MACRONUTRIENT ANALYSIS IN WESTERN DIETS COMPARED TO MODERN HUNTER-GATHERER AND PALEOLITHIC DIET CONCENTRATIONS

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Stephanie L. Schnorr, B.A.

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MACRONUTRIENT ANALYSIS IN WESTERN DIETS COMPARED TO MODERN HUNTER-GATHERER AND PALEOLITHIC DIET CONCENTRATIONS

Committee Members Approved:

Kerrie P. Lewis, Chair

Elizabeth M. Erhart

Sylvia L. Crixell

Approved:

J. Michael Willoughby
Dean of the Graduate College

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ABSTRACT

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By

Stephanie L. Schnorr, B.A.

Texas State University-San Marcos

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SUPERVISING PROFESSOR: KERRIE P. LEWIS

Modern societies experience diminished amounts of physical activity in the daily lives of westernized populations and an emphasis on refined agricultural foods in the diet. This study investigates the interplay between diet and activity in terms of everyday food choice. I predicted that strenuous physical activity, with total energy expenditure (TEE) over resting metabolic rate (RMR) $\geq$ 1.8, should impact the dietary needs of a body, and that as such, athletic individuals would maintain macronutrient profiles closely aligned with that of modern hunter-gatherers: 19-35% protein, 28-58% fat, and 22-40% carbohydrate. If the macronutrient percentage of modern athletic diets

corresponds closely with that of modern hunter-gatherer diets, then perhaps an active lifestyle induces natural preferences for the same type and quantity of macronutrients that our Paleolithic ancestors ate.

I conducted an online survey of university students to obtain 24 hour dietary recall and daily physical activity logs for each individual. My data show that 64.9% of subjects exhibited an athletic profile (TEE/RMR ≥ 1.8), while only 4.6% matched the hunter-gatherer macronutrient profile. Only 1.3% met hunter-gatherer values for both diet and physical activity. Ancestral human diets were restricted to nutritionally dense foods to accommodate a small gut, large brain, and active metabolism. However, 94% of athletic subjects matched a modern dietary profile associated with sedentary populations; one that emphasizes refined carbohydrates (> 40% total calories). I discuss important health implications related to this dietary shift over time and how current nutritional guidelines influence the dietary decisions of modern western athletic individuals.

CHAPTER I

INTRODUCTION

Since diverging from the ancestral ape lineage between 6 and 7 million years ago, early hominins experienced sweeping changes to dietary breadth and content (Eaton et al. 1997, Conklin-Brittain et al. 2002, Braithwaite 2005, Cordain 2006). Many techniques have been used to reconstruct these hominin diets, including skeletal morphology, isotope analysis, paleoecology, coprolite analysis, tool technologies, bone assemblage analysis, archaeological assemblages, ethnographic studies, non-human primate studies, and genetic research (Lee and DeVore 1968, Wymer 1982, Milton 1993, Defleur et al. 1999, Lee and Daly 1999, Calvin 2002, Larsen 2002, Lee-Thorp 2002, Rodman 2002, Teaford et al. 2002). Results from these studies almost unanimously conclude that australopithecine diets included more energetically dense foods, progressing even further through the genus *Homo* (Eaton et al. 1997, Eaton et al. 2002, Cordain 2006). Early hominin diets may have gradually included fruits, nuts, insects and small animals to eventually culminate in a big-game meat based subsistence by the Upper Paleolithic around 120,000 years ago (Hart and Sussman 2005). However, unlike our hunter-gatherer ancestors, most human populations today thrive on the products of agriculture and industry (Eaton and Konner 1988, Cordain 2002). The sparse remaining foraging populations of today exist often as only fragmented communities located at the fringe of a once expansive wilderness and with varying degrees of Westernization (Lee and Daly 1999, Marlowe 2005). Some such as the Blackfoot Plains people and Caribou Inuit of North America, the Ache of Paraguay, and the Aboriginal peoples of Western Australia have remained relatively isolated from Western influence and still live by the ancestral traditions of their forbearers (Lee and Daly 1999). Other groups, however, found partial or complete acculturation to be the only assurance for future survival in an increasingly Westernized world. Undoubtedly, though, modern hunter-gatherers are distinctly closer to what was once a universal subsistence pattern for over 90% of human existence (Lee and Daly 1999). They forage wild foods by hunting game and gathering vegetation with little to no reliance on domestication. Modern hunter-gatherer populations, therefore, provide one bridge of many to a gradual understanding and modeling of early human lifestyles and behavior (O'Keefe and Cordain 2004, Braithwaite 2005). Much of the work and research on human dietary evolution has been pursued by a very select group of anthropologists and nutritionists who dominate the literature in this field. Literature searches on this topic predominantly led to work by the following authors and their collaborators: Cordain, Eaton, Konner, Conklin-Brittain, Leonard, Robertson, Ungar, Teaford, O'Keefe, and Milton.

Given the dichotomy between the Westernized world and indigenous life, is it still possible that an intrinsically driven universal correlate remains in existence among all humans, independent of cultural experience? This study investigated the possibility that modern Western humans maintain a biological correlation between energy output and energy input. In non-human primates and indigenous human groups, there is a distinct trend of higher energy expenditures correlating with higher diet qualities (Leonard and Robertson 1997). Leonard and Robertson (1997) showed that the !Kung and the Ache preferred higher quantities of meat and energy dense plants to less nutritive fibrous foods while still maintaining the highest levels of energy expenditure and the largest day ranges of any other primate group. Given this relationship in modern human hunter-gatherers, it may be expected that similar dietary constituents, which supported millions of years of human evolution, remain the fallback for highly active modern Western people. Using modern hunter-gatherer diets as a model for Paleolithic human diets, this study investigated whether a sample population of modern Western athletes mimicked the average macronutrient distribution of modern hunter-gatherer diets for evidence of a correlation between diet and physical activity.

Modern hunter-gatherer (HG) populations differ in both subsistence practices and physical activity level from Western populations (Cordain 2006). Additionally, a growing body of research illuminates the health disparity between modern HG populations and Westernized populations (Eaton and Konner 1985; Eaton and Konner 1988; O'Keefe and Cordain 2004; Braithwaite 2005; Cordain 2006; Ströhle et al. 2009). Indigenous life naturally confers a physically active lifestyle in the absence of time and labor saving technologies available to the industrialized world (Leslie et al. 1984, Rode and Shephard 1994, Cordain et al. 1998). Modern Western populations practice agriculture and animal domestication as the foundation of food acquisition (Diamond 1987, Cordain et al. 2005). Documented activity patterns for Western populations are, on average, relatively sedentary when compared to modern HG groups (Pearson 1990). Research links these lifestyle differences to the high prevalence of the following metabolic diseases, or diseases of affluence, in Westernized nations such as: obesity, diabetes, coronary heart disease, hypertension, and a host of auto-immune disorders (Brand-Miller and Colagiuri 1994, Brand-Miller and Holt 1998, Keller et al. 2003, WHO 2004, Cordain et al. 2005). Concurrently, energetic models in primate research suggest a tight correlation between daily energy expenditure and dietary quality based upon relative day ranges and food energy density in non-human primates (Sih and Milton 1985, Leonard and Robertson 1992, Leonard and Robertson 1997). If such models apply to human populations, then perhaps humans are supremely adapted to a certain dietary formula based upon evolutionary experience and energy budgeting trends. This formula is summarized in Cordain et al. (2000) to be approximately 28-58% of daily calories from fat, 22-40% from carbohydrate, and 19-35% from protein. Therefore, the goal of this study is to investigate a potential correlation between high physical activity and dietary composition in modern Western populations. Specifically, perhaps humans evolved to eat the foods consumed by our Paleolithic ancestors, as these foods were necessary to meet the needs of high human energy investments in growth, development, reproduction and activity (Pontzer and Kamilar 2009).

Diet

Just 2000 years of human history does not encompass the true magnitude of dietary change that has progressed throughout human evolution. Twelve-thousand years ago, at the end of the Upper Paleolithic, every living human subsisted as hunters and gatherers and had done so historically for the 2.5 million years prior to what is now considered the Agricultural Revolution (Eaton and Konner 1985, Hawkes et al. 1997, Lee and Daly 1999, Larsen 2002). About ten-thousand years ago, human populations underwent a very severe dietary transformation when crop cultivation and permanent settlements led to a new civilization dependent upon agricultural practice (Diamond 2002, Semino et al. 2004, Jönsson et al. 2005, Cordain 2006). In short, farming was invented. Farming practices, however, did not reach the scale with which agriculture is associated today until the Industrial Revolution just 200 years ago (Gilbert 1985, Diamond 1987, Eaton et al. 1988). Today, most Western diets characterize a micronutrient and macronutrient composition much different from those of early *Homo* and later Paleolithic diets as well as even the diets of modern hunter-gatherers (Eaton and Konner 1985, Lee and Daly 1999, Cordain et al. 2005, Marlowe 2005). In the Paleolithic, prior to agriculture, yearly average macronutrient consumption consisted primarily of fat and protein (Cordain et al. 2000). Since carbohydrates in the form of simple sugars are relatively rare in the wild, and even complex carbohydrates are locked away in high fiber plant matter, the abundance of carbohydrates in the modern human diet is a marked shift from the human dietary experience of the previous 2.5 million years (Milton 1993, Brand-Miller and Colagiuri 1994, Jönsson et al. 2005). The commencement of the Neolithic period, 10,000 years ago, altered the following seven key characteristics of the human diet: 1) glycemic load, 2) fatty acid composition, 3) macronutrient composition, 4) micronutrient density, 5) acid-base balance, 6) sodium-potassium ratio, and 7) fiber content. The differences can be easily summarized by a comparison of the difference in macronutrient percentages between modern Western humans and modern hunter-gatherers (Cordain et al. 2005).

