3.94 0.47 16	3.11* 0.44 53	3.61 0.56 3	2.91* 0.52 20
VO2max (ml/kg.min)	62.0 7.8 16	47.8* 5.9 53	54.3 6.1 3	44.8* 6.6 20

Values shown are the mean, standard deviation, and sample size.
Significantly different (*).

Table 55. The effects of sport and vigorous exercise. A comparison of active and sedentary females aged 17-29 years.

	AGE 17-19 yr		AGE 20-29 yr	
	SPORT	OTHER	SPORT	OTHER
AGE (yr)	18.5 0.8 3	18.3 0.9 16	22.9 3.8 4	24.5 2.7 42
HEIGHT (cm)	151.7 1.5 3	154.2 4.7 16	152.0 5.9 4	153.3 5.7 42
BODY MASS (kg)	54.8 8.8 3	54.4 5.2 16	54.0 5.7 4	54.7 7.8 42
SKIN-FOLDS (mm)	45.0 21.7 3	51.5 15.3 16	40.5 10.1 4	45.6 19.5 42
HAND GRIP FORCE (Newtons)	169.7 59.9 3	199.1 43.8 16	258.0 42.7 4	226.6 59.8 42
LEG EXTENSION FORCE (Newtons)	379.7 83.4 3	406.1 51.5 16	449.3 49.0 4	385.5 91.4 41
VO2max (l/min)	2.91 0.66 3	2.18* 0.47 16	2.69 0.15 4	2.20* 0.43 42
VO2max (ml/kg.min)	52.8 3.9 3	40.0* 6.6 16	50.0 2.8 4	40.1* 6.1 42

Values shown are the mean, standard deviation, and sample size.
Significantly different (*).

SECTION 7. SMOKING BEHAVIOUR OF IGLULINGMUIT

Smoking Behaviour in Men and Women

The average reported cigarette consumption for all men aged 17-59 years for 1970, 1980 and 1990 is shown in Table 56. Consumption by different age groups, 17-79 years, is summarized in Table 57. Table 58 shows the percentage of smokers in each age group for 1970, 1980, and 1990 and Figure 20 illustrates the relative percentages of smokers in 1970 and 1990.

From 1970 to 1980 the number of smokers among men aged 17-59 years decreased by some 4.5% (Table 58), but there was a substantial (24.8%, p=0.004) increase in the average per capita cigarette consumption (Table 56). From 1980 to 1990 the proportion of smokers in our sample remained the same, at 85%, but there was a significant (p=0.001) 21.7% decrease in the average per capita cigarette consumption from 16.6 to 13.0 cigarettes per day.

From 1980 to 1990, cigarette consumption decreased in all age groups with the exception of the 50-59 year old men (Table 57). For 17-19 year old men, there was a large 61.6% and highly significant (p<0.001) decrease in cigarette consumption. The 20-29 year old men showed a substantial but insignificant 20.2% decrease of 3.2 cigarettes/day. Average consumption in the 30-39 year old men decreased by 27% (p=0.071) and the 40-49 year old group also showed a large (39%) and significant (p=0.007) decrease.

Re-arranging the age grouping of our sample of men (for comparisons with data for men in Southern Canada), we see that the proportions of regular cigarette smokers in our sample of 15-69 year old men in 1970, 1980, and 1990 were 82, 86, and 82% respectively (Table 58). Comparable rates for 15-64 year old men in Southern Canada were 49, 37, and 31% for the years 1970, 1981, and 1986 (18).

The average reported cigarette consumption for all women aged 17-59 years for the period 1970, 1980, and 1990 are shown in Table 56. Consumption by different age groups, 17-69 years is summarized in Table 59. Table 60 shows the percentage of smokers in each age group and Figure 21 illustrates the corresponding percentage of smokers in our sample of volunteers for 1970 and 1990.

From 1970 to 1980, there was a small (4%) increase in the number of smokers among women aged 17-59 years (Table 60), but there was a large (37.8%) and highly significant (p=0.002) increase in the per capita consumption, from 9 to 12.4 cigarettes/day (Table 56). From 1970 to 1980, cigarette consumption in women increased in all age groups 17-59 years (Table 59). From 1980 to 1990, the proportion of smokers decreased by some 5.6% (Table 60), accompanied by a marginally significant (p=0.068), 14.5% drop in cigarette consumption (Table 56). However, in contrast to the men, cigarette consumption did not fall in all age groups, and the decrease from 1980 to 1990 was statistically significant only in the youngest age group. There was a large 45.2% (p=0.004) decrease in cigarette consumption for 17-19 year old women. The 20-29 and 40-49 year old women also showed decreases of 21.4 and 17.5% respectively, but these changes were statistically not significant. Two groups of Women, ages 30-39 and 50-59 years, showed

Table 56. Igloolik 1970-1990. Reported cigarette consumption for Inuit smokers aged 17-59 years.

SEX	Cigarette consumption per day		
	1970	1980	1990
MALE	13.3 5.8 73	16.6 # 9.0 102	13.0 * 7.7 129
FEMALE	9.0 6.1 45	12.4 # 5.7 76	10.6 7.1 94

Values shown are the mean, standard deviation and sample size.
Significantly different from 1970 (#); from 1980 (*).

Table 58. Proportion of regular smokers among male children and adults, showing sample size (N), number of smokers in sample (SN), and the percent of smokers in sample (S%).

	1970			1980			1990		
AGE (yr)	N	SN	S%	N	SN	S%	N	SN	S%
9-10	6	0	0	12	3	25	2	0	0
11-12	13	0	0	19	14	74	19	2	11
13-14	8	1	13	24	21	88	23	12	52
15-16	16	8	50	19	19	100	12	17	71
17-19	16	13	81	22	21	96	31	27	87
20-29	34	33	97	38	36	95	70	65	93
30-39	24	20	83	31	22	71	24	19	79
40-49	8	7	88	18	14	78	16	10	63
50-59	7	6	86	10	8	80	10	8	80
60-69	2	1	50	6	4	67	7	2	29
70-79				2	1	50	3	2	67
17-59	89	79	89	119	101	85	151	129	85
15-69	107	88	82	144	124	86	175	143	82

Table 59. Igloolik 1970-1990. Cigarette consumption for Inuit women who smoke, aged 17-69 years.

AGE (yr)	Cigarette consumption per day		
	1970	1980	1990
17-19	11.0 5.7 6	15.4 5.1 10	8.4 * 5.9 18
20-29	8.5 7.8 21	13.5 # 6.0 22	10.6 6.9 44
30-39	9.9 4.2 11	10.8 6.1 22	13.2 8.9 13
40-49	8.5 3.0 4	11.0 3.7 16	9.1 6.4 13
50-59	5.7 2.1 3	13.5 7.6 6	13.7 # 7.0 7
60-69		8.0 0.0 1	2.0 0.0 1

Values shown are the mean, standard deviation and sample size.
Significantly different from 1970 (#); from 1980 (*).

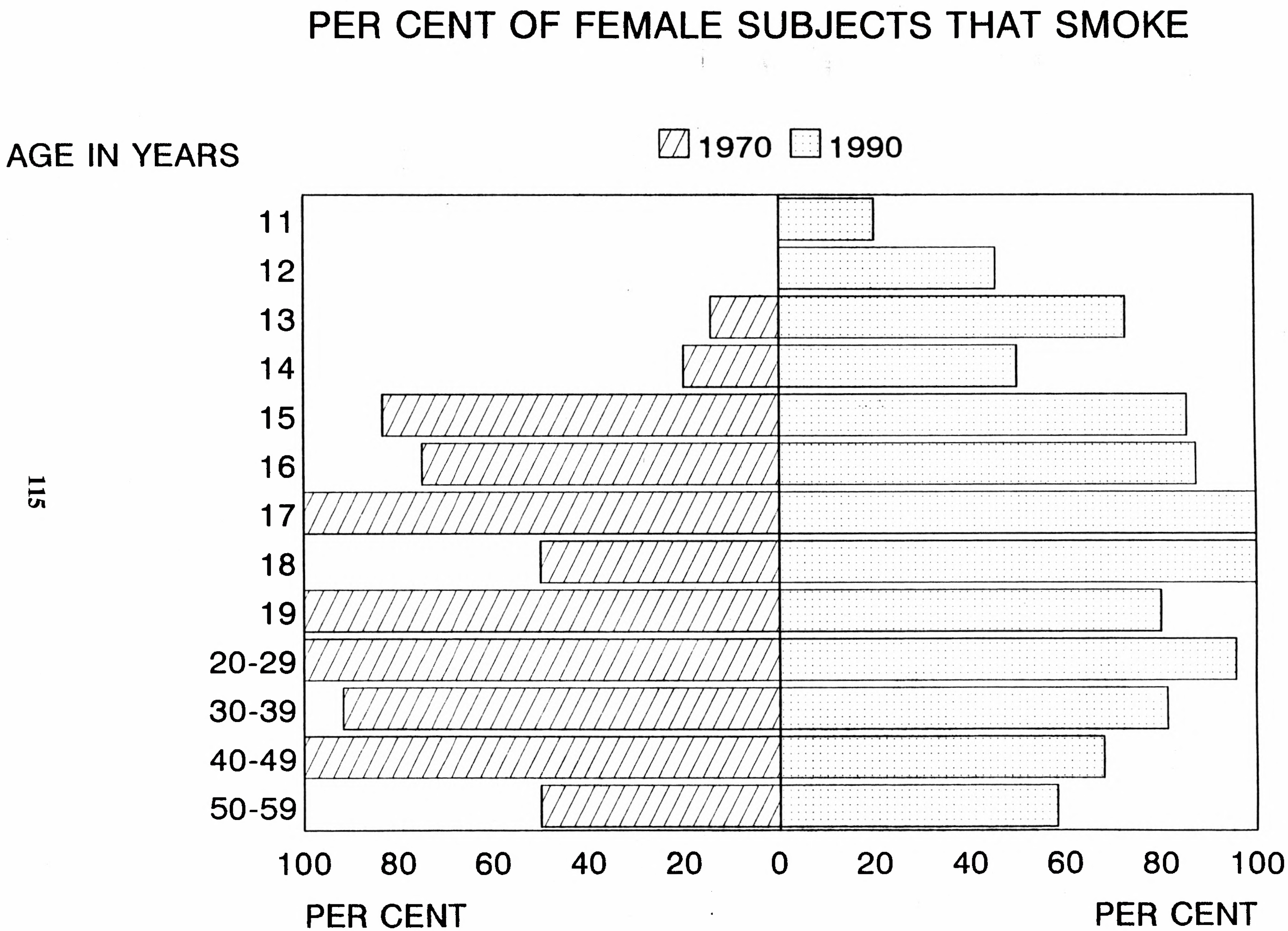

Figure 21. Relative proportions of Igloolik females smoking in 1970 and 1990.

to 93%. In those aged 15-16 years there was little variation in the number of smokers from 1970 to 1990.

The proportion of regular cigarette smokers among Southern Canadian girls aged 15-19 years was 25, 23, and 18% for 1970, 1981, and 1986, respectively. The rates for our sample of Inuit girls were 78, 88, and 91% for 1970, 1980, and 1990, respectively. The rates in Inuit girls were not only 3 to 5 times higher than those in Southern Canada, but also **increased**, in contrast to declining rates in the rest of Canada.

The average reported cigarette consumption of the girls increased at practically all ages from 1970 to 1980 and then decreased from 1980 to 1990 (Table 62). The decreases (1980-1990) in the youngest girls were relatively small and insignificant, with drops of 4 and 13% in the 11-12 and 13-14 year old girls, respectively. However, the 15-16 year old girls showed a large 49% decrease (p=0.001) of 6 cigarettes/day from 1980 to 1990. The 17-19 year old girls had a similar, 45% decrease in average consumption of 7 cigarettes/day (p=0.004).

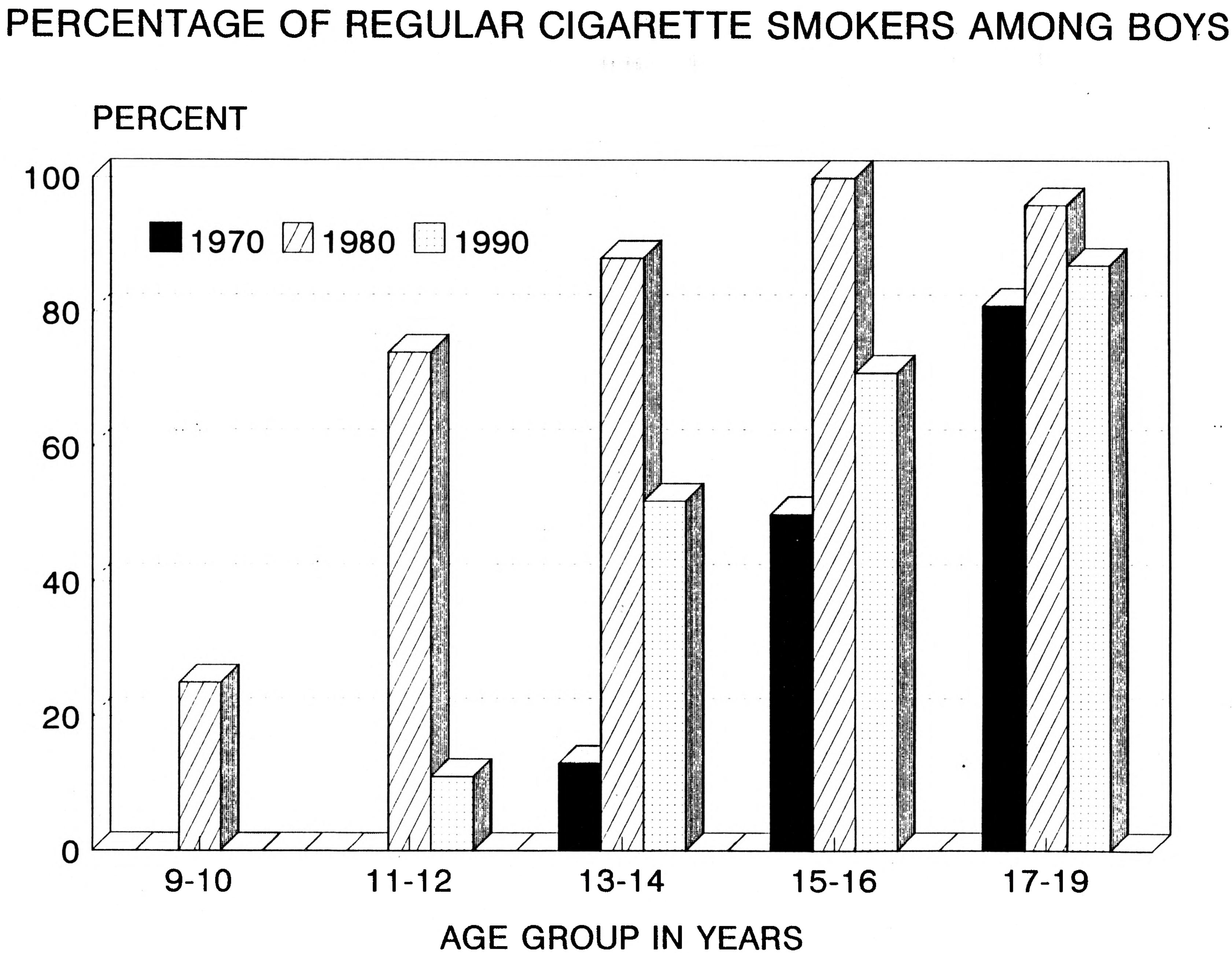

Figure 22. Igloolik 1970-1990. Percentage of regular cigarette smokers among Inuit boys aged 9-19.

The proportion of smokers among Igloolik youth.

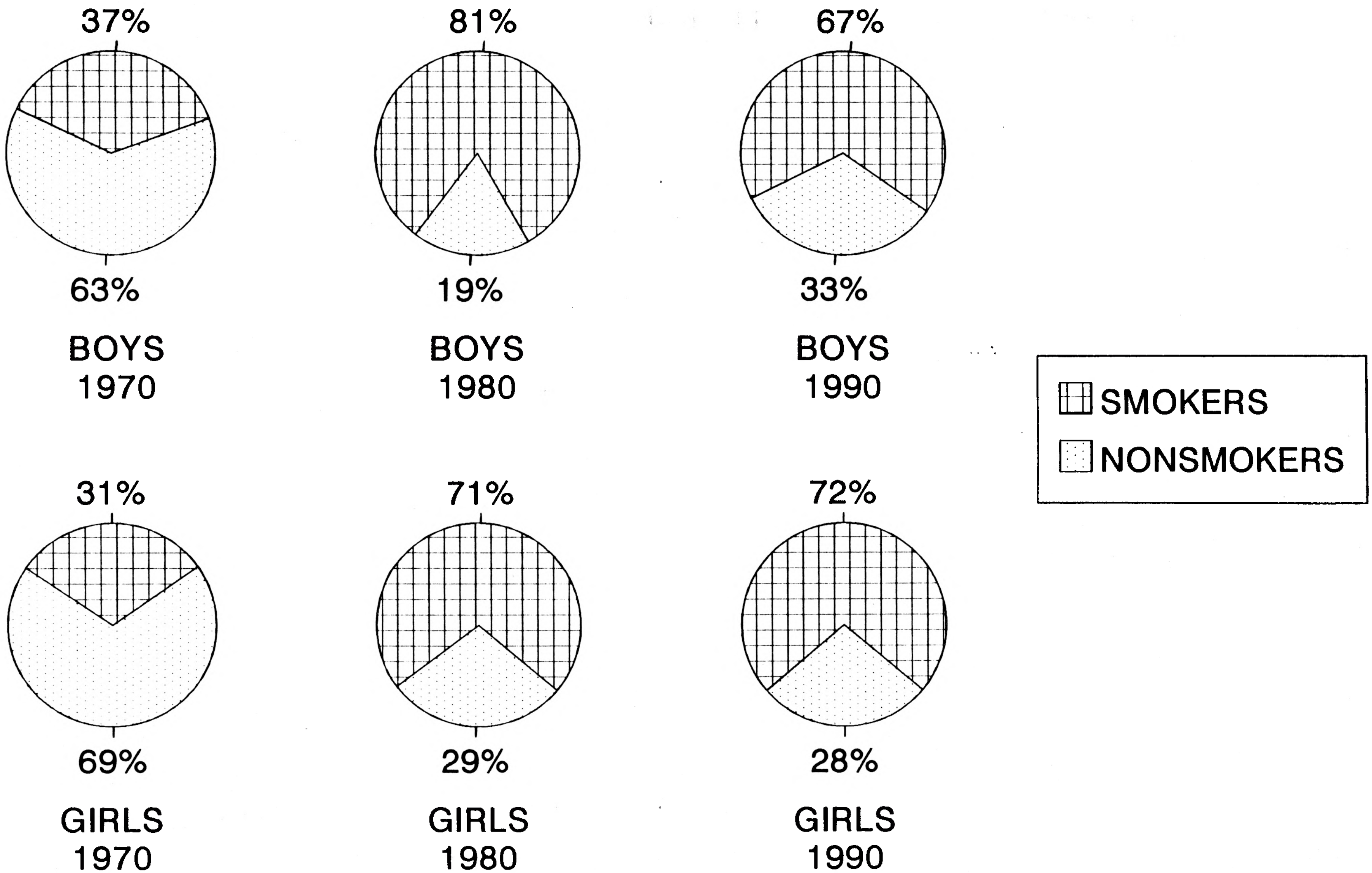

Figure 24. The percentage of smokers and non-smokers among Igloolik boys and girls aged 9-19 years for the period 1970 - 1990.

SECTION 8. BODY COMPOSITION, STRENGTH, AND FITNESS IN CHILDREN

Results for Boys Aged 9-19 Years

Cross-sectional data from 1970, 1980, and 1990 for boys aged 9-19 are summarized in Tables 63-72 and illustrated in Figures 25-31.

The data for anthropometry and strength are shown in Tables 63-67 and Figures 25-29; the corresponding data for predicted aerobic power can be seen in Tables 68-72 and Figures 30-31.

Height

No significant cross-sectional changes were seen in the age grouped data on heights (Tables 63-67). Figure 25 suggests that the 13-14 year old boys became progressively taller from 1970 to 1990, but the changes (Table 65) were not statistically significant.

Body Mass

The only significant mass changes were seen in 13-14 year old boys who showed a progressive increase of mass (Figure 26) from 1970 to 1990, with values of 41.7, 44.9, and 49.5 kgs in 1970, 1980, and 1990, respectively. The total 7.8 kg increase from 1970 to 1990 was significant at p=0.020.

Skinfold Thicknesses

From 1970 to 1990, subcutaneous fat increased significantly in all but the youngest boys (Figure 27 and Tables 63-67) who, nevertheless, showed a substantial but insignificant 66.7% increase. From 1970 to 1990 skinfold thicknesses in the 11-12, 13-14, 15-16, and 17-19 year old boys increased by 48% (p=0.020), 90% (p=0.001), 64% (p=0.004), and 63% (p=0.001), respectively.

Grip Strength

Significant changes were seen in only 2 age groups:- the 11-12 and 17-19 year old boys, who showed significant strength losses of 21% (p=0.009) and 12% (p=0.027), respectively.

Leg Strength

Significant strength losses were seen in all but the youngest group of boys (Figure 29). From 1970 to 1990, leg strength in the 11-12, 13-14, 15-16, and 17-19 year old boys decreased by 21% (p=0.024), 31% (p=0.059), 32% (p=0.001), and 37% (p<0.001), respectively.

Absolute Aerobic Power

From 1970 to 1990, the absolute aerobic power decreased in all but the youngest boys (Tables 68-72; Figure 30) who maintained essentially the same level of absolute aerobic fitness.

Table 63. Anthropometry and strength in boys aged 9-10 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	10.2 0.9 6	10.3 0.5 12	10.6 0.2 2
HEIGHT (cm)	132.0 5.5 6	130.5 3.6 12	137.0 * 5.7 2
BODY MASS (kg)	29.0 2.9 6	29.2 3.0 12	33.1 2.4 2
SUM 3 SKINFOLDS (mm)	12.0 2.4 6	17.1 # 3.6 12	20.0 5.7 2
HAND GRIP FORCE (Newtons)	134.1 19.3 6	135.7 30.4 12	112.8 20.8 2
LEG EXTENSION FORCE (Newtons)	361.3 41.4 6	266.5 # 84.4 12	407.1 * 20.8 2

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#); from 1980 (*).

Table 65. Anthropometry and strength in boys aged 13-14 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
AGE (yr)	13.8 0.5 8	14.1 0.6 24	13.8 0.6 23
HEIGHT (cm)	148.5 12.9 8	151.9 7.9 24	154.3 7.2 23
BODY MASS (kg)	41.7 8.9 8	44.9 7.9 24	49.5 # 7.4 23
SUM 3 SKINFOLDS (mm)	14.1 3.8 8	16.8 3.7 24	26.9 #* 12.6 23
HAND GRIP FORCE (Newtons)	234.3 67.5 8	265.7 78.5 24	224.4 80.8 23
LEG EXTENSION FORCE (Newtons)	534.7 206.8 8	441.8 131.3 24	368.1 #* 120.1 23

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#); from 1980 (*).

Table 67. Anthropometry and strength in boys aged 17-19 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	18.1 0.5 16	18.3 0.9 22	18.4 0.8 31
HEIGHT (cm)	166.8 6.5 16	162.5 5.3 22	163.5 5.1 31
BODY MASS (kg)	62.7 9.4 16	62.0 7.1 22	63.0 6.5 31
SUM 3 SKINFOLDS (mm)	17.7 6.8 16	23.5 # 10.2 22	28.8 # 11.6 31
HAND GRIP FORCE (Newtons)	455.6 50.2 16	469.5 64.9 22	402.2 #* 60.3 31
LEG EXTENSION FORCE (Newtons)	802.4 153.8 16	685.2 # 164.9 20	509.1 #* 131.8 31

Values shown are means, standard deviations, and sample sizes.

Significantly different from 1970 (#); from 1980 (*).

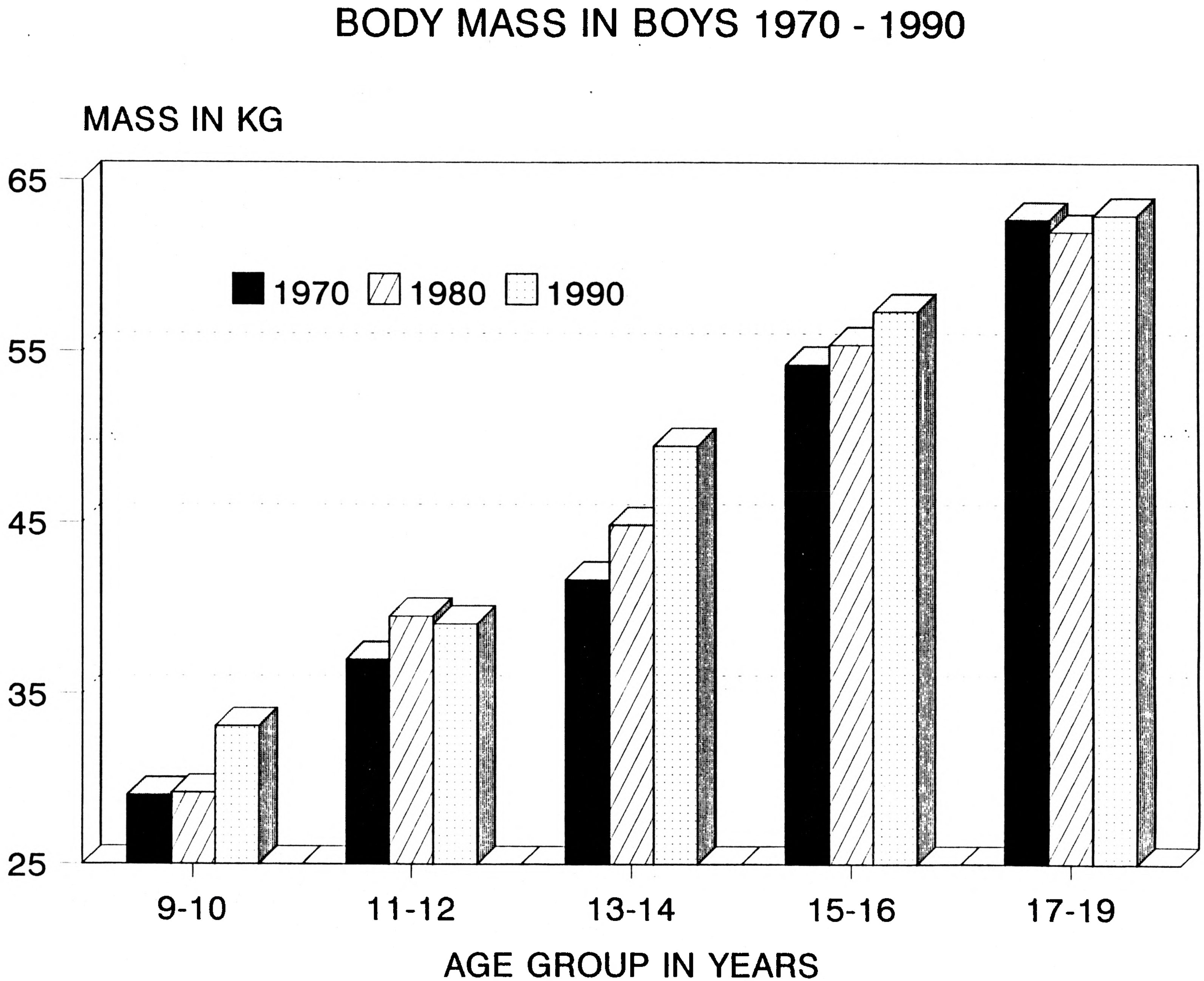

Figure 26. Body mass in boys aged 9 - 19 years in 1970, 1980, and 1990.

HAND GRIP FORCE IN BOYS 1970 - 1990

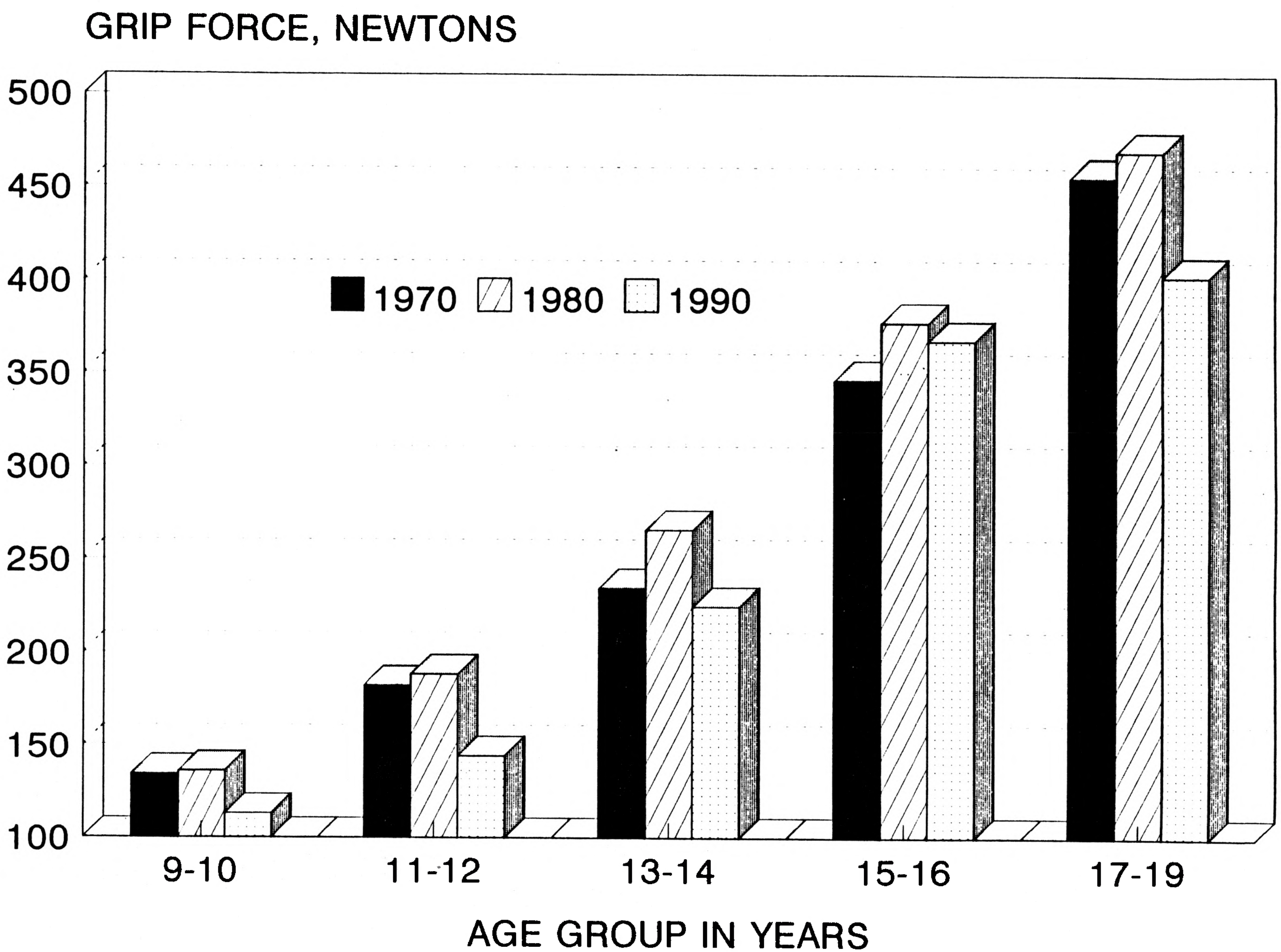

Figure 28. Dominant grip strength in boys aged 9 - 19 years in 1970, 1980, and 1990.

Table 68. Lung function and predicted aerobic power (VO2max) in boys aged 9-10 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
FORCED EXPIRATORY VOLUME (Litres, BTPS)		1.99 0.18 12	2.45 0.50 2
FORCED VITAL CAPACITY (Liters, BTPS)		2.34 0.24 12	2.95 0.41 2
FEV/FVC (%)		85.2 5.1 12	82.5 5.0 2
FORCED MID-EXPIRATORY FLOW (l/sec, BTPS)		2.21 0.41 12	2.64 0.96 2
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	1.84 0.27 6	1.87 0.21 12	1.86 0.06 2
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	63.1 6.3 6	64.7 11.2 12	56.2 2.4 2
HEMOGLOBIN (g/l)		139.0 6.6 12	

Values shown are the mean, standard deviation, and sample size.

Table 70. Lung function and predicted aerobic power (VO2max) in boys aged 13-14 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
FORCED EXPIRATORY VOLUME (Litres, BTPS)	2.90 0.60 14	3.18 0.63 23	3.17 0.56 23
FORCED VITAL CAPACITY (Liters, BTPS)	3.53 0.76 14	3.74 0.79 23	3.76 0.61 23
FEV/FVC (%)	82.1 5.8 14	85.7 4.6 23	84.4 5.2 23
FORCED MID-EXPIRATORY FLOW (l/sec, BTPS)		3.52 0.79 23	3.53 0.92 23
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	2.79 0.30 8	2.69 0.64 24	2.71 0.56 23
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	68.7 11.2 8	60.1 10.8 24	55.0 # 8.1 23
HEMOGLOBIN (g/l)	136.5 7.0 14	144.5 8.2 24	137.7 10.3 19

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#).

Table 72. Lung function and predicted aerobic power (VO2max) in boys aged 17-19 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
FORCED EXPIRATORY VOLUME (Litres, BTPS)	4.25 0.67 10	4.23 0.57 22	4.42 0.51 31
FORCED VITAL CAPACITY (liters, BTPS)	5.11 0.52 10	5.17 0.63 22	5.24 0.61 31
FEV/FVC (%)	81.6 5.5 10	81.8 4.4 22	84.5 5.4 31
FORCED MID-EXPIRATORY FLOW (l/sec, BTPS)		4.27 0.97 22	5.04 * 1.19 31
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	3.96 0.35 15	3.27 # 0.37 22	3.51 # 0.65 31
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	63.1 7.6 15	53.2 # 7.0 22	55.7 # 9.0 31
HEMOGLOBIN (g/l)	152.0 7.7 10	158.8 10.3 21	155.3 9.7 27

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#); from 1980 (*).