Diet in Human Evolution

The genus *Homo* emerged around two and a half million years ago (Zihlman 1982, Kimbel et al. 1996, Hart and Sussman 2005) beginning with *Homo habilis* and followed closely by *Homo rudolfensis* and *Homo ergaster*. These early hominins were fully upright and bipedal and exhibited little of the contemporaneous australopithecine cranial characteristics (Richards 2002). The fossil *Homo* skulls showed a reduction in brow ridge size, mandible size, prognathism, post-orbital constriction, zygomatic arch size and flare, molar size and an increase in cranial capacity as compared to australopithecines (Zihlman 1982). All of these changes served as a gracilization process, indicating less reliance on heavy mastication or prolonged chewing of hard or fibrous foods (Teaford et al. 2002). However, distinct dietary changes may not have occurred until the emergence of *Homo ergaster* about 1.8 million years ago.

The Miocene ancestor of both modern chimpanzees (*Pan troglodytes*) and humans most likely ate an ape-like diet of fruit, leaves, seeds, pith and flowers (Milton 1993, Conklin-Brittain et al. 2002, Rodman 2002). Chimpanzee diets include on average 33.6% fiber (Conklin-Brittain et al. 2002), whereas the minimum recommendations in humans are only 20-30g fiber, or about 6% of calories consumed for a 2000 calorie diet (Papazian 1997). The hypothesis for the dietary transition from the australopithecines to early *Homo* suggests that hominins needed progressively lower fiber and higher nutrient diets for brain development (Aiello and Wheeler 1995, Conklin-Brittain et al. 2002). Evidence from isotope indicators, ecological reconstruction and cranial architecture suggests that these early ancestors increasingly supplemented their diets with seeds, nuts, tubers, and meat, preferring an energetically dense food source when available (Conklin-

Brittain et al. 2002, Lee-Thorp 2002, Teaford et al. 2002). This dietary transition had the effect of shrinking human guts, specifically the colon, minimizing masticatory structures, such as the mandible and zygomatic insertions, and providing developing human brains with rich fatty acids and an energy dense fuel source (Milton 1999, Eaton et al. 2002, Larsen 2002, Teaford et al. 2002). The emergence of *Homo* is thus largely regarded as the definitive point at which meat-eating became a dietary staple, contributing further to the variety that is key to human omnivory (Milton 1999, Ungar and Teaford 2002, Hart and Sussman 2005).

Support for a meat-eating hypothesis is shown with the decrease in cranial and mandibular robusticity, molar size, and occlusal relief, all indicating an emphasis on tearing rather than grinding foods (Eaton et al. 2002, Teaford et al. 2002). The effect of meat-eating on brain development is implicated from analysis of ancient and modern cranial capacity (Eaton et al. 2002). Rapid cranial expansion occurred from *H. habilis* to *H. sapiens* culminating in peak capacity during the Late Paleolithic, but cranial capacity in modern humans has fallen by about 11% and parallels a decrease in consumption of animal foods (Henneberg 1988, Ruff et al. 1997). Meats rather than plants provide long-chain fatty acids valued as the building blocks for brain tissue growth (Eaton et al. 2002). Although the gracilization of human cranial features may indicate a dietary specialization, if is perhaps more likely that as the diet of *Homo* became more flexible, dental morphology reflected an emphasis on food processing, cooking, and tool use with non-specialization to any particular food source (Teaford et al. 2002).

The human brain consumes between 300-400 kcal/day from the total resting metabolic consumption of 1400 kcal/day (Leonard and Robertson 1992), about one quarter of the body's basal energy demands. Studies showing high day ranges associated with high reproductive activity suggest that humans evolved a status of high energy "throughput," more commonly seen in smaller primates (Pontzer and Kamilar 2009). Throughput is total energy passing in and out of a system. Put another way, humans have intrinsically large energy budgets for high metabolic activities, such as foraging and reproduction, and require more energy per day than the other apes (Pontzer et al. 2010). To think of this in terms of the first law of thermodynamics, that energy in a closed environment is neither created nor destroyed, where $\Delta E = Ein + Eout$ (E stands for energy), the ΔE is increased, subsequently driving a change in Ein and Eout. Therefore, an increased basal metabolic rate from brain activity alongside high day ranging and reproduction required *Homo* to include energy dense foods for fuel use and an efficient fat deposition mechanism for fuel storage by way of insulin resistance (Leonard and Robertson 1992, Brand-Miller and Colagiuri 1994, Venn-Watson 2010).

Humans also experienced a severe reduction in colon volume and therefore a greatly reduced capacity to ferment insoluble fiber (Aiello and Wheeler 1995, Popovich et al. 1997, Milton 1999). A chimpanzee or ancestral ape diet of 99% fruit and leaves (Milton 1993, Conklin-Brittain 2002) would not have provided sufficient energy, essential fatty acids, fat-soluble vitamins and glucose to foster brain growth coincident with a metabolically active body (Eaton et al. 2002). The large intestine of all but the human great apes is essential in converting non-digestible fiber into short chain fatty acids (SCFA). Yet as previously indicated, human colon size was greatly reduced, presumably because subsistence shifted away from processing copious amounts of low nutritive fibrous plant foods (Eaton and Konner 1985, Popovich et al. 1997, Milton 1999).

Neolithic and Modernity

Arising from the last glacial maximum 15,000 years ago was what may be considered the pinnacle of the Paleolithic hunter-gatherer culture (Curry 2008). Representative of this period were cave art, sophisticated stone tools, beads and sewing implements, carvings, and pendants, all recognizable signs of definitive culture. Most inspiring of the archaeological remains is the 11,000 year old temple at Göbekli Tepe, Turkey, built just before an agriculturally based civilization took hold. Göbekli temple is perhaps indicative of the resources, intelligence and leisure of the ancient hunter-gatherer lives, which is in opposition to Thomas Hobbes' account as "nasty, brutish, and short," (Lee and Daly 1999, Curry 2008). Nonetheless, farming spread from its epicenter in the Fertile Crescent to the Balkans and Western Europe following the waterways of the Danube and Mediterranean and assimilating the remaining hunter-gatherers of Northern Europe into the Neolithic (Greco 1997, Semino et al. 2004). Wild seasonal food sources were replaced with monocrop annuals, which produced food staples such as rice, corn, wheat, millet, sorghum, soy, potatoes, oats, as well as commodity items such as sugar cane and tobacco (Jönsson et al. 2005). Food stabilization, abundance, and settlement allowed the human population to rapidly grow (Greco 1997). However, not since the last 50 years have humans faced food abundance like the modern corn industry of North America, nor was surplus ever a problem (Gussow 1978). Obesity is now rampant among modern Westernized countries (CDC 2009, DHHS 2010), especially the U.S., and is considered a result of overeating and under-activity (Lustig 2006, AHA 2005, USDA

2009, DHHS 2010, Brownell and Horgen 2004, WHO 2004). Yet despite the over consumption of food that seemingly plagues industrialized nations, people frequently face a dilemma of what foods are actually healthful. The most virulent topics of modern times include how to eat healthily, what foods are considered healthy, and how or if humans can confer health benefits from food alone. The NHES/NHANES I-IV (CDC 2009) tracked the initially gradual and later sudden rise in obesity, which many now blame on a lifestyle at odds with our Paleolithic ancestry (Eaton and Konner 1985, Eaton and Konner 1988, Cordain et al. 2005). Anthropological studies found that modern hunter-gatherer populations have eluded the most common diseases of affluence such as diabetes, obesity, anemia, hypertension and heart disease (Hawkes et al. 1997, Cordain et al. 2000, Eaton et al. 2002, Milton 2002, Cordain 2006). In fact, members of these populations actually exude exceptional physical health when compared to an average member of Western society (Diamond 1987). Very recent and growing evidence attributes hunter-gatherer health to diets resembling ancient Paleolithic diet composition and to significant physical activity experienced throughout their lives (Eaton and Konner 1988, Stinson 1992, Cordain 1997). While individuals in Western societies struggle to maintain a healthy weight and body composition, the oldest and most isolated indigenous populations alone live well on a diet composition very similar to that of our earliest human ancestors, emphasizing wild unprocessed foods (Cordain et al. 2000, Cordain 2002, Milton 2002, Cordain 2006, DHHS 2008).

The particular views within the medical science community and cultural history in a given region certainly impact the emphasis placed on nutrition in the daily lives and health of its populace. Yet, while fad diets pour into our lives through a variety of social media, science and medicine are now called upon more than ever to lay a solid scientific foundation on human nutrition (Taubes 2007, pp 22-42). As a result, government intervention initiatives and private organizations currently set the standard recommendations for modern human nutrition in the U.S. (USDA 2009).

Found across the world are clusters of isolated and indigenous cultures often geographically segregated (only slightly more integrated today) in which their distinction comes partly from the foods they eat. Canadian Inuits and the !Kung are just two examples of the extreme variation in human diets, even within modern indigenous populations. Meat constitutes 90% of the Inuit diet with the !Kung subsisting on 70% gathered food from plants (Lee 1968, Lee and Daly 1999, Cordain et al. 2000). Culture and geography undeniably alter and indoctrinate particular eating practices. These extremes also show the flexibility humans have in dietary choices. Despite culture, however, burgeoning nutritional research focuses on the hypothesis that humans may be universally adapted to the Paleolithic diet from evolutionary history as hunter-gatherers (Stinson 1992, Brand-Miller and Colagiuri 1994). The importance of such a diet hinges upon high protein content for cellular maintenance, adequate fat for energy, and fibrous plant foods to supply essential vitamins, minerals and antioxidants. The approximation of an ideal macronutrient distribution range for the human diet is not regarded, in the literature, as a temporary diet, but rather, a lifestyle. It is a range of macronutrients that best defines the actual dietary composition and resource availability of extant hunter-gatherer societies around the world (Cordain et al. 2000).

Exercise

Principles of exercise in the modern Westernized working world are equally as regimented as nutritional and dietary standards. The hectic pace of contemporary Western society demands efficient use of time for extra-curricular activities. People desire to have "programmed" fitness routines that will ensure an acceptable level of intensity and duration to meet their personal fitness requirements. These standards are based on a model defined by recent (the last 50 years) health science investigations (Durnin and Passmore 1967, Cooper 1968, Leslie et al. 1984, ACSM/AHA 2008). Nearly all exercise literature addresses a proximate model for ideal human physical activity (Cordain et al. 1998) based on sports training and exercise physiology laboratories. The overarching goal of the modern health and nutrition industry is thus to increase the longevity and quality of life and promote disease prevention (Taubes 2007).

However, the groundwork for modern fitness standards started only in the most recent era of human existence, literally a fraction of the time since modern humans evolved. The American College of Sports Medicine was founded only in 1954, more than a century after the industrial revolution and marked decline in manual labor (ACSM 2007). It is commonly assumed that daily total energy expenditure has decreased because of advanced technology and more sedentary jobs (Pearson 1990). Physical activity for Westernized populations is usually reserved for the gym and is rarely incorporated within regular daily activities.

Evolutionary Models

Before natural human habitats gave way to modification, construction, civilization and technological change, humans were much like free-living wild mammals, living unsheltered from everyday hardship, danger, and natural disaster (Hayes et al. 2004). Very little labor saving technology existed. Also, ancient humans most likely exhibited similar body mass adjusted energy expenditure characteristics as compared to wild animals as a result of subsistence-based living. However, since Paleolithic humans cannot be directly assessed, researchers look to modern foraging and unindustrialized populations for a representative of ancient human energy expenditure (Leonard and Robertson 1992, Leonard and Robertson 1997, Cordain et al. 1997, Cordain et al. 1998, Sorenson and Leonard 1999, Hayes et al. 2004). Further, both theoretical and experimental research actively contributes to the entirety of our understanding of ancient human activity patterns and energy expenditure.

Leonard and Robertson (1992) conducted some of the first and best known studies on two extant indigenous groups, the !Kung bushmen and the Ache. Their results showed that in comparisons with other hominoids, the human groups had the largest day ranges, the highest great ape resting metabolic rate per kilogram, the most metabolically active brain, and the highest energy expenditure ratio (TEE/RMR) among selected anthropoid species. Later studies have corroborated these results using doubly labeled water to measure energy expenditure rather than hourly activity budget estimates (Hayes et al. 2004, Pontzer and Kamilar 2009). Since the latter are shown to actually underestimate true energy expenditure values (Hayes et al. 2004, Pontzer and Kamilar 2009), Leonard and Robertson's (1992) earlier work can be regarded as minimum values for human energy expenditure in the wild. Hayes et al. (2004) compared the energy expenditures of recreationally and occupationally active individuals along with inactive individuals among a Westernized population. They also included very active individuals from rural undeveloped nations who make their living by farming. They found that the average ratio of TEE/RMR was 1.8 for the active human groups and was comparable to physical activity levels in free-ranging small mammals. These studies then suggest that Paleolithic human activity levels were at least equivalent with highly active modern hunter-gatherers (Hayes et al. 2004), but likely far surpassed these levels based upon observations of skeletal robusticity in fossil human remains (Cordain 1997, Sorenson and Leonard 1999). The perspective from Cordain et al. (1998) found that ancient humans maintained activity levels far in excess of what contemporary Western humans experience. Since the portion of the human genome that determines basic anatomy and physiology is unchanged, modern humans have the potential, and are actually genetically adapted, to maintain highly active lifestyles throughout their lifespan (Cordain et al. 1998, Hayes et al. 2004, Pontzer and Kamilar 2009).

The physical activity of U.S. citizens is likely quite different from the performance potential of modern humans (Pearson 1990, Cordain et al. 1998). Ancestral humans lived radically different lives from contemporary humans, and so too were their physical activity patterns different from modern people (Pearson 1990, Leonard and Robertson 1992, Cordain et al. 1997, Cordain et al. 1998). It makes sense then to base the human model of fitness not on the average Western population, but on the result of evolutionary selection, culminating sometime around 30,000 – 100,000 years ago with Paleolithic *Homo sapiens* (Cordain et al. 1998).

The American College of Sports Medicine (ACSM) leads the world standard for exercise science (ACSM 2007). More recently, the U.S. Department of Health & Human Services released Physical Activity Guidelines for Americans for 2008. Within this they recommend that adults aged 18-64 get at least 2 hours and 30 minutes of moderate-intensity physical activity per week, or 1 hour and 15 minutes of vigorous intensity exercise (DHHS 2008). The guidelines for ACSM fitness goals and performance training are widely published and provide the following recommendations: physical activity 3-5 days/week at 50-85% maximum intensity for 20-60 minutes for health promotion and maintenance (ACSM 2007). However, the daily physical activity requirements proposed by the ACSM reflect only 44% of the physical activity levels in modern hunter-gatherers and Paleolithic humans. As a result, a typical American expends only about 65% of the total energy a Paleolithic human might expend (Cordain et al. 1998, Hayes et al. 2004). The difference is equivalent to adding about a 12 mile walk each day for the average sedentary Westernized individual (Hayes et al. 2004). The U.S. Department of Health & Human Services 2008 guidelines recommend even less than the ACSM standards, averaging only 17 minutes of moderate exercise every day.

The disparity between ancestral human and modern human physical activity is severe enough to warrant a closer look at the effects on human physiology and consequential diet patterns. While the current model of dietary health and nutritional guidelines in the U.S. is founded on multiple epidemiological and clinical studies (Taubes, 2007), current anthropological research indicates that perhaps up to 70% of modern Western foods were completely absent in the ancient human diet (Cordain et al. 2005). Paleolithic humans did not cultivate grain food products, nor did they acquire milk from livestock because none were domesticated. Starches such as potatoes, rice, pasta and bread did not enter the human diet until after the agricultural revolution, and are considered inferior to other vegetable and animal food sources available throughout human evolution. Instead, human ancestors presumably ate plenty of tender greens, nuts, and herbs, some tubers, seeds, insects, grubs, fish, shellfish, fowl, eggs, and berries, and most importantly, large wild game (Lee 1968, Eaton et al. 1997, Hawkes et al. 1997, Brand-Miller and Holt 1998, Lee and Daly 1999, Hart and Sussman 2005, Cordain 2006). Since human energy expenditure was also higher prior to agriculture and especially the industrial revolution, this study investigates the potential correlation between diet and energy expenditure among a modern Western sample population. The belief is that if energy expenditures were to return to Paleolithic and modern hunter-gatherer levels, then dietary constituents would also mimic the patterns seen in early and modern hunter-gatherers.

Study Aims

I examined whether the diet of physically active modern Western individuals differed from that of inactive individuals in a sample Western population through a comparison of macronutrient quantities consumed. The individuals in the sample Western population were designated as either athletic for high activity, or non-athletic for low-activity levels. Macronutrients in this study were defined as the three main caloric constituents of a diet: fat, carbohydrate, and protein. Furthermore, I examined an evolutionary basis for this dietary difference by assessing whether diets of athletic subjects were more similar in macronutrient distribution to those of human Paleolithic ancestors than non-athletic subjects. Since it is impossible to directly observe the dietary and activity patterns of Paleolithic humans, modern hunter-gatherers were used as a proxy for Paleolithic activity levels and dietary content. This hunter-gatherer model was based upon the work of Cordain et al.'s (2000) analysis of 229 modern hunter-gatherer diets in which the average macronutrient distribution range was hypothesized as: 28-58% fat, 22-40% carbohydrate, and 19-35% protein.

Hypothesis

I predicted that athletic subjects within the Western sample population would have a dietary macronutrient distribution similar to that of the modern hunter-gatherer model as outlined above. Furthermore, I expected non-athletic subjects to not only deviate from the hunter-gatherer model, but also to maintain a macronutrient distribution consistent with the United States Department of Agriculture (USDA) acceptable macronutrient distribution range (AMDR): 20-35% fat, 45-65% carbohydrate, and 10-35% protein (USDA 2009). Accordingly, athletic macronutrient consumption was expected to include more protein and fat and less carbohydrate. The proposed mechanism for this difference was that physiological necessity would outweigh cultural influence on dietary decision making in the sample Western population. In essence, athletic subjects should crave more foods containing high protein and fat as a product of their activity levels. Non-athletic subjects by contrast would not experience cravings for high protein and fat due to low activity levels, and would more likely make dietary decisions based on cultural experience.

Athletic and non-athletic classifications were designated from analysis of total energy expenditure (TEE) relative to the resting metabolic rate (RMR) over a single day.

A TEE/RMR value of 1.8 or higher constituted an “athletic” classification. The energy expenditure ratio is a standard measurement appropriate for analyzing activity levels across a range of individuals or even species since it is independent of body weight and size. Expected athletic frequency within the sample population was 40% or less based on the Center for Chronic Disease Prevention (CDC) (1999) report stating that 60% of American adults were not regularly active and the Department of Health and Human Services (DHHS) (2008) report stating that 31% of adults 18 years and older engaged regularly in moderate or vigorous physical activity. In the context of a college student sample, a meta-analysis by Keating et al. (2005) found that 40-50% of college students were completely inactive. Estimations of Paleolithic human physical activity rates and intensity are given by bone density analysis and muscle development patterns, which show acute adaptations to heavy and frequent weight-bearing activities (Sorenson and Leonard 2001). Modern Western populations by comparison are regarded as sedentary and inactive, reaching only about 65% as much energy expenditure as Paleolithic humans (Hayes et al. 2005). A hunter-gatherer level of physical activity among the sample Western student population was, as a result, expected to be minimal.

My null hypothesis states that Western athletes do not differ from non-athletes in dietary macronutrient composition, and do not correlate with the hunter-gatherer macronutrient model. Athletes and non-athletes should both show conformity with the USDA AMDR since, in this case, cultural experience rather than biological adaptation would have favorably influenced dietary selection.

CHAPTER II

METHODS

This was a survey-based study of dietary and exercise habits of modern Western individuals, using a student population at Texas State University-San Marcos. Since the survey required human participation, approval from the Internal Review Board (IRB) was necessary (granted 4/18/2009, 2009S7020).