AEROBIC POWER IN BOYS 1970 - 1990

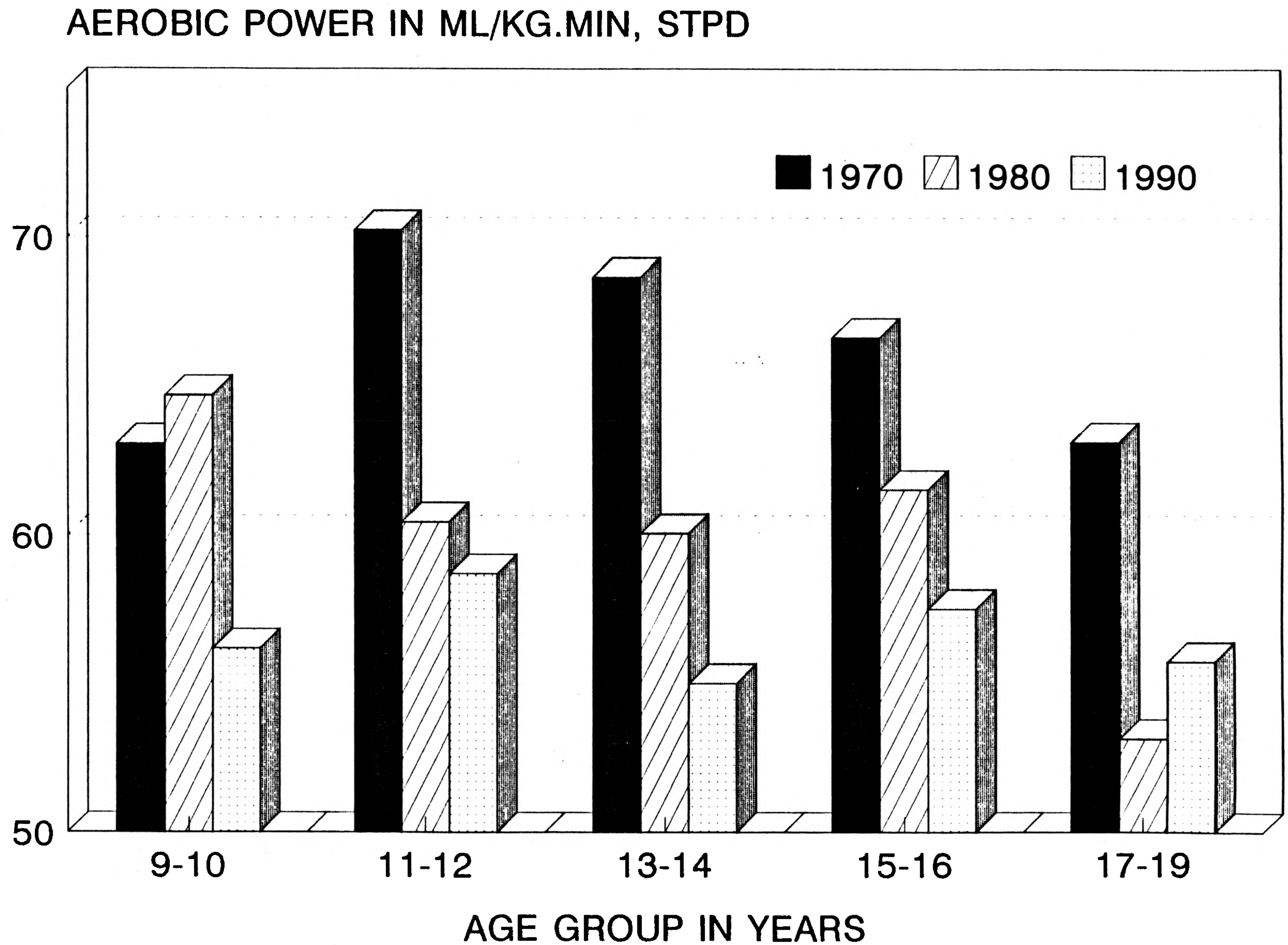

Figure 31. Relative aerobic power in boys aged 9 - 19 years in 1970, 1980, and 1990.

Absolute Aerobic Power

Figure 37 shows that there was a progressive decline of aerobic power from 1970 to 1990 in girls of all age groups. The decreases for girls aged 9-14 years were not statistically significant, with respective losses of 2, 10, and 11% for girls aged 9-10, 11-12, and 13-14 years. Significant decreases were seen in the 15-16 and 17-19 year old girls, who showed losses of 14% (p=0.042) and 14% (p=0.032), respectively.

Relative Aerobic Power

Girls in all age groups showed progressive and significant losses of aerobic power from 1970 to 1990 (Figure 38, Tables 78-82). The losses for girls aged 9-10, 11-12, 13-14, 15-16, and 17-19 years were 20% (p=0.004), 16% (p=0.012), 9% (p=0.052), 13% (p=0.048), and 15% (p=0.024), respectively.

Table 74. Anthropometry and strength in girls aged 11-12 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
AGE (yr)	12.2 0.7 13	12.1 0.6 18	12.1 0.7 16
HEIGHT (cm)	142.8 5.7 13	141.8 6.0 18	144.6 5.4 16
BODY MASS (kg)	38.3 6.3 13	38.3 7.1 18	41.7 8.5 16
SUM 3 SKINFOLDS (mm)	19.0 8.5 13	23.1 11.6 18	35.1 #* 20.6 16
HAND GRIP FORCE (Newtons)	180.3 33.8 13	152.6 # 37.8 18	96.9 #* 34.1 16
LEG EXTENSION FORCE (Newtons)	428.0 135.7 13	307.4 # 100.7 18	320.7 # 90.8 16

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#); from 1980 (*).

Table 76. Anthropometry and strength in girls aged 15-16 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
AGE (yr)	15.9 0.5 10	16.3 0.6 19	16.1 0.5 15
HEIGHT (cm)	153.9 6.5 10	151.8 5.8 19	153.0 5.1 15
BODY MASS (kg)	54.4 6.4 10	52.3 6.2 19	54.3 9.0 15
SUM 3 SKINFOLDS (mm)	32.8 9.1 10	36.1 11.5 19	54.5 #* 19.6 15
HAND GRIP FORCE (Newtons)	286.5 32.0 10	256.1 52.6 19	198.2 #* 51.3 15
LEG EXTENSION FORCE (Newtons)	551.3 208.2 10	505.5 141.6 19	390.4 #* 100.4 15

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#); from 1980 (*).

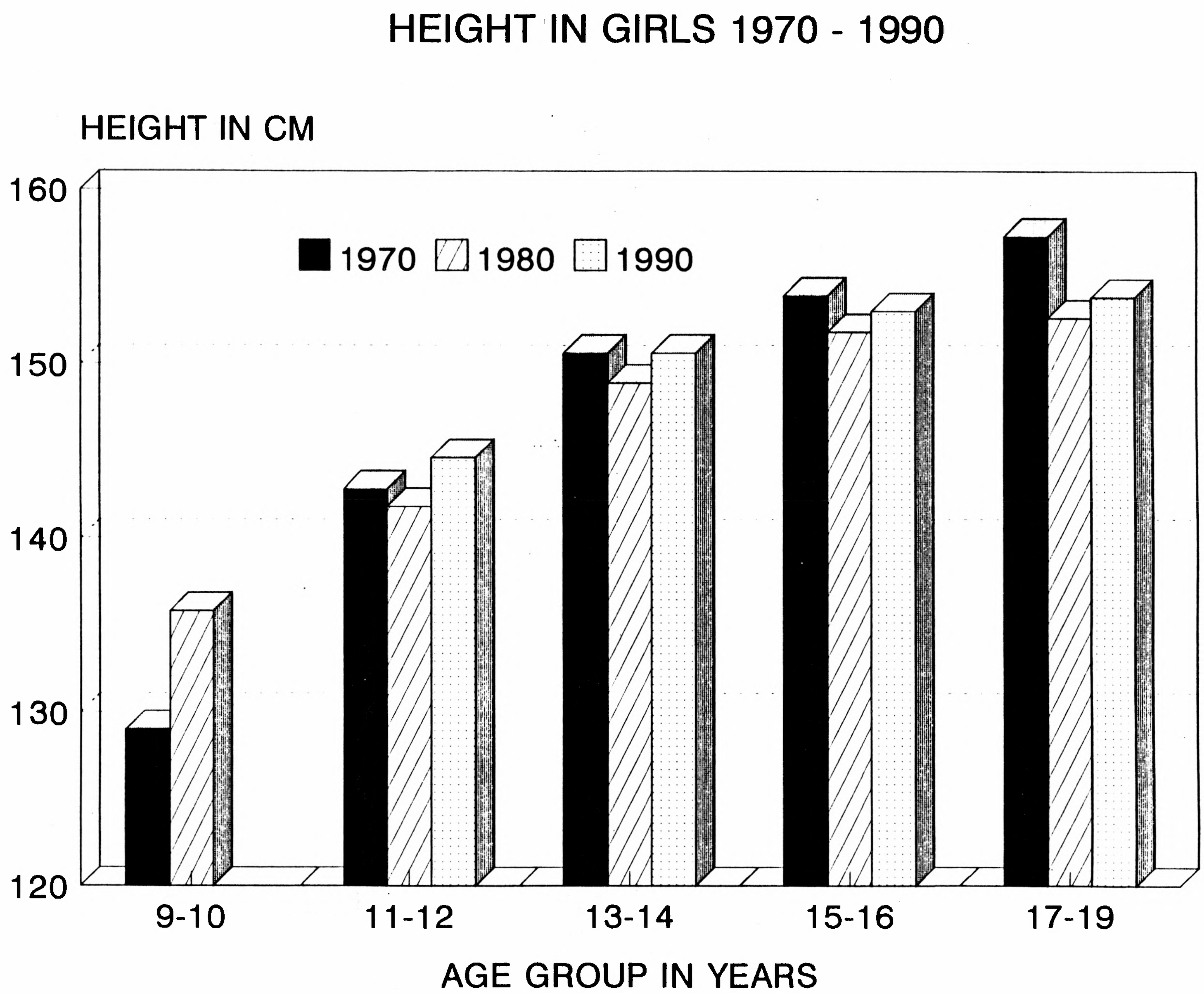

Figure 32. Height in girls aged 9 - 19 years in 1970, 1980, and 1990.

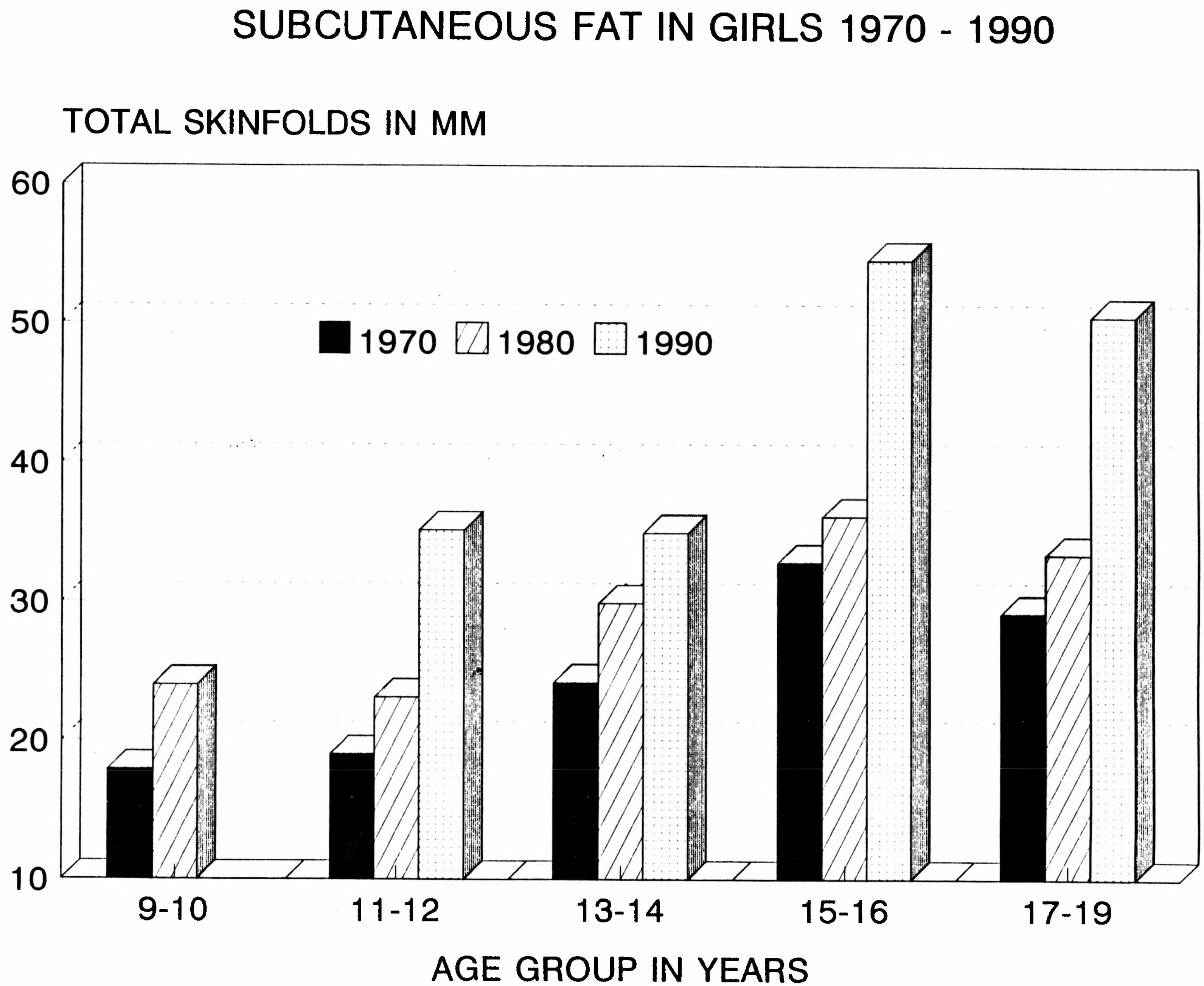

Figure 34. Subcutaneous fat in girls aged 9 - 19 years in 1970, 1980, and 1990.

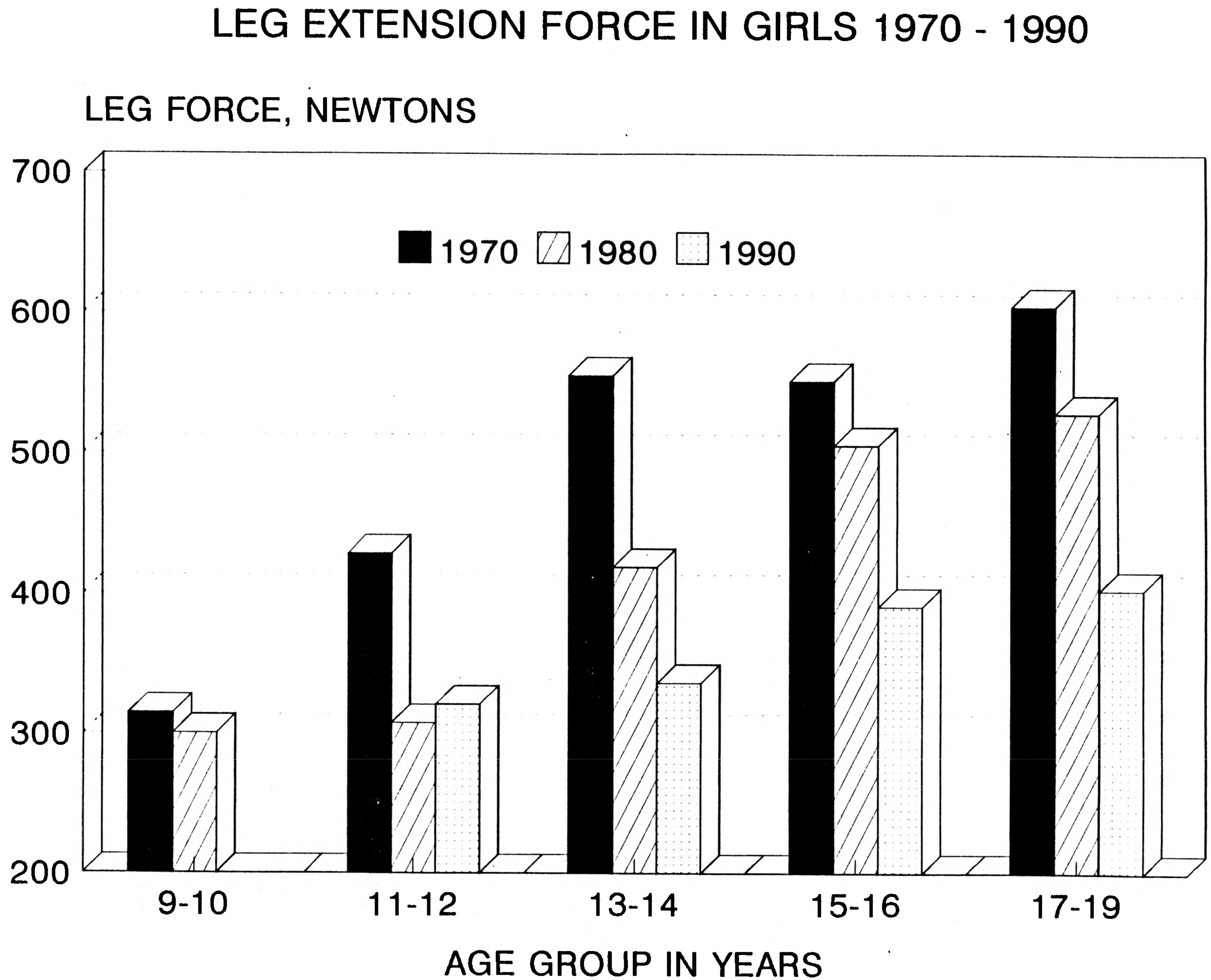

Figure 36. Leg extension strength in girls aged 9 - 19 years in 1970, 1980, and 1990.

Table 79. Lung function and predicted aerobic power (VO2max) in girls aged 11-12 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
FORCED EXPIRATORY VOLUME (Litres, BTPS)	2.80 0.38 3	2.46 0.32 18	2.61 0.35 16
FORCED VITAL CAPACITY (Liters, BTPS)	3.33 0.40 3	2.83 0.39 18	3.03 0.38 16
FEV/FVC (%)	84.0 1.0 3	86.9 4.3 18	86.3 5.1 16
FORCED MID-EXPIRATORY FLOW (l/sec, BTPS)		3.03 0.62 18	3.08 0.64 16
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	2.10 0.41 13	1.90 0.32 18	1.88 0.31 16
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	55.0 7.5 13	50.0 # 5.6 18	46.2 # 9.7 16
HEMOGLOBIN (g/l)	136.0 9.5 3	140.8 6.2 18	133.4 * 8.1 11

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#); from 1980 (*).

Table 81. Lung function and predicted aerobic power (VO2max) in girls aged 15-16 years.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
FORCED EXPIRATORY VOLUME (Litres, BTPS)	3.12 0.24 5	3.12 0.53 19	3.23 0.39 15
FORCED VITAL CAPACITY (Liters, BTPS)	3.85 0.51 5	3.68 0.57 19	3.84 0.47 15
FEV/FVC (%)	81.4 5.4 5	84.5 5.0 19	84.3 6.9 15
FORCED MID-EXPIRATORY FLOW (l/sec, BTPS)		3.58 0.92 19	3.77 0.94 15
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	2.63 0.49 10	2.44 0.48 19	2.26 # 0.37 15
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	48.4 8.7 10	46.5 6.3 19	41.9 #* 4.5 15
HEMOGLOBIN (g/l)	133.2 9.5 5	137.4 5.3 16	135.6 14.9 14

Values shown are the mean, standard deviation, and sample size.

Significantly different from 1970 (#); from 1980 (*).

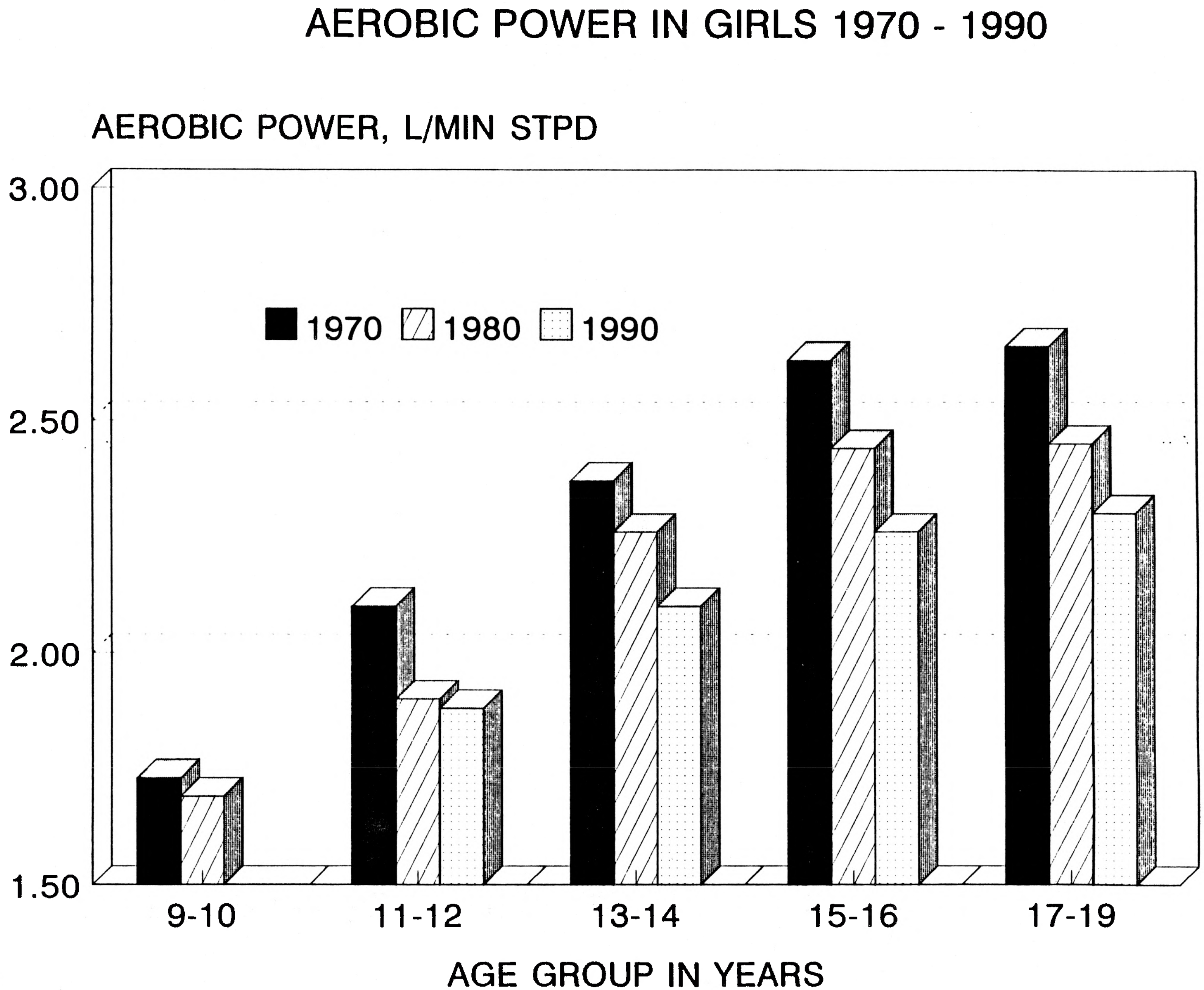

Figure 37. Absolute aerobic power in girls aged 9 - 19 years in 1970, 1980, and 1990.

SECTION 9. GROWTH AND DEVELOPMENT OF IGLOOLIK CHILDREN

Data for Boys Aged 9-19 Years

Age-specific cross-sectional data from 1970, 1980, and 1990 on the anthropometry, strength, and fitness of Igloolik boys aged 9-19 years are summarized in Tables 83-93 and illustrated in Figures 39- 45. The corresponding data for girls is shown in Tables 94-104 and Figures 46-52.

Approximately one year after the initial tests, we were able to re-test 55 boys and 42 girls originally aged 11-19 years, giving us semi-longitudinal data on growth and development. Data for the boys is summarized in Tables 105-107 and shown graphically in Figures 53-58. The corresponding data for the girls is shown in Tables 108-110 and Figures 59-64.

Height

The cross-sectional data in Fig. 39 shows that in 1990 the growth spurt for height in boys appeared to start at an average age of 12.3 years and continued until the 15th year, when the growth rate slowed. This puts the 1990 start of the growth spurt about a year ahead of that for the 1970 boys, who showed an acceleration in growth starting at the average age of 13.6 years.

The semi-longitudinal data for the 1990 boys (Table 105, Fig. 53) shows the most rapid growth in height was from age 11.8 to 15.3 years.

Body Mass

For both 1970 and 1990, the cross-sectional data (Fig. 40) showed that the most rapid gains in body mass were concurrent with the greatest height increases. As with height, large gains in body mass started at an earlier age (12.3 years) in 1990 than in 1970 (13.6 years). The semi-longitudinal data for 1990 showed that whereas gains in height (Fig 53) decreased substantially after age 15 years, growth in body mass (Fig 54) continued well past the maximum increases in height.

Grip Strength

The plot of the cross-sectional grip strength data (Fig 42) looks very similar for both the 1970 and 1990 boys, with the exception of the very youngest and the oldest boys. Our age-grouped data (Tables 63-67; Fig 28) also showed that the 11-12 and 17-19 year old boys had significantly higher grip strengths in 1970 than in 1990. Figure 42 suggests that the steepest part of the growth curve for grip strength started earlier in 1990 (12.3 years) than in 1970 (13.6); however, whereas in 1990 the growth in grip strength appeared to slow after age 15 years and even decreased after age 18 years, in 1970 the growth in grip strength continued to age 18 years.

In contrast to the above, the semi-longitudinal data for 1990 (Table 105, Fig. 55) showed continued growth in grip strength from age 11 to 20 years, with the greatest growth from age 11 to 15 years.

Grip Strength

The graph (Fig. 49) for age-specific cross-sectional data shows that the 1990 girls were weaker at all ages than the girls tested in 1970. Acceleration in the growth of grip strength started at a later age in 1990 (12.5 years) than in 1970 (10.4 years). Our semi-longitudinal data for 1990 (Fig 64) showed the greatest increase from age 11 to 15 years, little change from 15-17 years with additional increases in grip strength from age 17 to 20 years.

Leg Strength

The data in Fig. 50 shows that with the exception of one ten year old girl in 1990, the girls in 1970 were stronger at all ages than those seen in 1990. As with grip strength, increases in leg strength started at a later age in 1990 (14.5 years) than in 1970 (9.4 years). The semi-longitudinal data (Fig. 65) showed growth of leg strength from age 11 to 19 years, with the greatest increases from age 13 to 16 years.

Absolute Aerobic Power

A plot of the age-specific cross-sectional data (Fig. 51) shows that after age 11 years the absolute aerobic power was lower at all ages in 1990 than in 1970. In 1970, growth of absolute aerobic power started at age 9 years, whereas in 1990 it started some 3 years later at an age of 12.5 years. The semi-longitudinal data for 1990 (Fig. 66) showed the most rapid increases from age 11-13 years, some decline at age 13-14 years, further growth at age 14-15 years, and then a general decline to age 20 years.

b) Relative Aerobic Power

Fig 52 shows the data on relative aerobic power for girls. As with the absolute values, relative power was lower at all ages in 1990 than in 1970.

Table 84. Anthropometry, strength, and fitness data for 10-year old boys 1970 - 1990.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	10.9 0.1 3	10.5 0.3 8	10.6 0.2 2
HEIGHT (cm)	136.0 3.5 3	131.5 2.7 8	137.0 5.7 2
BODY MASS (kg)	29.9 2.3 3	29.0 3.5 8	33.1 2.4 2
SUM 3 SKINFOLDS (mm)	12.7 3.5 3	17.9 3.9 8	20.0 5.7 2
HAND GRIP FORCE (Newtons)	143.9 22.7 3	138.6 35.3 8	112.8 20.8 2
LEG EXTENSION FORCE (Newtons)	372.8 51.9 3	278.4 88.7 8	407.1 * 20.8 2
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	1.86 0.05 3	1.95 0.13 8	1.86 0.06 2
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	62.2 3.6 3	68.4 11.5 8	56.2 * 2.4 2

Values shown are the mean, standard deviation, and sample size.

Table 86. Anthropometry, strength, and fitness data for 12-year old boys 1970 - 1990.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	12.4 0.3 9	12.5 0.2 10	12.3 0.2 15
HEIGHT (cm)	140.8 9.7 9	148.4 7.0 10	143.0 5.2 15
BODY MASS (kg)	36.6 5.2 9	43.3 8.2 10	38.5 4.4 15
SUM 3 SKINFOLDS (mm)	14.2 4.1 9	23.8 14.1 10	20.5 # 6.4 15
HAND GRIP FORCE (Newtons)	182.1 44.4 9	209.9 25.4 10	145.2 #* 40.1 15
LEG EXTENSION FORCE (Newtons)	448.0 133.2 9	363.0 57.6 10	356.4 101.8 15
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	2.62 0.61 9	2.51 0.30 10	2.27 0.33 15
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	71.3 10.1 9	58.8 # 7.7 10	59.4 # 7.5 15

Values shown are means, standard deviations, and sample sizes. Significantly different from 1970 (#); from 1980 (*).

Table 88. Anthropometry, strength, and fitness data for 14-year old boys 1970 - 1990.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	14.5 0.2 2	14.6 0.2 13	14.4 0.3 9
HEIGHT (cm)	162.0 11.3 2	155.2 8.6 13	157.3 7.6 9
BODY MASS (kg)	50.6 11.2 2	48.3 8.2 13	52.0 8.6 9
SUM 3 SKINFOLDS (mm)	13.5 0.7 2	17.9 # 3.5 13	23.3 # 10.4 9
HAND GRIP FORCE (Newtons)	323.7 27.8 2	295.0 94.2 13	259.4 82.8 9
LEG EXTENSION FORCE (Newtons)	848.6 34.7 2	458.8 # 141.0 13	363.0 # 80.7 9
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	3.17 0.38 2	2.95 0.70 13	3.01 0.69 9
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	63.4 5.6 2	61.5 13.2 13	58.1 9.8 9

Values shown are means, standard deviations, and sample sizes.
Significantly different from 1970 (#).

Table 90. Anthropometry, strength, and fitness data for 16-year old boys 1970 - 1990.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
AGE (yr)	16.3 0.2 5	16.4 0.4 13	16.5 0.3 7
HEIGHT (cm)	165.2 3.7 5	161.7 4.5 13	161.3 3.9 7
BODY MASS (kg)	57.3 8.7 5	57.6 6.9 13	55.9 4.8 7
SUM 3 SKINFOLDS (mm)	14.2 4.0 5	17.9 5.7 13	18.9 # 3.2 7
HAND GRIP FORCE (Newtons)	386.5 73.3 5	400.7 100.5 13	386.8 78.5 7
LEG EXTENSION FORCE (Newtons)	616.1 285.7 5	691.2 168.9 13	473.7 67.7 7
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	3.52 0.87 5	3.36 0.53 13	3.28 0.72 7
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	60.8 6.8 5	58.7 8.9 13	58.4 11.6 7

Values shown are the mean, standard deviation, and sample size. Significantly different from 1970 (#).

Table 92. Anthropometry, strength, and fitness data for 18-year old boys 1970 - 1990.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	18.3 0.2 9	18.6 0.3 5	18.4 0.3 13
HEIGHT (cm)	166.0 6.9 9	163.9 3.8 5	163.5 5.1 13
BODY MASS (kg)	61.5 9.0 9	63.3 5.0 5	63.9 7.8 13
SUM 3 SKINFOLDS (mm)	15.9 4.3 9	22.0 # 3.4 5	28.5 # 12.0 13
HAND GRIP FORCE (Newtons)	451.3 93.1 9	476.8 93.8 5	416.5 47.9 13
LEG EXTENSION FORCE (Newtons)	782.2 146.7 9	690.6 146.1 5	547.1 #* 122.4 13
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	3.93 0.33 9	3.54 0.34 5	3.62 0.63 13
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	64.6 6.5 9	56.3 # 6.7 5	57.0 # 10.0 13

Values shown are the mean, standard deviation, and sample size. Significantly different from 1970 (#); from 1980 (*).

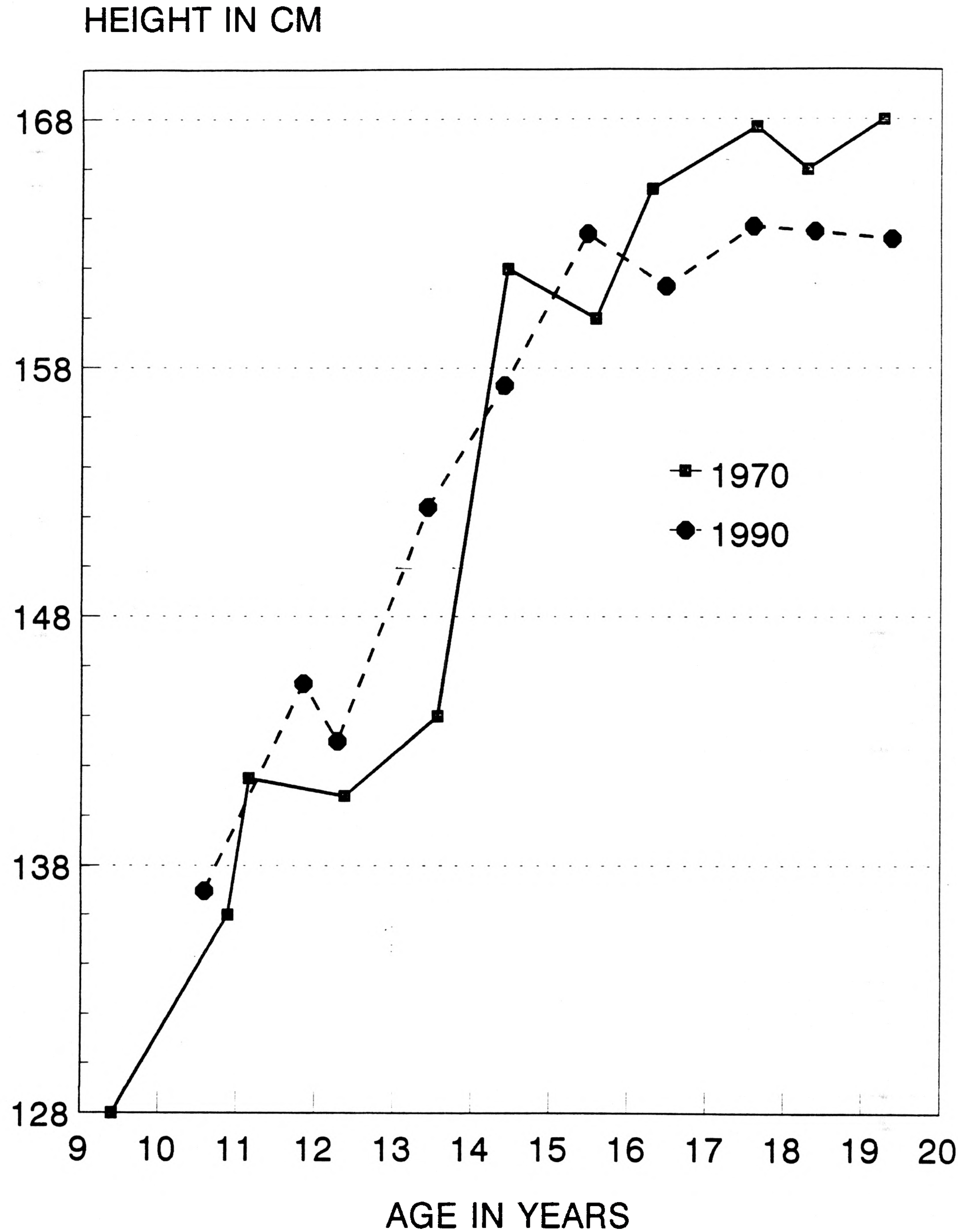

Figure 39. Height comparisons in Igloolik boys 1970 and 1990. Data from cross-sectional studies.