Subjects

The survey targeted students from two Health and Wellness courses in the 2009 Spring semester (PE 4317 and PE 3117) and the Fall 2009 Introduction to Physical Anthropology (ANTH 2414) Texas State courses. The Health and Wellness courses provided 94 useable student subjects and the Introduction to Physical Anthropology provided 168 useable student subjects, with a net total of 262 Western sample subjects. Since the basis of my study was to compare modern hunter gatherers with a modern Westernized population, I wanted a sample population that was actively living and presumably participating in the local American culture, rather than soliciting participants from unfamiliar regions of the United States and other countries. I chose the Health and Wellness Department students to ideally sample people with a greater likelihood of participating in high amounts of physical activity and the Introduction to Physical Anthropology class for a large sample size.

With the assistance of their instructors, I contacted the students via email and sent them a URL link to the online survey, with instructions requesting information about their exercise and dietary patterns. All responses were anonymous. Each student respondent received extra credit from their course instructors for accessing the link and completing the survey. Criteria for the participants were that they [1] held an active university email account [2] were enrolled in classes on campus at Texas State and [3] were 18 years of age or older. This ensured that the sample population comprised all students in a small geographic region of the United States centralized at San Marcos, Texas.

Pilot

I considered a pilot study necessary to refine the questions in the survey. The pilot subjects were a class of 15 undergraduates in ANTH 3374 Primate Cognition. Each student in the class was given a paper version of the pilot survey during class time on the 22nd of April 2009 (see Appendix B). Instructions were announced verbally prior to the start of the survey. During the survey, the students were asked to answer questions as fully and carefully as possible about their diet and activity patterns during the last 24 hours. Upon completing the survey, each student was permitted to leave the classroom. Students who participated in the pilot study were given extra credit toward their final grade. Responses and data from the pilot study were used to refine and clarify both the questions and also the spreadsheet design and organization in the actual online version of the study survey built using *mrInterview* program explained below.

Survey

To collect dietary information and exercise patterns from my sample population in the absence of a validated recall method, I used self reporting in a carefully constructed survey built and hosted through *mrInterview* software available at Texas State. The survey distribution entailed a link embedded in an introductory email sent to all the subjects and directed the participant to the web based survey. Access to the survey was allowed first for the Health and Wellness students during the week of May 4th to May 12th, 2009 and for the Introduction to Physical Anthropology students from September 11th to September 18th, 2009. A weekly fee of $50 plus $.35 per respondent applied to hosting the online survey with *mrInterview*.

The survey comprised three sections of questions pertaining to exercise, diet, and personal information, taking approximately 10, 20, and 3 minutes respectively. An example of the survey as it was viewed by the subjects can be found in Appendix A. The first section asked respondents to list the type, intensity and number of hours they engage in physical activity with intensity split into three levels: Light, Moderate, and Vigorous. All other activity was classified as Rest/Sitting. Other questions asked about whether the respondent engaged in physical activities as a consequence of daily lifestyle, planned exercise, personal training, coaching, and/or competitive sports. Respondents were prompted to answer for the number of hours per day and days per week they engaged in activities of each varying intensity level with a final question asking for the hourly breakdown of a typical day's activity.

The second section asked for detailed recalls of each respondent's typical daily diet by following a standard recall question prompt. Respondents were asked first to recall all the foods and beverages they consumed over the previous day (a 24 hour period) from the moment they woke up to the end of that 24 hour period. Once they completed this recall, a question asked whether the previous day's consumption was typical. If the respondent answered no, they were then asked to recall a typical day's food and beverage consumption using an identical prompt format. To gather as much information about each individual's consumption and dietary practices, the survey also asked about any dietary restrictions, special needs, practices, commercial diets, eating disorders, food cravings, nutritional education, and supplement usage (Rhodes et al. 2004). Where discrepancies or difficulties occurred in particular recalls, these additional questions assisted in a more accurate understanding of the respondent's lifestyle.

The final section of the survey asked basic questions about personal statistics and information, most importantly, acquiring physical attributes such as height, weight, body fat composition, age, sex, physical condition, cultural background and current area of residence. I decided to end the survey on easier and shorter questions, but also with questions that might cause discomfort and hesitance on the part of the respondent. My intent was that if the survey respondent disclosed exercise and dietary information first, then they would be more likely to truthfully answer direct questions about their physical attributes.

All data from the survey responses were saved in the *mrInterview* database, which I received in spreadsheet format. The survey was anonymous with respondent names and email addresses hidden and an automatically assigned respondent ID used as sole identification of each subject.

Exercise Analysis

The goal of the exercise portion of my study was to determine the resting metabolic rate (RMR) and the total energy expenditure (TEE) of each person. Using the downloaded spreadsheet of raw data directly from the survey database, I reorganized the questions and responses to view each section of the survey on a separate sheet. I recorded the respondent ID's and the corresponding hours they reported to have spent in vigorous, moderate, light and rest states of activity.

Resting Metabolic Rate (RMR)

First, I determined the RMR using Pearson's (1990) formula for the estimated metabolic rate on energy expenditure in Samoan populations (Pearson 1990). Pearson's (1990) formulas were based on the methods of Leslie et al. (1984) concerning caloric requirements of human populations (Leslie et al. 1984) and validated by the Durnin and Passmore regression table from *Energy, Work and Leisure* (Durnin and Passmore 1967). The equation for RMR is as follows:

$$RMR\ (kcal/min) = [(19.3824 * kg) - (13.896 * \text{body fat percentage}) + 524.304] / 24 / 60$$

*Where body fat percentage is given as a whole number (n<1.0 * 100)*

The total in brackets gives the RMR for one day, then divided by 24 (providing an answer in kcal/hour) and again by 60 to give the answer in kcal/minutes. Although later use of RMR required kcal/hour, keeping the values in kcal/minutes rendered it more easily manipulated for any set period of activity. I also compared the outputs against the rates yielded by Durnin and Passmore's (1967) regression table using the same units. Ultimately, the equation was more accurate than the regression table because it used exact body fat percentages, which allows for obtaining a more accurate RMR. I used the table only to verify my results from the equation. Since body fat percentage was a key component in determining RMR and not all respondents knew their body fat, I also calculated body mass index (BMI) using the following equations (Lee and Nieman 2006):

$$\text{Metric: } weight(kg) / height(m)^2$$

$$\text{English: } (weight(lbs) / height(in)^2) * 703$$

The BMI values correspond to a universal interpretation of a person’s excess mass (Lee and Nieman 2006):

Underweight = <18.5

Normal = 18.5 – 24.9

Overweight = 25 – 29.9

Obese = >30.0

These interpretations fit with the Durnin and Passmore’s (1967) assessment of body fat percentage. Therefore, for the respondents that did not answer or did not know their body fat percentage, I used the BMI value to classify them as either underweight, normal, overweight, or obese, and found the corresponding body fat percentage for each BMI description from the Durnin and Passmore’s (1967) table to use in the RMR equation. Since respondents gave their weight in English measurements, the accepted and most familiar measurement based on the location of my study, I inputted all height and weight values in their original units and converted to metric units using 1 in = 0.0254m and 1 lb = 0.453kg.

Total Energy Expenditure (TEE)

To find the total energy expenditure (TEE) of each subject, I used the energy estimate equations from Pearson (1990), adapted from Leslie et al. (1984). These equations were identical except for the work rate coefficients. Each category of activity, rest, light, moderate, and vigorous, is associated with a specific work rate cost determined through the extensive studies done by Durnin and Passmore (1967) and used in Leslie et al. (1984) and Pearson (1990). Lower work rates had coefficients less than 1 kcal/kg/hr, while vigorous or extreme rates reach as high as 10 kcal/kg/hr (Leslie et al. 1984: 147). In my calculations of TEE, I used the following coefficients for each activity intensity level:

Rest = 0.25 kcal/kg/hr

Light = 1.25 kcal/kg/hr

Moderate = 4.5 kcal/kg/hr

Vigorous = 7 kcal/kg/hr

I found the value for energy expenditure (EE) for each designated period of activity at a particular intensity in hours. TEE is the EE in addition to RMR, yielding a net number of predicted calories expended over the course of one day. I used the following equation to calculate TEE at each activity level (Pearson 1990: 326, Leslie et al. 1984: 149):

*TEE = [RMR(kcal/hr) + Work Rate Cost (kcal/kg/hr) * weight (kg)] * hrs spent at intensity*

*i.e. Light activity = [RMR * 60 + 1.25 * weight] * hrs*

Where 60 was used to convert the RMR to kca/hrs (previously kcal/min), and 1.25 is the work rate coefficient for light activity.

After calculating the EE for each period of activity reported by the subjects during one day, I totaled the EE’s from rest, light, moderate and vigorous activity to arrive at the TEE for each person. The survey asked each subject to report the number of hours spent at each activity level, with examples of the types of activities that would classify as rest, light, moderate and vigorous activity. All survey participants were asked to report estimated hours spent at every intensity level for an average day. If the hours reported by the subject did not add up to 24, as requested, then I inputted the hours they reported for light, moderate, and vigorous activities, then subtracted the sum of those hours from 24 to get the remaining number of hours spent at a rest intensity level. Since the number of hours spent at rest is likely more ambiguous than reporting the hours spent in any activity, I reasoned that the values given for rest were either over- or under-estimated and more attainable by finding the remaining hours not reported in any activity.

With the final TEE and RMR values (in kcal and kcal/day respectively) I found the ratio of TEE/RMR, necessary for comparing to existing values for hunter-gatherer populations, given as 1.8 – 2.0 (Cordain 1998: 330, Cordain 1997: 55). My conditions were that any subject with a TEE/RMR ratio ≥ 1.8 corresponded to hunter-gatherer energy expenditure rates. Any subject with a TEE/RMR ratio < 1.8 did not correspond to hunter-gatherer energy expenditure. Dividing the TEE by the RMR eliminated problems with comparing subjects of different height and weight (Leslie et al. 1984: 141, Cordain 1998: 331). Without a ratio, smaller body sizes would skew towards less energy expenditure and large body sizes toward more energy expenditure when compared to each other. To nullify the difference in size and shape, the ratio showed energy expenditure in each individual based on that individual's resting metabolic rate.