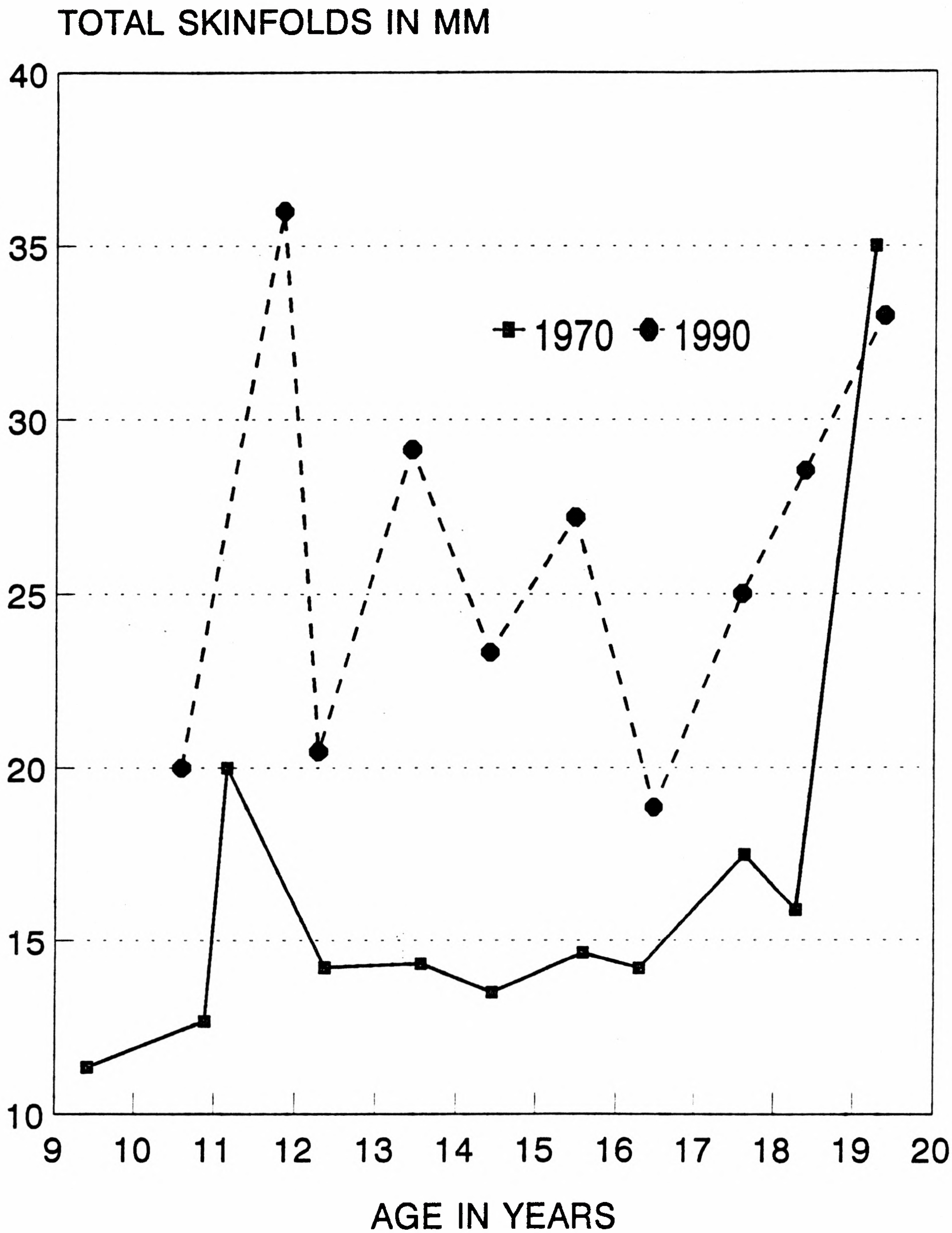

Figure 41. Cross-sectional comparisons of subcutaneous fat in Igloolik boys 1970-1990; sum of three skinfolds.

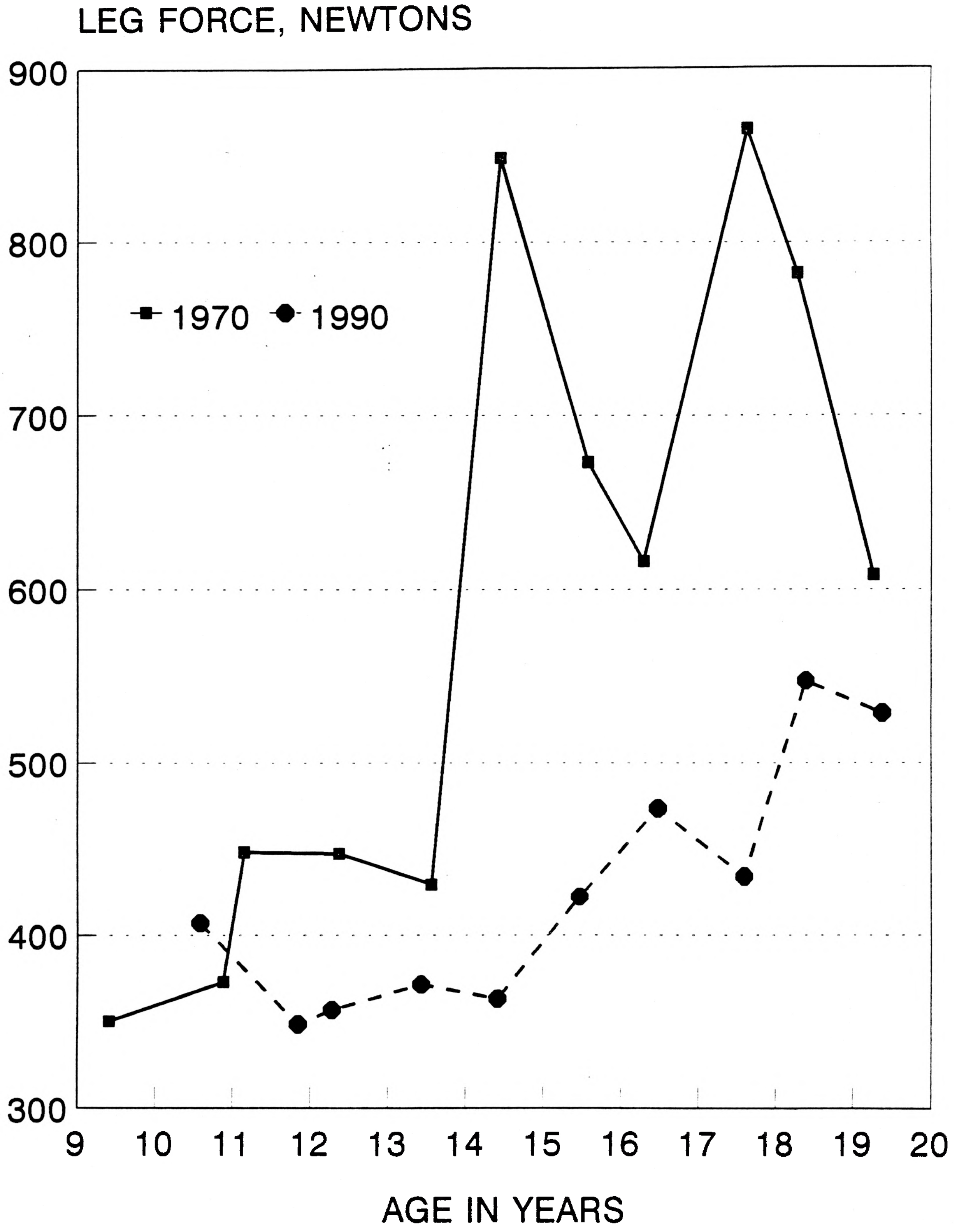

Figure 43. Cross-sectional comparisons of leg extension force in Igloolik boys 1970-1990.

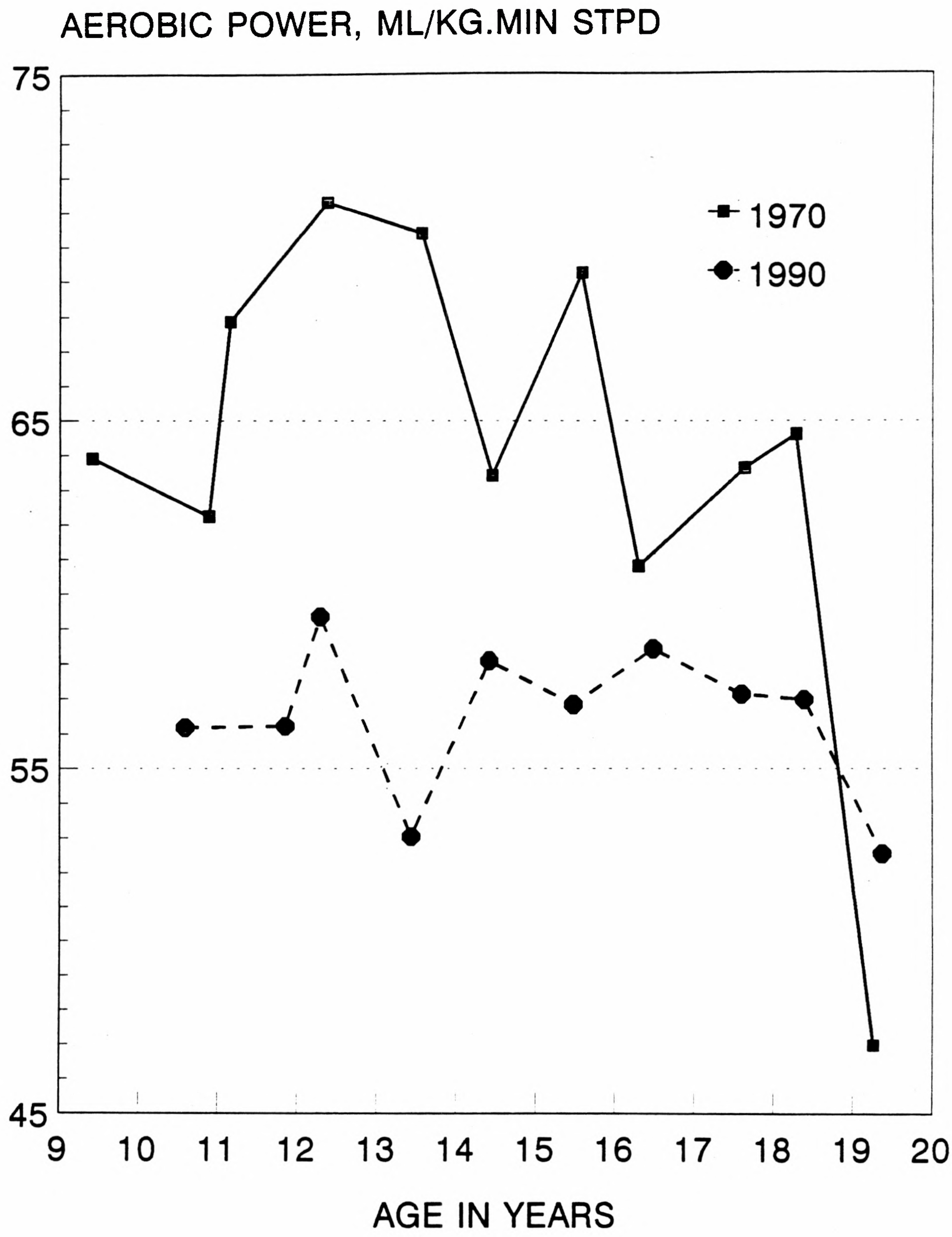

Figure 45. Cross-sectional comparisons of aerobic power (VO2max) in Igloolik boys 1970-1990.

Table 95. Anthropometry, strength, and fitness data for 10-year old girls 1970 - 1990.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	10.4 0.4 4	10.7 0.4 4	10.9 0.0 1
HEIGHT (cm)	130.8 3.8 4	133.5 4.7 4	146.5 0.0 1
BODY MASS (kg)	29.7 1.4 4	34.5 2.8 4	48.6 0.0 1
SUM 3 SKINFOLDS (mm)	19.0 9.9 4	24.8 3.7 4	66.0 0.0 1
HAND GRIP FORCE (Newtons)	103.0 40.4 4	107.9 31.0 4	98.1 0.0 1
LEG EXTENSION FORCE (Newtons)	364.4 45.1 4	306.6 92.8 4	519.9 0.0 1
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	1.86 0.31 4	1.69 0.25 4	1.95 0.00 1
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	62.8 11.4 4	48.6 3.7 4	40.2 0.0 1

Values shown are the mean, standard deviation, and sample size.

Table 97. Anthropometry, strength, and fitness data for 12-year old girls 1970 - 1990.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
AGE (yr)	12.6 0.4 8	12.6 0.3 8	12.5 0.4 11
HEIGHT (cm)	144.3 6.3 8	145.2 3.4 8	145.2 4.5 11
BODY MASS (kg)	41.1 6.3 8	40.9 7.6 8	39.9 5.4 11
SUM 3 SKINFOLDS (mm)	22.0 9.0 8	25.4 15.9 8	29.6 11.4 11
HAND GRIP FORCE (Newtons)	191.3 29.6 8	163.1 47.8 8	99.9 # 38.2 11
LEG EXTENSION FORCE (Newtons)	472.2 132.0 8	302.9 116.2 8	290.8 57.3 11
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	2.22 0.43 8	2.03 0.39 8	1.87 0.36 11
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	54.3 8.2 8	50.0 5.7 8	47.5 9.7 11

Values shown are the mean, standard deviation, and sample size.
Significantly different from 1970 (#).

Table 99. Anthropometry, strength, and fitness data for 14-year old girls 1970 - 1990.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	14.5 0.4 5	14.5 0.3 6	14.5 0.3 4
HEIGHT (cm)	150.8 0.5 5	149.0 4.2 6	150.4 6.0 4
BODY MASS (kg)	47.2 6.5 5	45.3 7.4 6	47.9 6.7 4
SUM 3 SKINFOLDS (mm)	26.0 11.3 5	27.0 9.7 6	35.5 6.4 4
HAND GRIP FORCE (Newtons)	247.2 44.6 5	242.0 41.0 6	149.6 #* 60.1 4
LEG EXTENSION FORCE (Newtons)	510.1 40.4 5	358.1 # 148.2 6	313.9 # 118.5 4
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	2.42 0.43 5	2.06 0.41 6	2.14 0.65 4
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	51.0 3.9 5	46.7 12.3 6	43.9 7.7 4

Values shown are the mean, standard deviation, and sample size. Significantly different from 1970 (#); from 1980 (*).

Table 101. Anthropometry, strength, and fitness data for 16-year old girls 1970 - 1990.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	1970	1980	1990
AGE (yr)	16.5 0.2 4	16.6 0.3 14	16.4 0.2 8
HEIGHT (cm)	156.3 8.2 4	152.4 6.8 14	153.6 5.3 8
BODY MASS (kg)	57.5 6.5 4	53.5 6.2 14	54.8 11.7 8
SUM 3 SKINFOLDS (mm)	35.0 9.0 4	37.6 12.0 14	54.8 23.4 8
HAND GRIP FORCE (Newtons)	284.5 33.9 4	262.0 37.8 14	196.2 #* 46.3 8
LEG EXTENSION FORCE (Newtons)	630.3 260.4 4	510.1 154.9 14	401.0 105.0 8
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	2.78 0.27 4	2.54 0.49 14	2.20 # 0.35 8
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	48.4 1.5 4	47.4 6.5 14	40.7 #* 3.9 8

Values shown are the mean, standard deviation, and sample size. Significantly different from 1970 (#); from 1980 (*).

Table 103. Anthropometry, strength, and fitness data for 18-year old girls 1970 - 1990.

IGLOOLIK HEALTH AND FITNESS PROJECT 1970-1990.			
MEASUREMENT	**1970**	**1980**	**1990**
AGE (yr)	18.3 0.3 4	18.7 0.3 5	18.4 0.3 7
HEIGHT (cm)	153.8 6.9 4	151.2 4.5 5	153.4 5.2 7
BODY MASS (kg)	53.9 3.3 4	51.2 5.1 5	51.6 3.7 7
SUM 3 SKINFOLDS (mm)	33.3 8.7 4	32.0 7.7 5	46.6 16.3 7
HAND GRIP FORCE (Newtons)	279.6 20.4 4	272.7 44.1 5	179.4 #* 38.7 7
LEG EXTENSION FORCE (Newtons)	627.8 113.6 4	567.0 40.1 5	402.2 #* 32.6 7
PREDICTED AEROBIC POWER, VO2max (l/min, STPD)	2.60 0.26 4	2.37 0.33 5	1.92 #* 0.27 7
PREDICTED AEROBIC POWER, VO2max (ml/kg.min, STPD)	48.1 3.6 4	46.5 6.1 5	37.5 #* 6.9 7

Values shown are the mean, standard deviation, and sample size. Significantly different from 1970 (#); from 1980 (*).

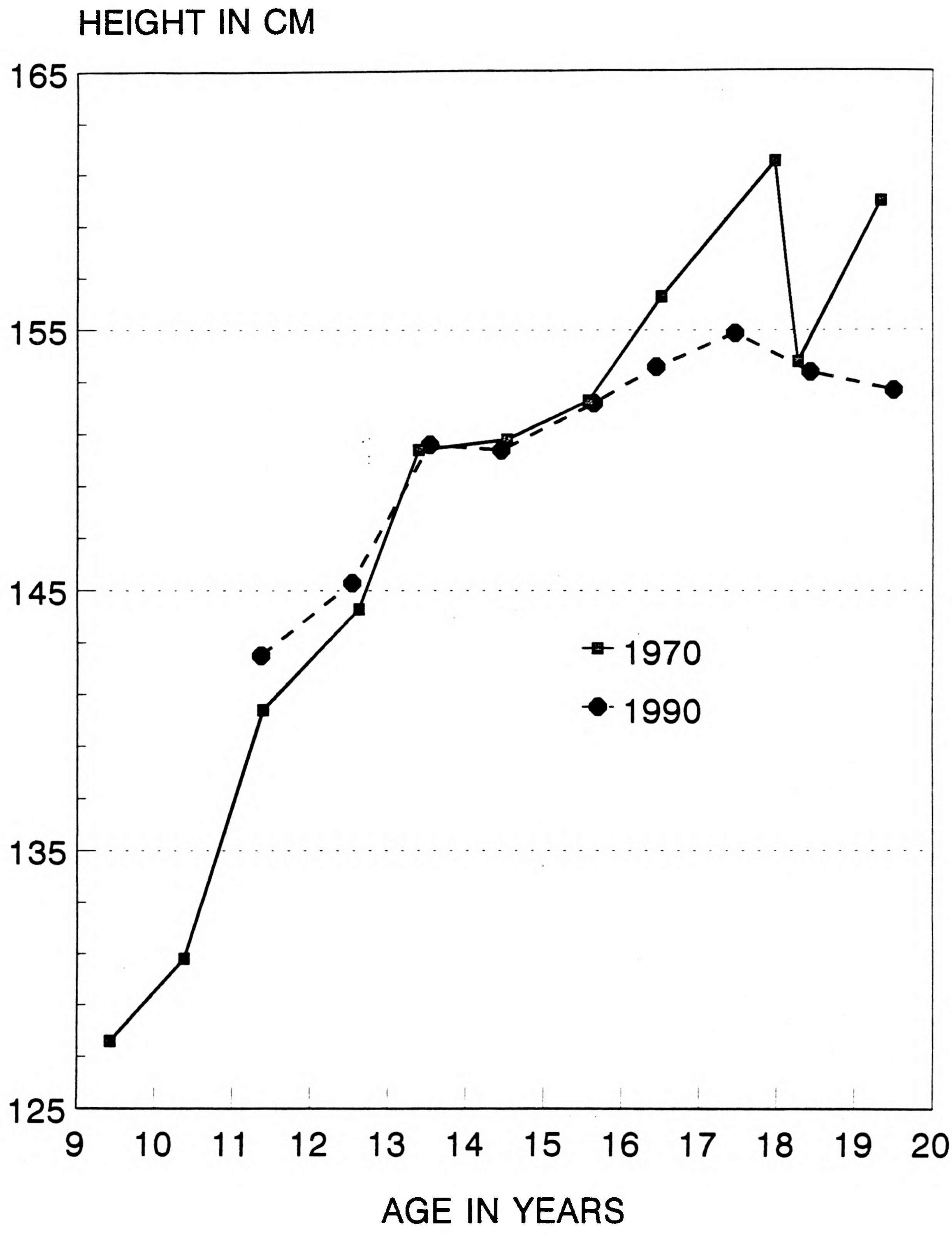

Figure 46. Height comparisons in Igloolik girls 1970 and 1990. Data from cross-sectional studies.

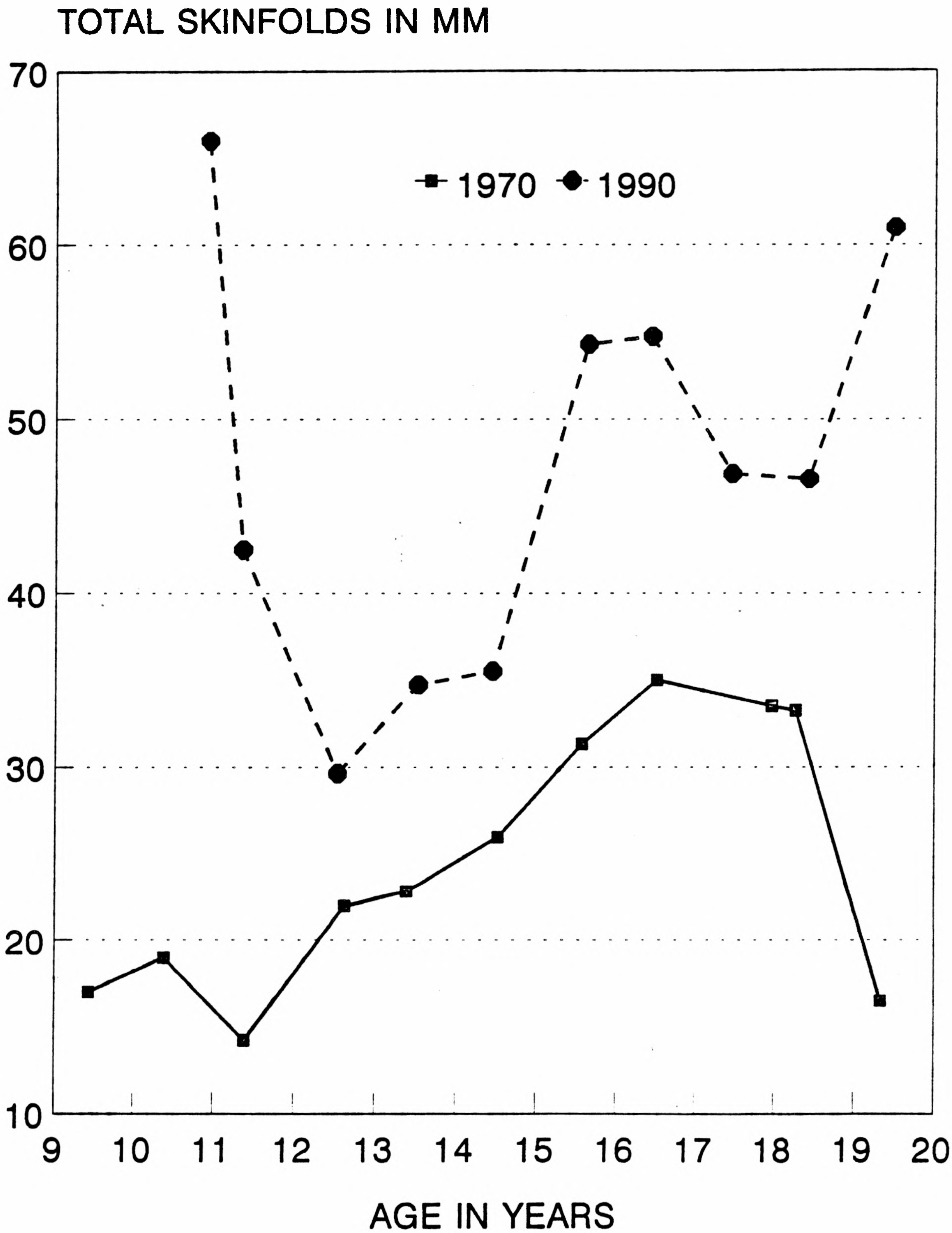

Figure 48. Cross-sectional comparisons of subcutaneous fat in Igloolik girls 1970-1990; sum of three skinfolds.

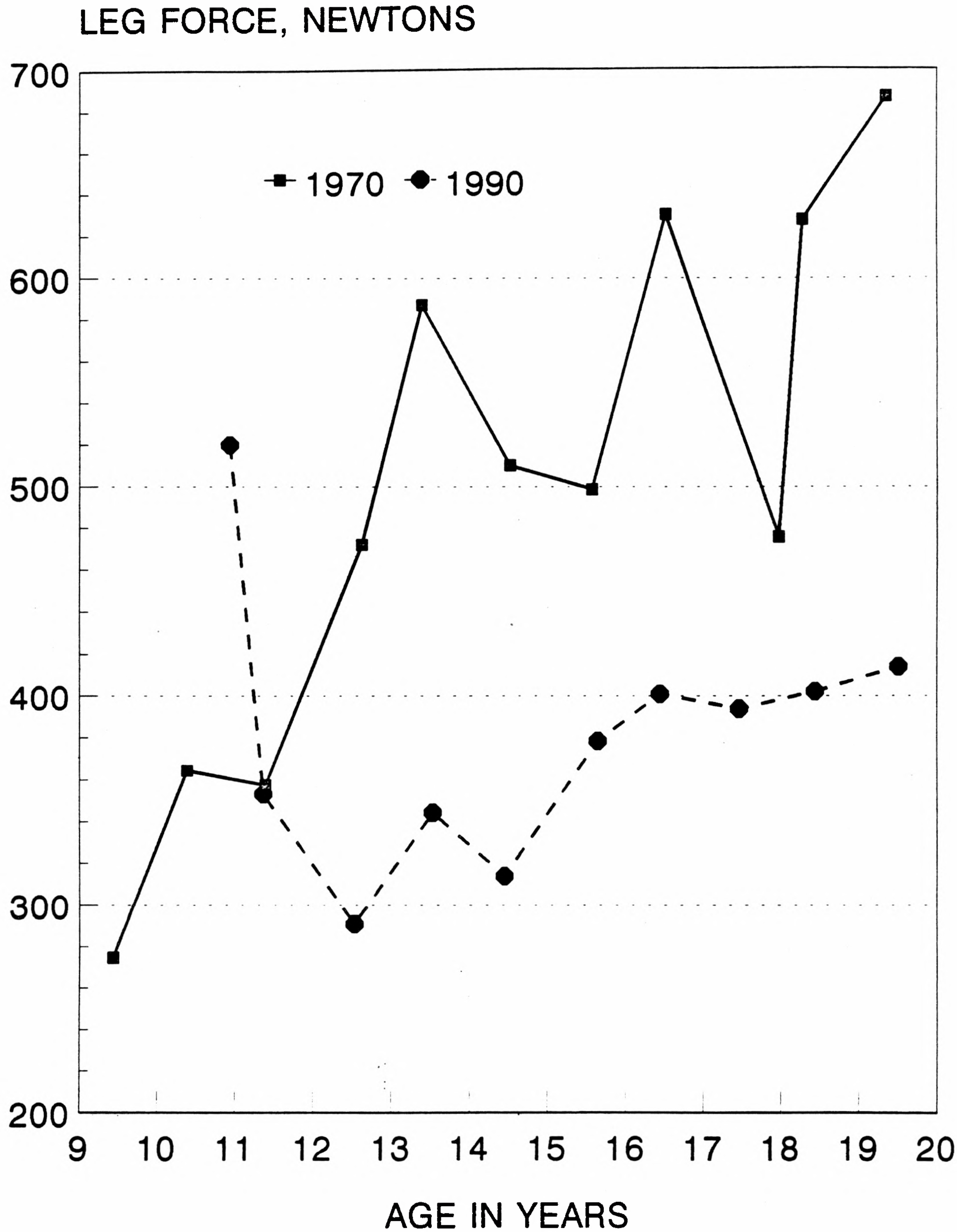

Figure 50. Cross-sectional comparisons of leg extension force in Igloolik girls. 1970-1990.

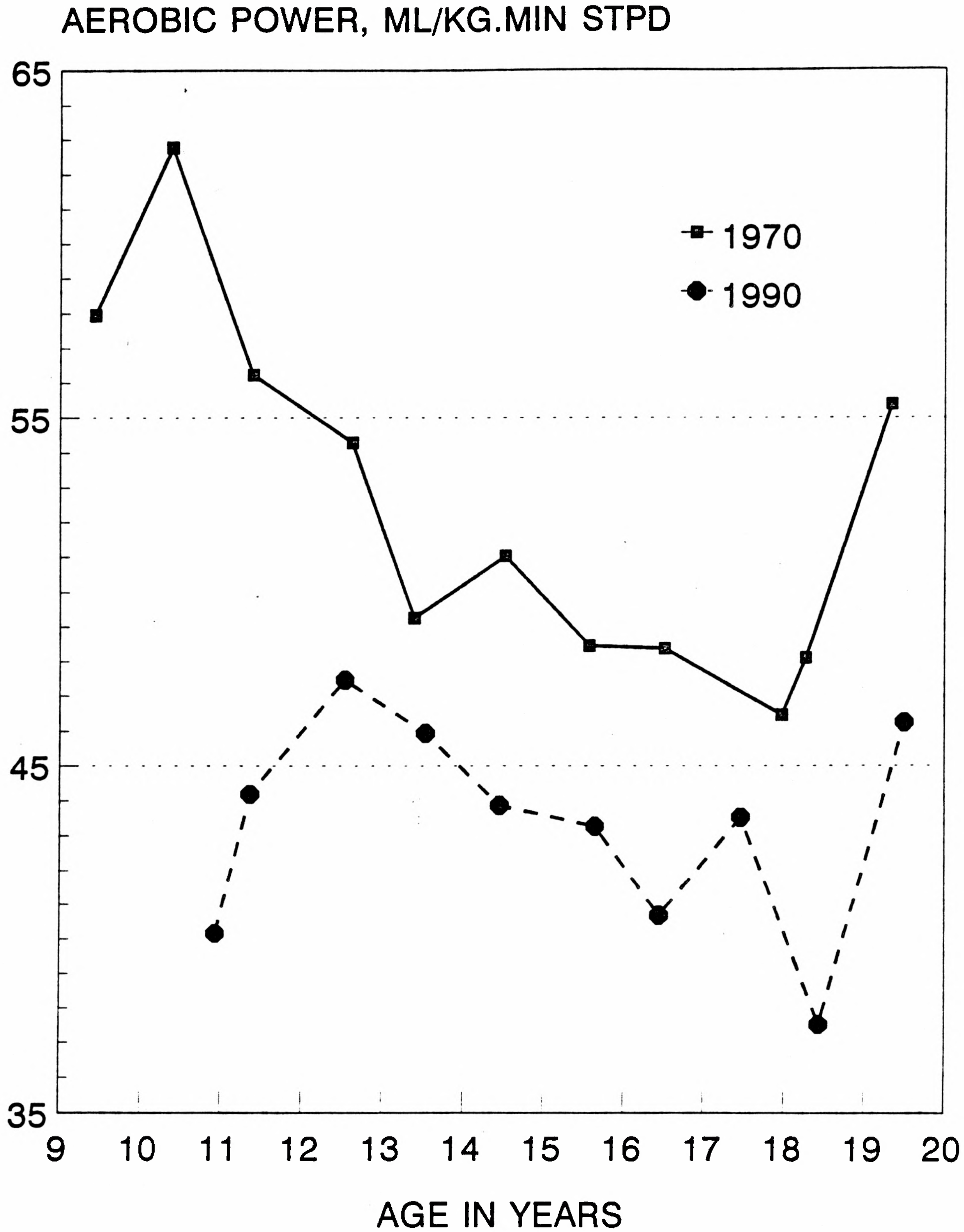

Figure 52. Cross-sectional comparisons of aerobic power (VO2max) in Igloolik girls 1970-1990.

Table 106. Semi-longitudinal data for boys showing the average monthly growth rates (mean, SD) of aerobic power.

Average Age (yr)		N	Aerobic Power, STPD	
Start	Finish		Litres/min	ml/kg.min
11.84	12.68	4	0.025 0.015	0.23 0.28
12.38	13.31	4	0.026 0.022	-0.04 0.51
13.40	14.36	10	0.041 0.031	0.27 0.67
14.33	15.30	7	-0.005 0.034	-0.58 0.76
15.57	16.56	6	0.017 0.043	0.08 0.70
16.53	17.49	7	0.019 0.038	-0.01 0.66
17.66	18.50	4	-0.016 0.046	-0.32 0.64
18.40	19.37	9	-0.004 0.052	-0.07 0.80
19.42	20.28	4	0.039 0.059	0.38 0.91

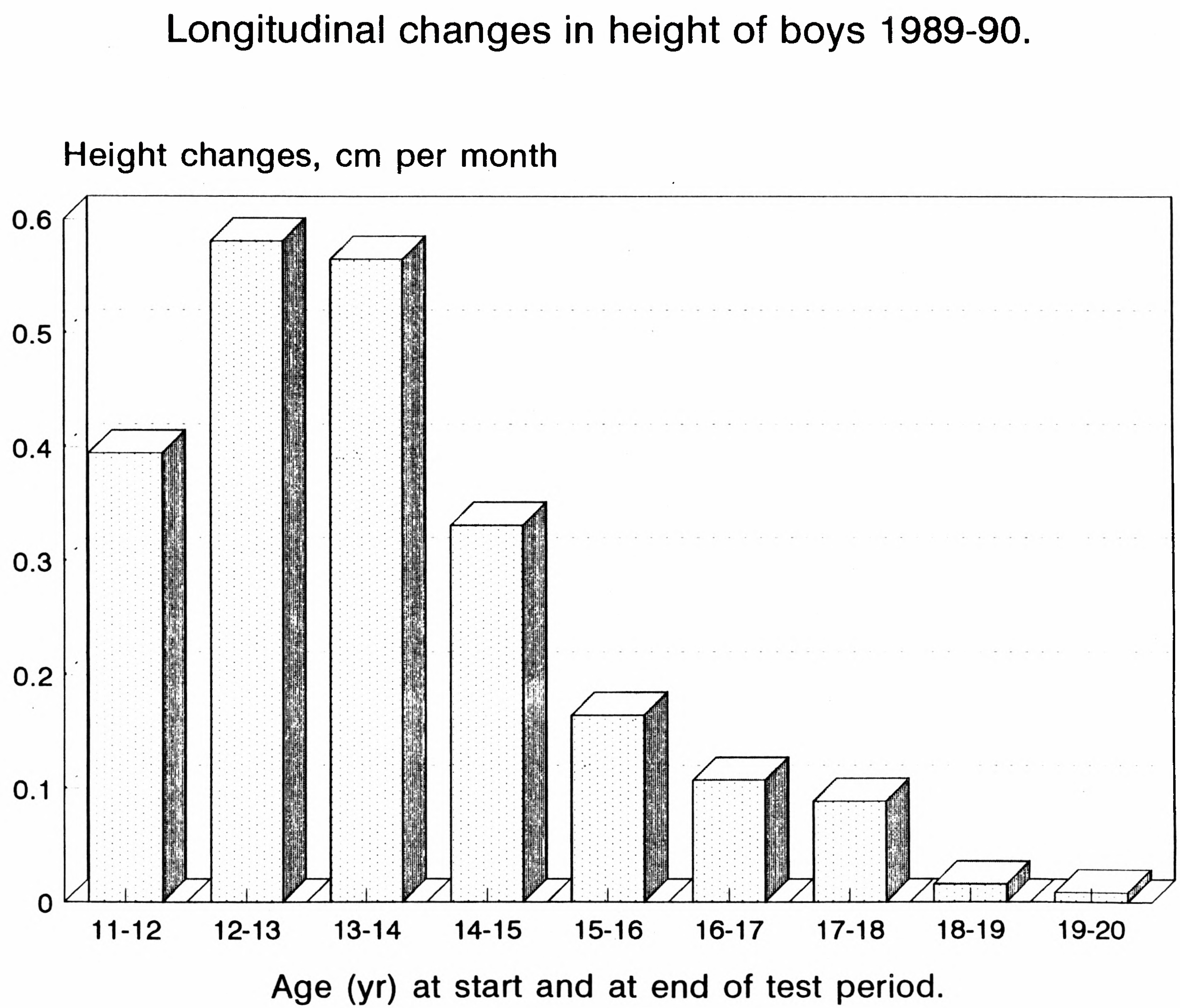

Fig 53. Longitudinal changes in height over an average period of 11.3 months.