Dietary Analysis

The premise of my dietary analysis was that all recalled information was for eating habits from a single day, specified as the previous 24 hours. Section two of the

Macronutrient and Exercise survey queried the survey participants on the types and amounts of foods and beverages consumed over a 24 hour period, modeled after a conventional day in the lives of each participant. The prompt asked for a recall of all the foods eaten starting immediately after the subject woke up and ending when the subject recalled everything they ate in that 24 hour period.

Nutrition information was obtained using *The Food Processor SQL* version 10.4.0 2008. I created a profile for each subject, using their respondent ID as an identifier, and searched for all the foods in the quantities the subject listed. *The Food Processor* reported quantities in both English and metric units and identified serving sizes for basic foods, or food items appropriated by the USDA. Reports included total calories as well as calories from fat, carbohydrate, and protein.

When specific brands and preparations were not available, I selected foods that best fit the information given. This approach may have introduced error though efforts were made to minimize estimation. When a food was not listed in *The Food Processor,* I looked for the nutrition information online at the appropriate brand name website. When a food was unavailable both on *The Food Processor* and online, I used the best match for that food through the processor search engine.

Where no serving size or quantity of food was indicated, I assumed a serving size of 1 for that particular food product. Most people likely ate more than a single serving, however, it was more consistent to normalize all unknowns to 1. I did not estimate portion sizes and, only when applicable, used whole numbers, as in, 1 can/portion/package/serving of a product. I listed all unspecified quantities for sandwich lunch meats and cheeses as 2 slices of meat and 1 slice of cheese. When a food item from a particular restaurant did not exist on the database, I used the closest combination of individual ingredients or a matching food item listed with the USDA. I did not include alcohol consumed or any alcoholic drink in the current analysis because the type of alcohol and beverage was not uniformly specified, only the average number of alcoholic drinks per week. This constituted a large amount of error in the true macronutrient representation of subjects' diets. However, inclusion of alcoholic beverages would only increase carbohydrate consumption. Since hunter-gatherer dietary correspondence was already very rare, inclusion of alcoholic beverages would only create a larger disparity between the sample Western population and the hunter-gatherer dietary model. All other beverages were included with the diet analysis. During the analysis, some individual subjects had unexpected problems, errors, or intricacies I dealt with on an individual basis. A list of these can be found in Appendix C.

Three respondents from the Health and Wellness survey sample and 7 from the Introduction to Physical Anthropology survey sample did not adequately complete the dietary portion of my survey and I therefore excluded them from the dietary analysis. An example of inadequate information was a response such as, "I ate Chinese food for lunch." Therefore, I omitted 10 subjects from the original sample of 272 respondents. My conditions, as outlined in the introduction, to match hunter-gatherer dietary compositions were: 28-58% fat, 22-40% carbohydrate, 19-35% protein (Cordain 2000: 689, Cordain 2006: 373). I totaled the correspondence to each macronutrient separately and then found how many subjects met the critical composition for all three macronutrients.

Statistical Methods

Statistical analyses were performed using the PASW Statistics 18 downloadable software as well as hand calculations of chi-squared tests if the expectations varied from 50%. Tests included descriptive statistics to acquire the mean, range, and standard deviation of macronutrient intake values. A single sample t-test analyzed the variance of mean macronutrient values for athletic and non-athletic subjects from the closest hunter-gatherer range value. A one-tailed t-test was used to compare the frequency of athletic and non-athletic subjects who matched the entire hunter-gatherer macronutrient model as I expected a difference in one direction in which the athletic subjects would more closely resemble the hunter-gatherer model. To compare the macronutrient values between groups, I used both an independent sample t-test and a one-way ANOVA, which derived identical results. Where equal variances could not be assumed, I reported on the Welch test of equality of means for a more robust analysis. The final analysis used was the chi-squared test to obtain p-values for expected versus observed frequencies for each population subgroup. Statistical significance was accepted by a *p*-value of 0.05 or less.

CHAPTER III

RESULTS

The hypothesis predicted that diets of athletic subjects would more closely resemble the hunter-gatherer macronutrient model than non-athletic subjects. The population breakdown for both survey populations and the number of athletic and non-athletic subjects among these populations is summarized in Table 1.

Table 1. Composition of subjects in each surveyed group.

	% Athletic	% Non-athletic	% Total
Health and Wellness	76.6 (n=72)	23.4 (n=22)	35.9 (n=94)
Introduction to Physical Anthropology	58.3 (n=98)	41.7 (n=70)	64.1 (n=168)
Total Sample Population	64.9 (n=170)	35.1 (n=92)	100 (n=262)

Sample Population Demographics

The sample Western population was composed entirely of undergraduate students enrolled at Texas State University, and so the age distribution was heavily weighted towards adults between ages 20-25 at 75% (n = 196) of the total population. Only 3% (n = 9) of subjects were 30 years of age and older. The distribution of male and female respondents is primarily female at 62% (n = 162), leaving 38% (n = 100) male. Figure 1 shows the sex distribution across all age groups.

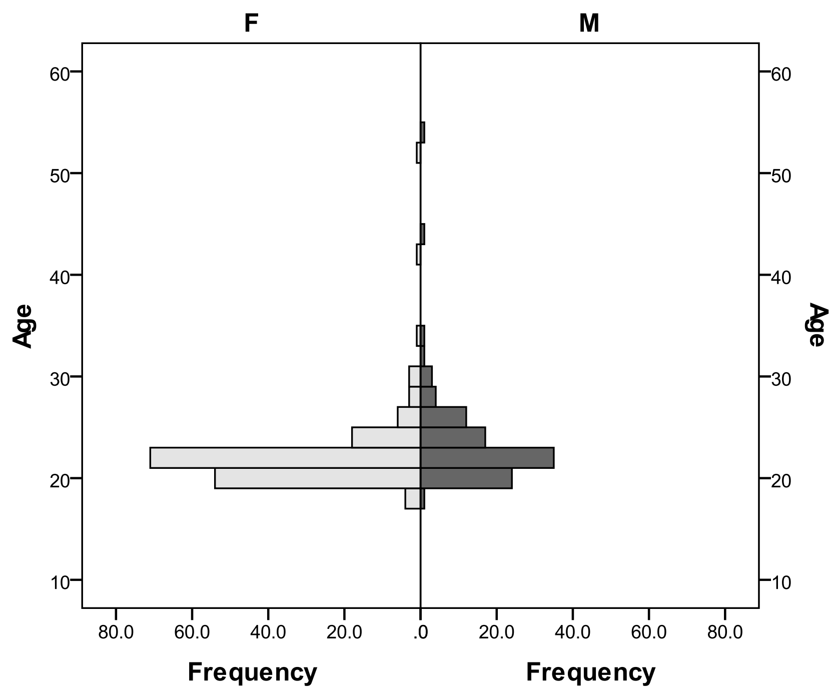

Figure 1. The distribution of females and males among each age group within the sample population shows a female majority and relatively young adult group. Three-quarters of the population were between 20-25 years of age, with only 3% aged 30 or older.

Athletic Distribution of the Sample Population

While the focus of this study was to compare Western diets and activity with that of modern hunter-gatherers, summarized by a model macronutrient and energy expenditure profile, there was an interesting deviation in the expected number of athletic subjects in the sample surveyed population. Specifically, a large number of subjects reported energy expenditures that classified them as athletic by the TEE/RMR criteria. The Center for Chronic Disease Prevention (CDC) issued a report (Shalala 1999) stating that only 40% of American adults were regularly active. Based on this report I expected a maximum of 40% of the sample population to classify as athletic according to my criteria. However, 65% of the entire sample reported an athletic level of energy expenditure in relation to resting metabolic rate. A chi-square test of the data shows that the observed frequency deviated significantly from the expected frequency, $X^2(1, N = 262) = 67.6$, $p < 0.01$.

Of particular interest is whether any difference can be seen in daily activity patterns between athletic and non-athletic subjects. Figure 2 shows a representative day based on the average number of hours spent at each physical activity level for classified non-athletic and athletic subjects. The results found significant differences in the mean time spent at all activity levels using the Welch statistic for a more robust ANOVA: vigorous- $F(1, 247.72) = 151.78$, $p < .001$; moderate- $F(1, 253.06) = 98.24$, $p < .001$; light- $F(1, 215.43) = 8.19$, $p = .005$; rest- $F(1, 256.48) = 144.64$, $p < .001$.

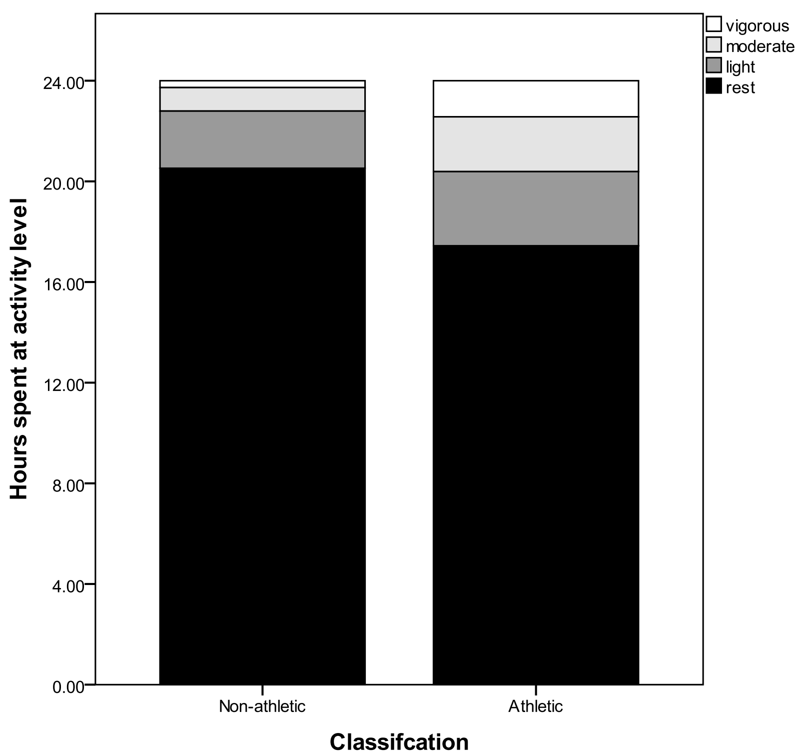

Figure 2. Activity budgets (hours per day) at varying physical activity levels for non-athletic and athletic subjects over a 24-hour period.