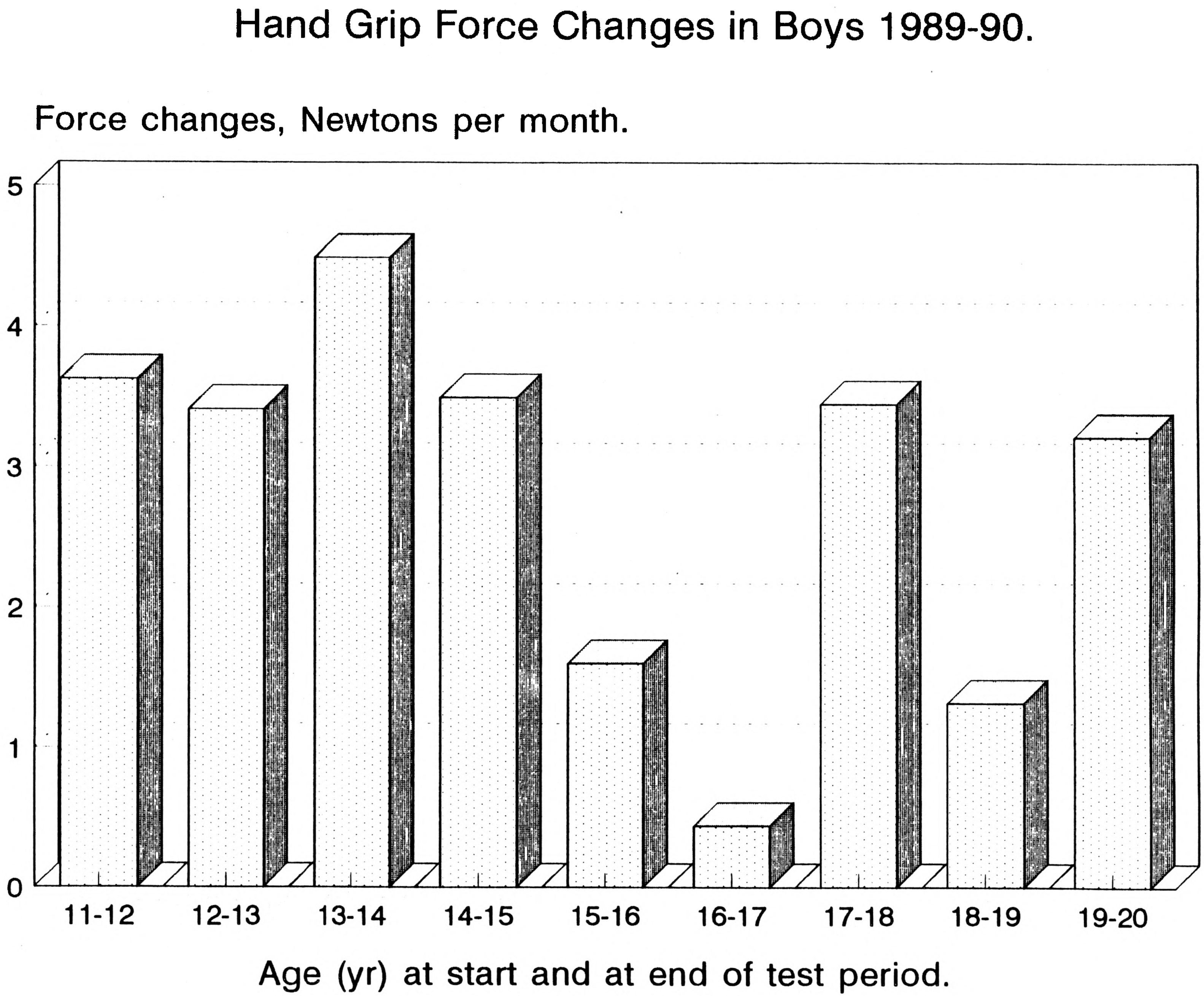

Fig 55. Longitudinal changes in hand grip force over an average period of 11.3 months.

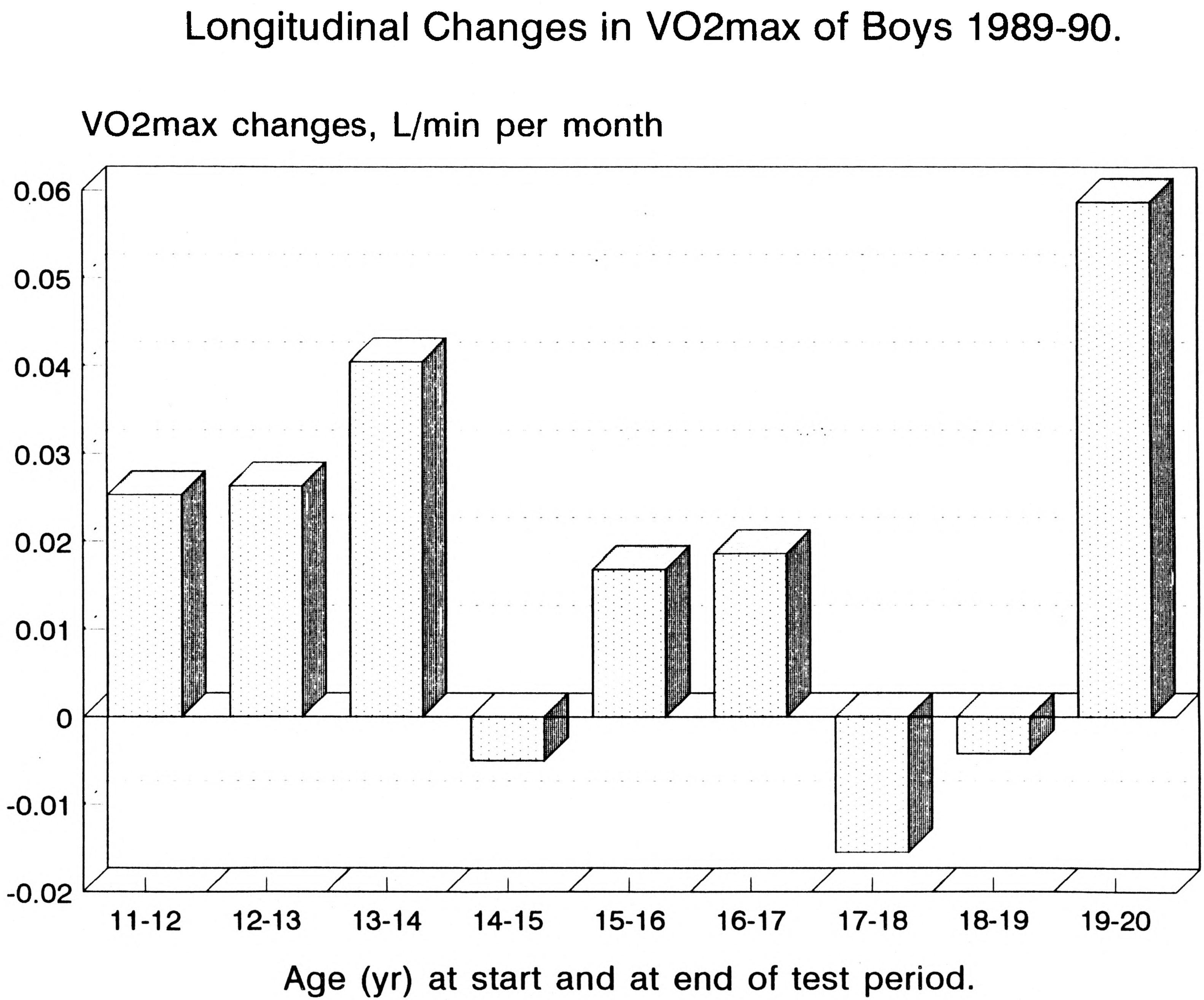

Fig 57. Longitudinal changes in VO2max over an average period of 11.3 months.

Table 108. Semi-longitudinal data (mean, SD) on the average monthly growth rates in girls for height (cm/month), body mass (kg/month), and strength (N/month)

Average Age (yr)		N	Height	Body Mass	Strength	
Start	Finish				Grip	Leg
10.97	11.87	2	0.42 0.07	0.60 0.34	1.8 2.5	1.5 12.2
12.36	13.29	6	0.40 0.22	0.49 0.10	3.6 1.8	1.4 6.3
13.57	14.51	10	0.18 0.19	0.33 0.13	2.6 2.8	4.6 4.2
14.39	15.33	3	0.07 0.03	0.41 0.20	3.5 1.5	9.5 10.1
15.61	16.57	4	-0.01 0.06	0.20 0.08	-0.2 1.7	10.3 9.1
16.44	17.39	7	-0.04 0.09	0.03 0.24	0.2 1.4	2.9 7.9
17.50	18.42	4	-0.02 0.03	-0.01 0.33	1.1 3.5	2.7 3.2
18.37	19.24	4	-0.06 0.07	0.05 0.06	1.6 2.6	1.9 4.6
19.61	20.40	2	-0.15 0.02	0.00 0.10	2.6 0.2	-4.2 9.5

Table 110. Semi-longitudinal data for girls showing the average monthly growth rates (mean, SD) of dynamic lung volumes.

Average Age (yr)		N	Dynamic Lung Volumes, BTPS		
Start	Finish		FEV (Litres)	FVC (Litres)	FMF (L/sec)
10.97	11.87	2	0.020 0.015	0.022 0.010	0.041 0.047
12.36	13.29	6	0.029 0.011	0.033 0.014	0.023 0.017
13.57	14.51	10	0.006 0.056	0.009 0.057	0.006 0.082
14.39	15.33	3	0.017 0.049	0.006 0.011	0.044 0.116
15.61	16.57	4	0.024 0.025	0.004 0.006	0.055 0.055
16.44	17.39	7	0.001 0.013	-0.009 0.010	0.001 0.048
17.50	18.42	4	0.003 0.026	-0.003 0.019	-0.005 0.054
18.37	19.24	4	-0.008 0.006	-0.006 0.008	-0.002 0.020
19.61	20.40	2	-0.003 0.010	-0.011 0.002	-0.002 0.027

Longitudinal Changes in Body Mass of Girls 1989-90.

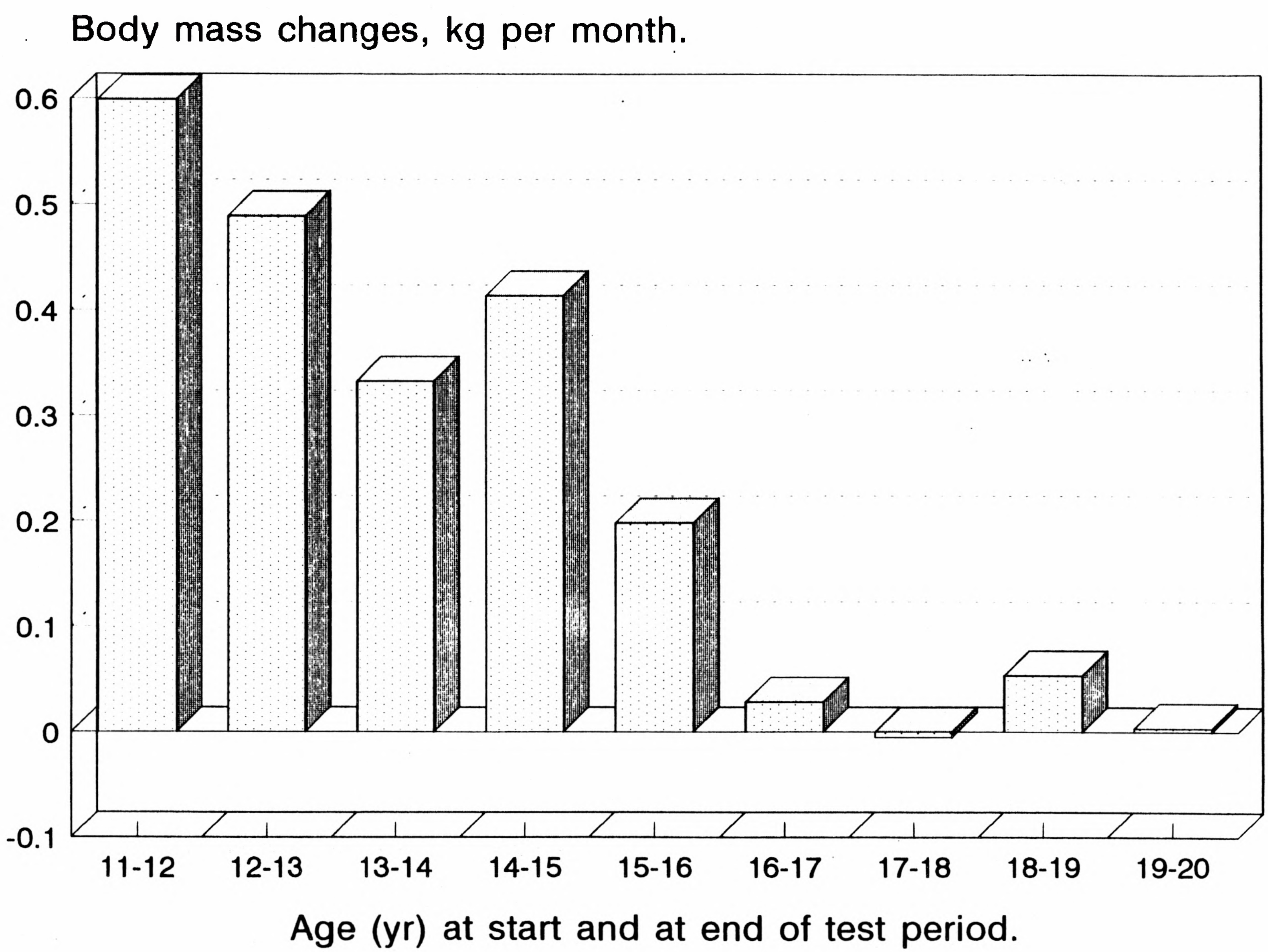

Fig 60. Longitudinal changes in body mass over an average period of 11.3 months.

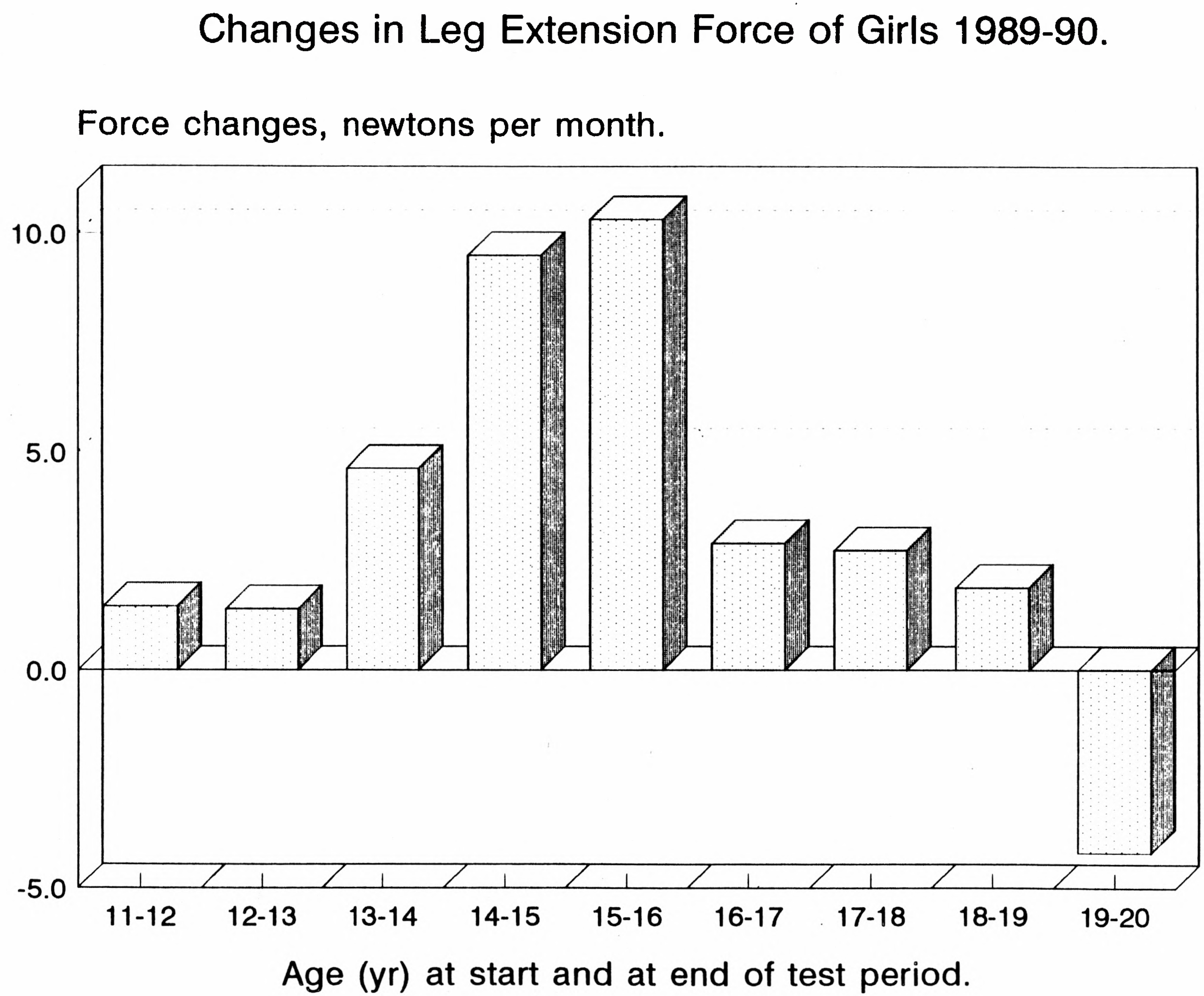

Fig 62. Longitudinal changes in leg extension force over an average period of 11.3 months.