Correspondence of Western Diets to Modern Hunter-Gatherer Model

The macronutrient differences between athletic and non-athletic subjects were expected to differ in one direction. Table 2 summarizes the comparison of mean values for athletic and non-athletic macronutrient percentages of total calories consumed with the hunter-gatherer macronutrient model. Both athletic and non-athletic subject samples fell within the model range of dietary fat percentage, but had a significantly higher mean carbohydrate percentage and significantly lower mean protein percentage than the model hunter-gatherer range.

Table 2. Mean (± standard deviation) percentage of macronutrient intake for both athletic and non-athletic subjects compared to the model range of modern hunter-gatherer macronutrient intake and single-sample t-test of significant deviation from range value closest to the mean.

	Hunter-gatherer range	**Athletic n=170**	**Single-sample t-test (*p*)**	**Non-athletic n=92**	**Single-sample t-test (*p*)**
Fat	28-58%	28.43% (±9.9)	0.57	28.85% (±9.8)	0.40
Carbohydrate	22-40%	54.28% (±11.1)	<0.001	55.17% (±10.4)	<0.001**
Protein	19-35%	17.28% (±6.4)	0.001	15.97% (±14.4)	<0.001**

In order to understand the correspondence of athletic diets to the hunter-gatherer model, a best fit approach was utilized with a chi-squared test of expected frequencies for each macronutrient. The results of the analysis confirm the null hypothesis that the level of activity, determined by the ratio of total energy expenditure (TEE) over resting metabolic rate (RMR) and coded by athletic or non-athletic, has no effect on diet: fat,

$X^2(1, N = 170) = 0.18$, $p > 0.67$; carbohydrate, $X^2(1, N = 170) = 1.41$, $p > 0.24$; protein, $X^2(1, N = 170) = 3.39$, $p > 0.06$.

Difference between Athletic and Non-Athletic Diets

Athletic subjects did not predominantly match the hunter-gatherer macronutrient model compared to non-athletic subjects as predicted by the hypothesis. Of the total athletic sample population, only 10 of 170 subjects (5.9%) matched the macronutrient dietary criteria and only 2 of the 92 (2.2%) non-athletic subjects matched the macronutrient dietary criteria. Figure 3 shows a box plot of the macronutrient percentage distribution for both athletic and non-athletic groups.

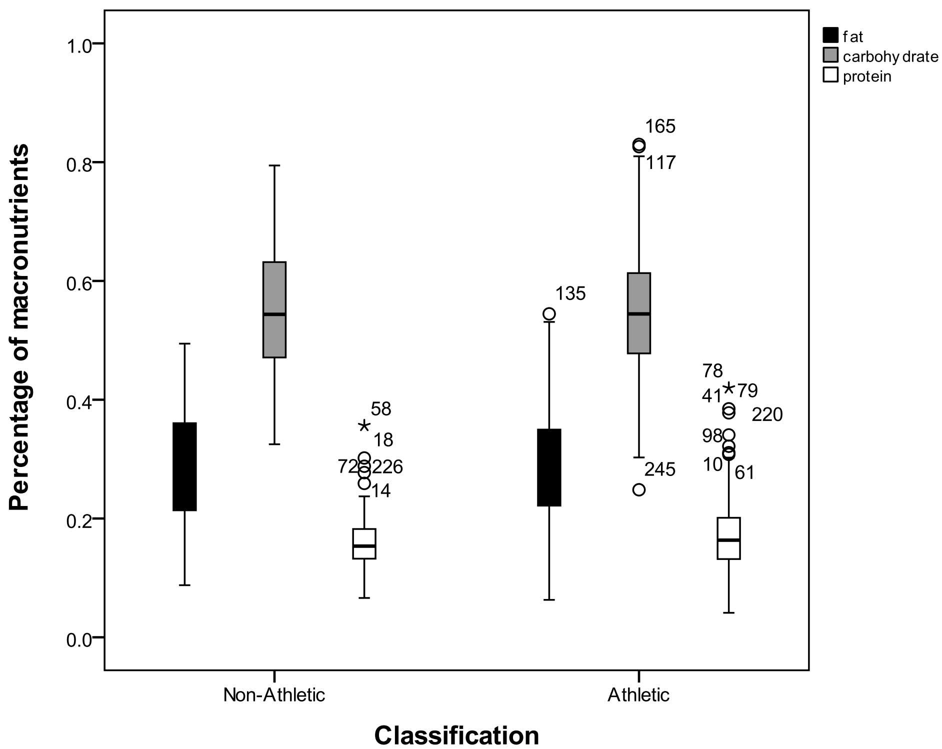

Figure 3. The distribution of fat, carbohydrate, and protein percentages are shown here in a comparison between non-athletic and athletic groups. There was no significant difference between groups for the means of each macronutrient tested. Values are listed as frequencies.

A comparison of the mean macronutrient values between athletic and non-athletic subjects using both an independent sample t-test and one-way ANOVA showed that the dietary composition with respect to macronutrients did not differ between the two groups, though the difference in protein values did approach significance (Table 3).

Table 3. P-values for independent sample t-test and one-way ANOVA comparing athletic and non-athletic macronutrient value means.

α level = 0.05	**Fat**	**Carbohydrate**	**Protein**
Athletic std. dev	±9.9	±11.1	±6.4
Non-athletic std. dev	±9.8	±10.4	±14.4
P-value	$p = 0.74$	$p = 0.53$	$p = 0.07$

Equal variances were assumed for both fat and carbohydrate between athletic and non-athletic samples. The variance of mean protein scores, however, violated Levene's test for equality of variances ($p = 0.03$) and thus violates the assumptions of the independent sample t-test. The *p*-value for protein reported in Table 3 was given by the Welch test of equality of means. See Figure 4 for a representation of the mean values between athletic and non-athletic subjects.

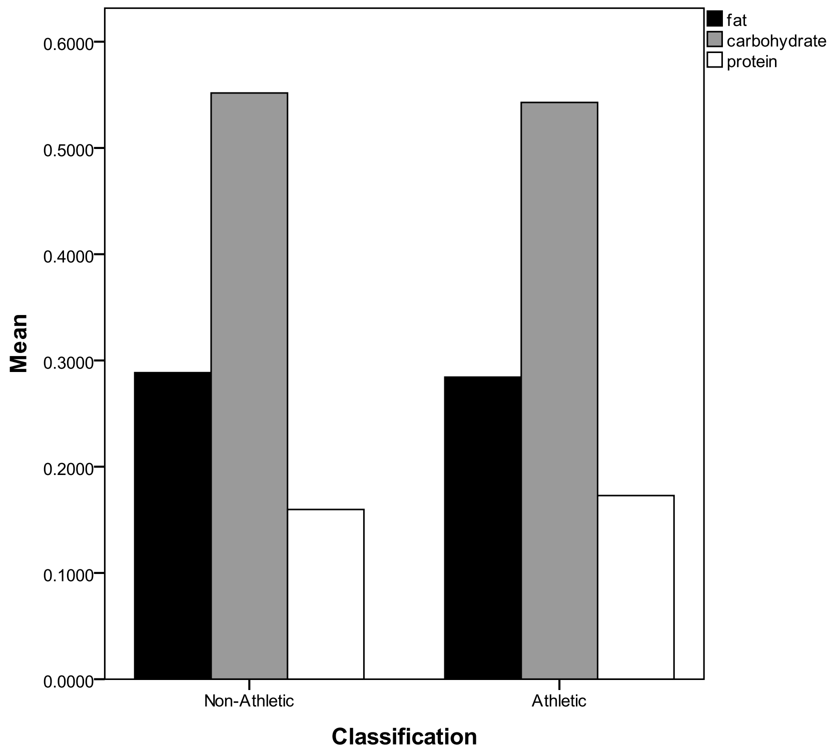

Figure 4. Comparison of macronutrient mean values between the non-athletic and athletic groups. Values are listed as frequencies. Despite different exercise patterns, the groups are closely matched for diet.

The alternate hypothesis stated that diets of athletic subjects would more closely match that of the modern hunter-gatherer model. I tested for possible differences between athletic and non-athletic hunter-gatherer diet frequencies using a Pearson chi-square test, $X^2(1, N = 262) = 0.29$, $p = 0.59$. The results instead reflect acceptance of the null hypothesis that athletic status did not correlate with diet composition. Table 4 summarizes the frequencies found for both athletic and non-athletic groups.

Table 4. Frequency of athletic and non-athletic subjects meeting the hunter-gatherer (HG) dietary criteria for each macronutrient and the total number of subjects in each group matching the criteria for all three macronutrients.

	% Match fat	**% Match carbohydrate**	**% Match protein**	**% Match HG diet**
Athletic (n=170)	49.4	12.4	28.8	5.9
Non-Athletic (n=92)	52.2	7.6	18.5	2.2
Total pop. (n=262)	50.4	10.7	25.2	4.6

Indication of Alternative Subgroups among the Sample

The sample population for this study came from two separate surveyed groups; both sample groups were student populations in a Health and Wellness class and Introduction to Physical Anthropology class. I tested the data for variance within these two sample groups to analyze any significant difference in diet and physical activity. I was also interested in whether or not sex of the respondent influenced the percentage of fat, carbohydrate and protein in the diet as well as activity expenditure. I used a one-way ANOVA to obtain and report F statistics and *p* values. I also tested for deviations from chance in the frequencies of matching dietary or energy expenditure criteria using a chi-square test.