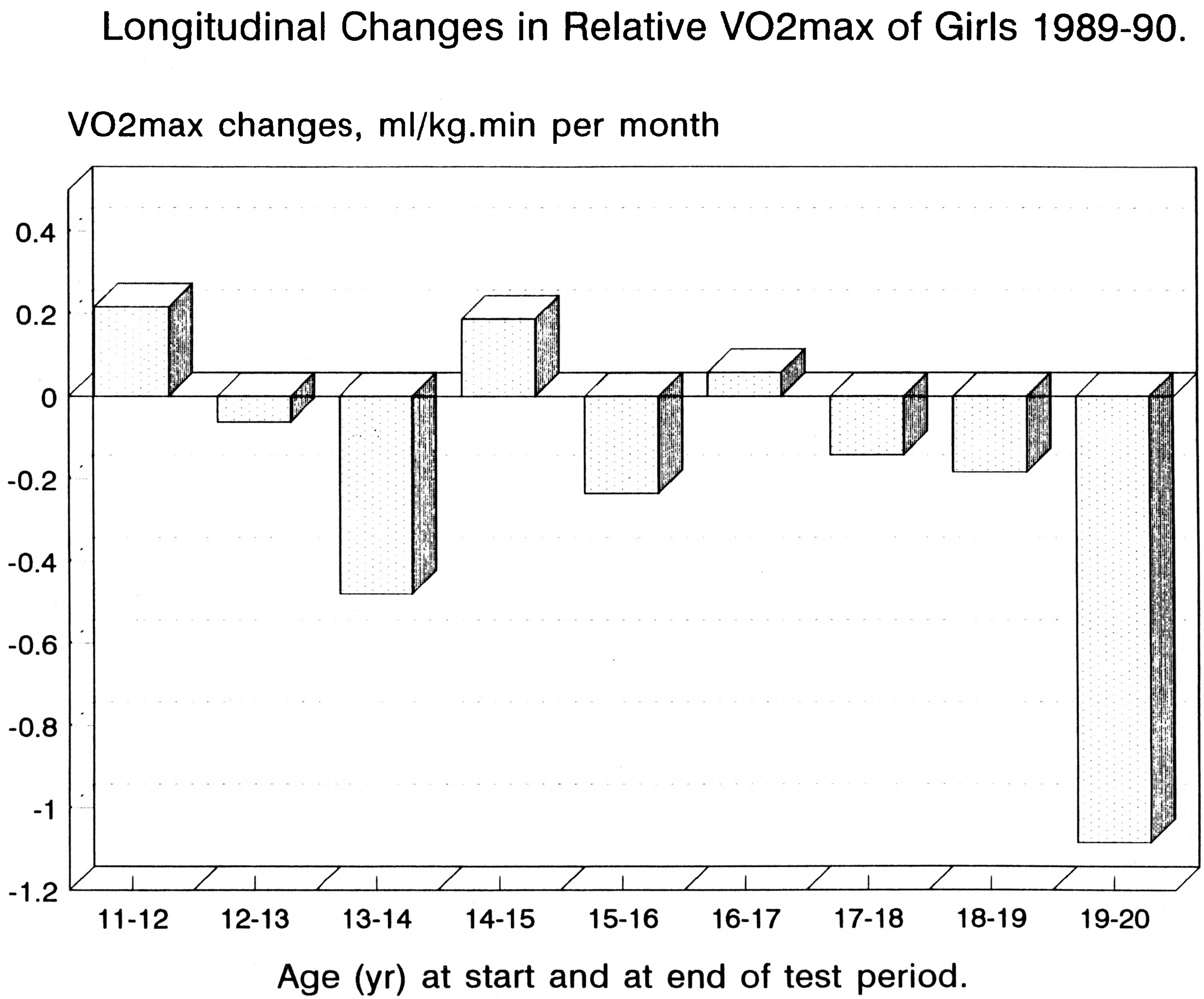

Fig 64. Longitudinal changes in relative VO2max over an average period of 11.3 months.

SECTION 10. DISCUSSION AND RECOMMENDATIONS

General. In the 20 years since our first series of anthropometric and physiological tests in 1970, the Inuit children and adults of Igloolik have experienced very rapid and unprecedented changes in lifestyle, with associated changes in body composition and personal fitness. The negative changes detailed in the section on results include a substantial accumulation of body fat, decreases in leg and handgrip strength, and deterioration of aerobic fitness in both sexes and in children as well as in adults. Nevertheless, some encouragement may be drawn from the finding that:

a) those children and young adults who participated in sports or other vigorous activities were able to maintain fitness levels equivalent to those seen in 1970; and,

b) there is some evidence that smoking has decreased among children, particularly in the young boys.

Factors contributing to deteriorating fitness levels and accumulations of body fat include a decrease of habitual physical activity and the consumption of an excess of food probably related to purchases of snacks such as candy, soft drinks, potatoe chips, and other "junk food". We did not have sufficient resources to analyze and document these general observations; however, one of us (A.R.) lived and worked continuously in Igloolik from 1970 to 1985 and he noted the increasing trend to the consumption of refined, imported foods and snacks at the expense of local game and fish. This was particularly true for the younger members of the community but was by no means limited to them.

Activity levels decreased as mechanization increased, with cars, light trucks, motorcycles, snowmobiles, all-terrain cycles, and bicycles virtually displacing walking as a means of locomotion in and around the village. The world-wide depression of fur sales (particularly sealskins) almost eliminated a powerful economic motive for hunting, and an increasing reliance on manufactured clothing and a preference for imported foods further reduced the need to hunt. As we showed in our 1970 studies (4), the physical demands of the hunt were an important factor contributing to physical fitness.

The arrival in Igloolik of television and various forms of video entertainment was another important factor displacing more active pursuits and leading to a further deterioration of physical fitness. Starting in the late 1970's, increasing amounts of leisure time were devoted to watching rather than doing. Landmarks in this cultural change were:

a) video cassette recorders (VCR's) and local cassette rentals in the late 1970's;
b) regular television programming via satellite transmission in 1983 and cable television in 1990;
c) video game machines (such as Nintendo) in the late 1980's; and,

body densities for a given skinfold total than a comparable Caucasian group, suggesting that a larger proportion of total body fat was carried internally by the Inuit, or that the bone density was lower in the Inuit. This was true for skinfold totals ranging from 15-25 mm, but at 35 mm the difference was no longer evident. The 30-39 year old Inuit men also had lower body densities for a given skinfold total and this was true for the whole range of skinfold totals considered, 15-35 mm, indicating that they too carried more fat internally and/or had lower bone densities.

In women aged 17-59 years the average increase in the total skinfold thickness from 1970 to 1990 ranged from 73% to 307%, with an overall average increase of 134% over the 20 years. The average thickness per skinfold was 10.7 mm in 1970; by 1990 the average reading had risen to 23.4 mm per fold.

Only the 17-29 year old women exhibited the pattern of weight loss, fat increase, and strength loss that was seen in the 17-39 year old men. In 1990, their weight was *the same or lower*, whereas subcutaneous fat deposits were significantly *higher*. This group of women also showed a highly significant deterioration in muscle strength: - hand grip and leg extension forces were significantly lower in 1990 than in 1970. As in the men, this pattern of change probably reflects loss of muscle mass. For women in other age groups, gains in subcutaneous fat were accompanied by gains in body mass; hand grip and leg extension forces were lower in 1990 than in 1970 for women in all age groups. For women aged 20-59 years the overall average hand grip and leg extension forces were lower in 1990 than in 1970 by 22.8 and 41.0%, respectively.

The changes in body composition and strength in children and young adults were in the same direction as those seen in men and women, but they were less dramatic. In boys aged 9-19 years old, the average increase in total skinfold thickness from 1970 to 1990 ranged from 48.1 to 90.8%, with an overall average increase of 66.5%. In 1970, the average thickness per skinfold was 5.0 mm; by 1990, the average reading was 8.2 mm.

For girls aged 11-19 years old, the average increase in total skinfold thickness from 1970 to 1990 ranged from 44.2 to 84.7%, with an overall average increase of 67.2%. For girls, the average thickness per skinfold was 8.8 mm in 1970 and 14.6 mm in 1990. The changes in the girls were highly significant for all age groups.

In the boys, changes in hand grip force were not as marked as the changes in leg extension force. For boys aged 9-19 years, the average change in grip strength ranged from +6.1 to -20.8%, with an overall change of -9.3% from 1970 to 1990. Decreases in grip strength were statistically significant in two age groups only, the 11-12 and 17-19 year old boys. The average change in leg extension force ranged from +12.7 to -36.6%, with an overall average decrease of 21.7% from 1970 to 1990. The decreases in leg strength were significant for all age groups except the 9-10 year old boys, for whom the 1990 values were insignificantly higher, by 12.7%.

In contrast to the boys, the girls aged 11-19 years old showed similar changes in both hand grip and leg extension forces, and the changes were greater than in the boys. In the girls, the average change in grip strength ranged from -28.7 to -46.3%, with an overall average decrease of 36.4% from 1970 to 1990. The average change in leg extension force ranged from -25.1% to - 39.4%,

Effects of Lung Disease. In the men, functional differences were relatively small between those with a previous history of lung disease and those who had remained free of chest disease. The two groups had similar lung function, aerobic power, and strength. The only notable difference was that in the men with a history of lung disease; the subcutaneous fat total for this group was 83% of that seen in the healthy men.

Women with a history of lung disease carried less fat (84% of that seen in the "healthy" women), they were lighter (93%), and they had a lower hand grip force (94%) than their healthy counterparts. They showed only slightly smaller lung volumes than their peers, but aerobic power was only 86% of that seen in healthy women. A large part of these differences was due to two women with emphysema. When these two individuals were excluded, the two groups were more alike. However, even if these two were excluded, the absolute aerobic power in the women with a history of chest disease was still only 88.5% of that found in the healthy women.

Right Branch Bundle Block. The threshold for the diagnosis of complete RBBB has been set at a QRS width of 0.090 to 0.110 sec by various authors (19); complexes broader than 0.120 sec have increasing pathological significance, while minor notching of the R wave frequently accompanies right ventricular hypertrophy in normal individuals (20-22). Although the prevalence of partial and complete RBBB originally reported for the Iglulingmuit (16) may have been substantially augmented by an incomplete sampling of the normal population, the proportion of cases (30% of males and 13% of females) nevertheless seems substantially greater than was reported for the small US city of Tecumseh, Michigan (2.6% of men, 0.9% of women; ref. 23).

At the time of the initial examination, a substantial proportion of the Igloolik sample had a high level of aerobic fitness (2,24), and whereas a proportion of the more severe instances of RBBB observed during the initial examinations may have been attributable to chronic pulmonary disease, it seems reasonable to suggest that the majority were due to a high level of physical fitness (20-22).

At first inspection, there seems to have been an increase in the prevalence of RBBB among the Iglulingmuit from 1970 to 1990. Since the records available to us were drawn from a single lead (CM5), it is conceivable that one factor making RBBB more obvious has been a leftward rotation of the electrical axis of the heart associated with an increase in abdominal fat. However, this seems an unlikely explanation. The two older men who had abnormal records in 1980 had gained additional body fat by 1990, but this had not apparently led to any further broadening of their QRS complexes.

Many of the cases of RBBB noted in 1990 showed no more than a minor notching of the R wave, without substantial broadening of the QRS complex. Most texts would regard changes of this type as non-pathological. It would be hard to reconcile an increased prevalence of chronic respiratory disease with the cultural changes that have occurred in the last two decades; the decrease of hunting, trapping, and fishing has probably decreased exposure of the local population to very cold air, and the control of tuberculosis and improved treatment of all forms of illness should have reduced the burden of chronic respiratory disease.

16 and 17-19 year old girls did show a significantly lower cigarette consumption in 1990 than in 1980, the overall 1990 rate for girls was very similar to that seen in the boys:- 4.8 and 5.1 cigarettes for boys and girls, respectively. However, unlike the boys who showed a decrease in the proportion of smokers from 1980 to 1990, the proportion of smokers among girls remained essentially the same, with rates of 71 and 72% for 1980 and 1990, respectively.

Smoking in the boys still appears to be almost universal by age 17-19 years, the proportion of smokers in that group being 81, 96, and 87% for 1970, 1980, and 1990, respectively (Table 58). At age 15-16 years, the rates for boys in 1980 and 1990 were 100% and 71%; even at age 13-14 years, the rates were still very high, at 52% for 1990. In the girls, smoking appears to be widespread at an even earlier age. In 1980, 93% of our sample of 13-14 year old girls reported regular cigarette consumption; in 1990 the proportion of smokers in this group was lower, but still too high at 67%. Even at age 11-12 years, the smoking rates among Igloolik girls was very high, at 39 and 38% for 1980 and 1990, respectively, substantially higher than the 26% reported for adult females in Southern Canada in 1986 (18). By age 15-16 years, the percentages of smokers in our sample of girls were 80, 95, and 87% for 1970, 1980, and 1990, respectively.

In our sample, some children as young as 9 years old reported regular cigarette consumption and our data show that addiction to smoking is pervasive by age 13-14 in the girls and 15-16 years in the boys. Whatever educational measures are taken against smoking addiction and resultant health hazards, they must be applied at the very earliest stages of a child's education; whatever resources are available should be concentrated at the primary level of education.

Our data show that whereas there has been a decrease in cigarette consumption in the last decade among the adult population, the number of people smoking has not changed materially. Thus, it is very likely that the lower cigarette consumption is due to the present high cost of cigarettes in Igloolik: $8.30 vs $5.00 in Toronto. A determined GNWT policy of additional steep increases in the price of cigarettes could be very effective in reducing cigarette consumption still further; moreover, it would price this dangerous product beyond the means of children.

Fitness and Lifestyle

Hunting. In 1970 we subdivided out sample of men into full-time hunters, part-time hunters, and those who worked for wages, showing that the predicted maximum aerobic power was some 35% higher in the full-time hunters than in the workers. The results of a similar comparison in 1990 proved to be strikingly different from the 1970 data in three ways:

a) the proportion of men in our sample who could be classified as full-time hunters had declined from 33% in 1970 to 15% in 1990;

b) as a group, the hunters of 1990 were substantially older than their 1970 counterparts, suggesting that they are a dying breed. In 1970 the average age of the hunters was 29.3 years; by 1990 the average age of the hunters was 42.8 years; and, The television, VCR, and video game habit is particularly insidious in a community where entertainment outside the home is very limited. Other factors encouraging the video habit at the expense of outdoor activities are long, cold, and severe winters, a substantial period of winter darkness, and many short winter days.

The accumulation of total body fat has reached the point where many of the Inuit are now classed as obese. In the near future we can anticipate the emergence of the health problems such as ischemic heart disease and diabetes which are generally associated with a sedentary lifestyle, excess weight, and obesity. Many of these problems could still be prevented, particularly in the case of Igloolik and similar Northern settlements, where the underlying causes are just now emerging.

Igloolik has excellent facilities for sports and recreation, but they appear to be under-utilized, particularly by men and women after the age of 30-39 and 20-29 years respectively. The favourable experience of those involved in such programs suggests that introduction of a program encouraging and supporting "Adult Recreation", with emphasis on cardio-respiratory fitness, together with education on nutrition, could prevent further unnecessary deterioration in cardio-respiratory fitness, helping to reverse the trend to increasing obesity among the population. Other preventive measures could include:

1. Expanding existing programs of physical education to include *daily* periods of vigorous exercise, sports, and/or games for *all* students;

2. An emphasis on, and promotion of physical activities in the schools that have the greatest "carry-over" potential into adult life:- activities consistent with and complimentary to the indigenous culture and suitable to the local climate and environment;

3. Additional emphasis on health education on tobacco and drugs; targeting the youngest school children and concentrating existing resources at the primary level of education;

4. Lobbying for additional and steep increases in the price of tobacco products; banning all tobacco advertising and limiting sales to adults; and,

5. Restricting indoor use of tobacco products.

The favourable health and fitness experience of those currently involved in sports programs is encouraging. Further research should identify i) the likelihood of sustained compliance, including carryover from childhood into adult life, and ii) methods of increasing compliance, the latter applying modern theories of exercise behaviour (eg the models of Fishbein and Ajzen) to Inuit society.

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