Comparison between Classes

Samples taken from the two different classes were coded as either Health and Wellness (1) or Introduction to Physical Anthropology (0). Using this classification, I ran an ANOVA with the Welch robust test for equality of means because the data otherwise violated assumptions based on Levene's test for homogeneity of variance for the variables, fat, carbohydrate, protein, and TEE/RMR. Consumption of protein varied significantly between both classes with the Health and Wellness group consuming significantly more protein than the Introduction to Physical Anthropology group, $F(1, 260) = 7.55$, $p = 0.007$. Fat and carbohydrate consumption as well as activity expenditure showed no statistically significant deviation. The chi-square test showed that the Health and Wellness group also had significantly higher than expected rates of athletic subjects than the Introduction to Physical Anthropology group, $X^2(1, N = 262) = 8.82$, $p < 0.01$.

Comparison between Sexes

A comparison of mean values for each macronutrient by sex is shown in Figure 5. Using the Welch equality of means test, differences in macronutrient consumption between males and females did not significantly vary for mean values of each macronutrient, although protein did approach significance: fat, $F(1, 260) = 0.14$, $p = 0.71$, carbohydrate, $F(1, 260) = 2.05$, $p = 0.15$, protein, $F(1, 260) = 3.52$, $p = 0.06$.

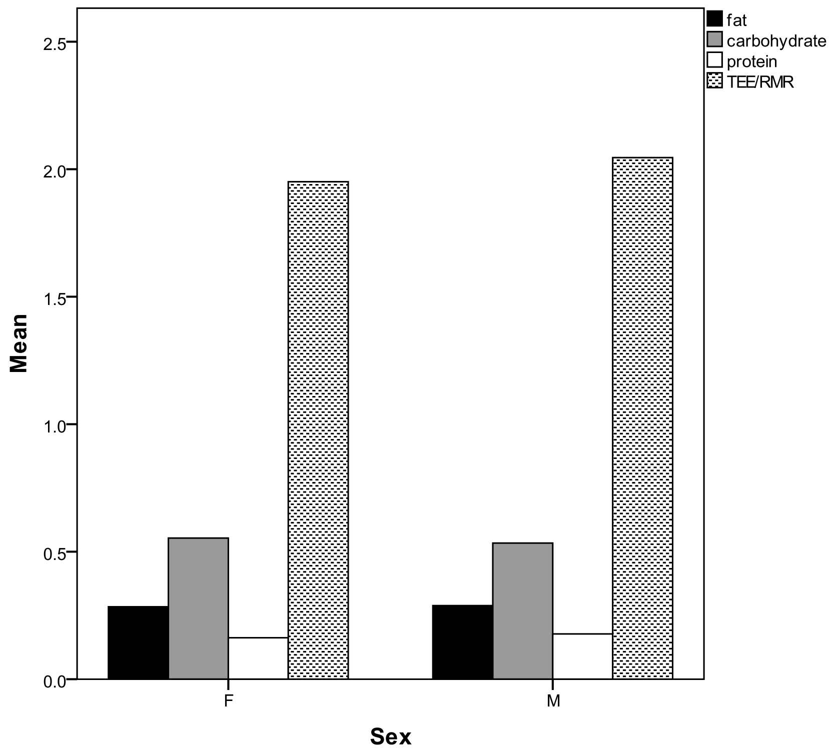

Figure 5. Comparison of mean macronutrient values and energy expenditure between sexes. Macronutrient values are represented as the percentage of total caloric intake and energy expenditure is shown as a ratio of the total energy expenditure (TEE) over the resting metabolic rate (RMR).

The difference in TEE/RMR was also non-significance, $F(1, 260) = 2.99$, $p = 0.09$. However, the frequency of athletes in each sex subgroup was significantly higher in males than females as represented in Figure 6, $X^2(1, N = 262) = 8.77$, $p < 0.01$. Seventy six percent of males reported energy expenditure levels high enough for athletic classification while comparatively fewer females, 58%, were considered athletic.

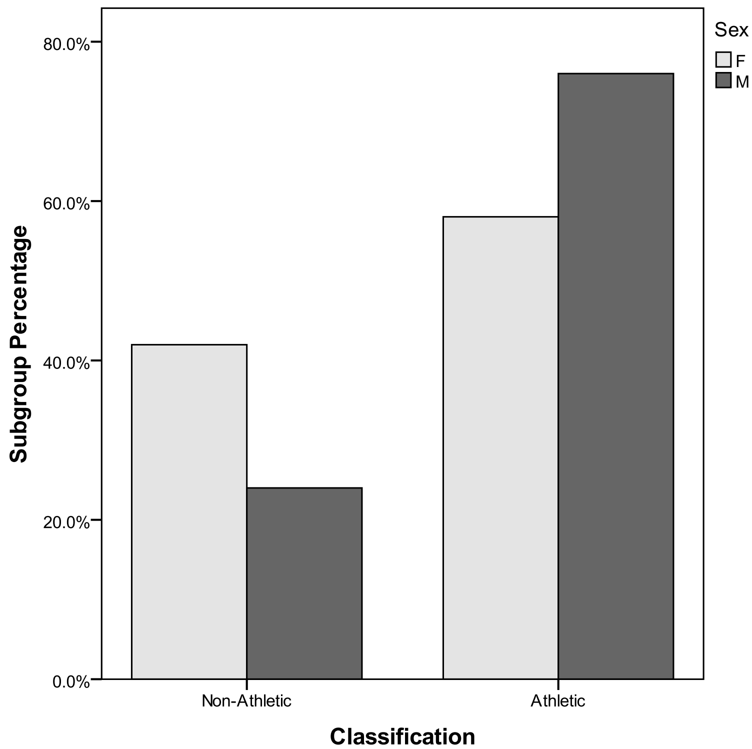

Figure 6. Percentage of female and male respondents classified as either non-athletic or athletic. A higher percentage of the male population compared to the female population reported to have athletic level energy expenditure.

Relationship between Macronutrients

Using a multiple regression analysis, I found a few significant relationships among the continuous variables tested (see Figure 7). This included percentage of protein, fat, and carbohydrate as well as TEE/RMR and age. The most significant relationship occurred between fat and carbohydrate percentage across the whole sample population. Protein percentage also showed a significant correlation in a regression test against fat ($r(260) = 0.13$, $p = 0.04$) and carbohydrate percent ($r(260) = 0.43$, $p < 0.001$) but a plot of the data points does not show a very clear linear relationship. However, fat and carbohydrates show a distinct inverse relationship in that as consumption of fat increases, the consumption of carbohydrate decreases, $r(260) = -0.84$, $p < 0.001$.

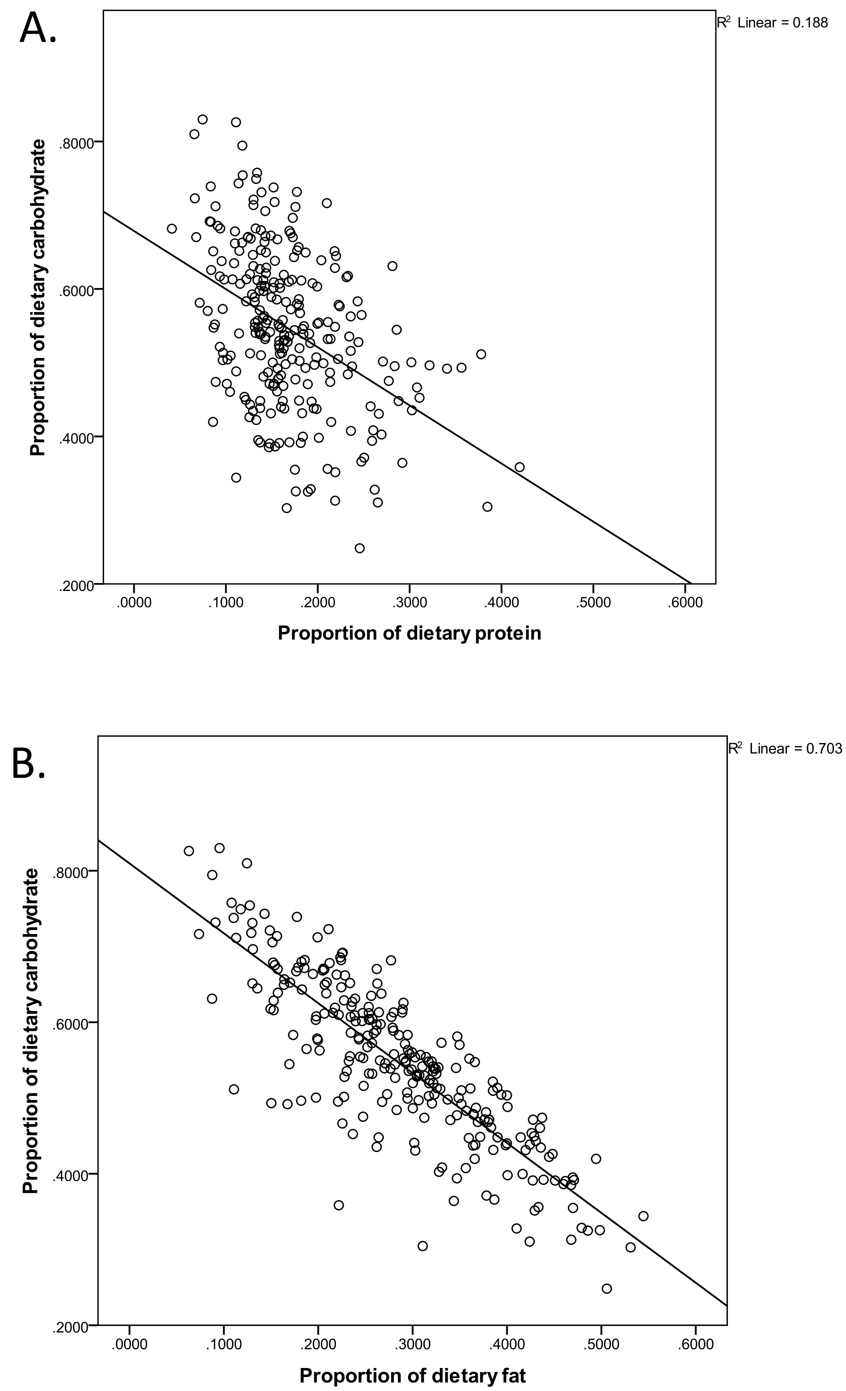

Figure 7. Regression relationships for A. proportion of carbohydrate and protein, and for B. carbohydrate and fat.

C.

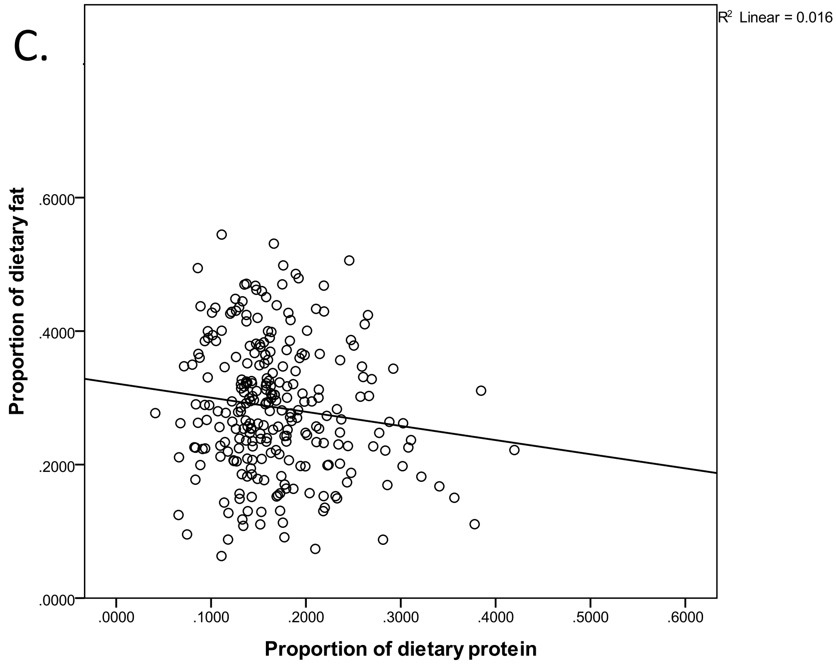

Figure 7. (continued) Regression relationships for C. fat and protein. The regression for proportions of fat and carbohydrate consumed showed a strong negative relationship while the other relationships were negative and less clearly linear.

Non-Parametric Test

I utilized a chi-square analysis whenever possible since I wanted to view my observed outcomes in comparison with the expected model and my primary interest was variation in population frequency. To clarify and organize all tests run, I consolidated the results in Table 5 where a summary of the variable categories can be easily viewed in reference to each significance level. Since each chi-square test tested only two possible outcomes, the degrees freedom were 1 for every test.

Table 5. Summary of chi-square tests consolidated from the text. [1]

N=262	Pearson chi-square value	Degrees freedom	Significance level (2-sided)
Athletic/ non-athlete			
HG fat	0.18	1	0.67
HG carbohydrate	1.41	1	0.24
HG protein	3.39	1	0.07
HG diet	0.29	1	<0.01*
Class (hw/ ia)[2]			
HG fat	0.37	1	0.54
HG carbohydrate	0.73	1	0.39
HG protein	2.49	1	0.11
Athletic	8.82	1	<0.01*
Sex (m/ f)			
HG fat	1.38	1	0.24
HG carbohydrate	3.15	1	0.08
HG protein	0.68	1	0.41
Athletic	8.77	1	<0.01*
Population distribution			
Athletic	67.6	1	<0.01*

[1]: Tests run in order of presentation in the table are: comparison of expected and observed frequencies of athletic and non-athletic subjects matching the hunter-gatherer (HG) criteria for each macronutrient and frequency of athletic and non-athletic subjects matching the criteria for the HG diet; comparison of expected and observed frequencies of each class population matching the HG criteria for each macronutrient and frequency of subjects from each class matching the athletic criteria; analysis of deviation from chance for either sex matching the HG criteria for each macronutrient and for either sex meeting criteria for athletic classification; analysis of the expected frequency for athletic classification for the entire sample population where the expected frequency was derived from the CDC report of active adults in the U.S. (Shalala 1999).
[2]: Health and Wellness (hw) and Introduction to Physical Anthropology (ia)

CHAPTER IV

DISCUSSION

At the outset of this study, a few fundamental observations of primate dietary and energetic research led me to propose the following three hypotheses about modern Western human populations: 1) the diets of physically active, Western people differ from non-physically active Western people, 2) the dietary macronutrient composition for Western people with a TEE/RMR ≥ 1.8 correspond to a modern hunter-gatherer diet model, and 3) non-athletic Western people in the U.S. consume macronutrients to the specifications as proposed by the USDA (2009) dietary guidelines. However, with the results largely in agreement with the null hypotheses, I aim to explain the major patterns and trends seen among subgroups within the sample population as well as describe mechanisms for the relationships observed between variables. By conducting this study, I hoped to illustrate potential similarities and major divergences between living human groups and their Paleolithic human ancestors, despite a ten-thousand year leap in cultural development. In particular, this study proposed that through an evolutionarily conserved physiological relationship, energy expenditure can correlate with specific dietary compositions among modern human populations.

Much of the current literature in human evolutionary nutrition acknowledges and provides evidence for the increasing disparity between modern Westernized lifestyles and the biocultural environment in which humans evolved (Eaton and Konner 1985, Eaton and Konner 1988, Brand-Miller and Holt 1998, O'Keefe and Cordain 2004, Braithwaite 2005, Cordain 2006, Ströhle et al. 2009). However, to my knowledge, no study has looked specifically at subgroups of modern Western populations to correlate both energy expenditure and macronutrient composition with extant hunter-gatherers as a proxy for Paleolithic humans. Earlier research investigated diet and energy expenditure as independent variables or as mechanisms for novel diseases, yet this study attempted to derive more specific correlations and map human adaptive patterns based on the relationship between diet and exercise in modern humans. Throughout this discussion, I highlight the following key topics among the ongoing research in human dietary evolution and their subsequent implications on human health: agriculture replaced hunting and gathering as the main source of food production, causing a decrease in food quality and variety, Western diets emphasize drastically different foods than do modern hunter-gatherer diets and Western populations are much more sedentary and emphasize different activity patterns than modern hunter-gatherers. Thus, it is unsurprising that physical activity and macronutrient consumption of the Western sample population resulted in no correlation with the dietary patterns of modern hunter-gatherers and Paleolithic humans.

Support of the null hypotheses is unsurprising given that the surveyed sample represents a small demographic within the same Westernized society and that extant hunter-gatherers are still very isolated, foreign cultures. However, if there was a biological preference for a particular macronutrient dietary composition, then comparing two wholly different societies is ideal, as dietary similarities would have to rule out cultural noise. Despite non-significance, the data illustrate a breaking point in the bioenergetic model upon which this study was first based. Rather than increasing dietary quality with increased energetic output as shown in Leonard and Robertson's (1992, 1997) studies, my data suggest that modern Western humans maintain similar dietary compositions independent of physical activity patterns.

Data Collection Limitations

Using a survey, I gathered information on diet, exercise, and physical characteristics such as height, weight and body fat. Conducting a dietary recall poses problems of standardization and validation of subjective data. Typically, to overcome these problems, dietary recall studies are conducted by a third-party agency, or the surveyor undergoes training for specific recall software and methods. An example of one such program is the Nutrition Data System for Research (NDSR) managed by the Nutrition Coordinating Center (NCC) at the University of Minnesota. The NCC provides standardized methods, a validated database, and accurate data reporting. However, due to high cost (estimated at $12,000 USD total), time constraint, and unsuitability for my research design, NDSR, or another equivalent, was not practical for the scope, timeline, and funding of this research. Instead, I created a novel survey that fulfilled both the exercise and diet questionnaire component of my research while still simulating validated recall methods as close as possible.

The Status of Western Diets Relative to Hunter-Gatherer Models

Comparing Athletic and Non-Athletic Macronutrients

A major observable pattern was that macronutrient consumption varied more between my sample Western population and the hunter-gatherer model than it did among groups within my sample population. Thus, the surveyed population acted as a completely separate population from the hunter-gatherer model. While it is perhaps not surprising that the non-athletic subjects ate standard low nutritive Western fare, it is interesting that the athletic subjects with activity levels comparable with modern hunter-gatherers resembled the macronutrient distribution instead of their non-athletic counterparts.

This study was based on the premise that more physically active individuals would consume a high quality and nutrient dense diet such as thought to have been consumed by Paleolithic humans. Diet quality and energy expenditure are highly correlated in primate and indigenous human models (Leonard and Robertson 1992, Leonard and Robertson 1997). I proposed whether that correlation could also extend to Westernized human groups. Instead, my data suggest that exercise frequency or intensity has no correlation with dietary composition. Percentages for carbohydrate and protein in athletic subjects significantly deviated from those in the hunter-gatherer model. At 54.28% carbohydrate intake, athletic subjects consumed significantly more carbohydrates than the highest model value range of 40%. Protein intake, at 17.28%, was significantly lower than the lowest predicted model value of 19%. Fat intake among the athletic and non-athletic sample population remained just barely within the hunter-gatherer model low range value of 28%. Both athletic and non-athletic subjects within my sample had very similar diet compositions, showing no statistical deviation from any macronutrient mean frequency.

I instead expected the individuals classified as athletic to consume more protein and fat combined, with less carbohydrate, matching the dietary quality of modern human foragers predicted in Leonard and Robertson's (1997) primate bioenergetic model. Their research showed that in primates, a large day range corresponded with a higher diet quality. Diet quality was measured by weighting the percent of fruit, animal material or fibrous plant parts in the diet. More fruit and animal matter in the diet constituted the highest diet quality values. Day range data for 17 non-human primates were compiled along with their diet quality values, weight and activity budgets. Day ranges for human foragers by comparison totaled four times higher than the most mobile non-human primate. This study inferred that activity levels based on day range are related to diet composition and that we might expect modern humans to show a similar pattern of high diet qualities (i.e., high quality fat and protein) in response to high physical activity. Primates exhibit large day range and subsequent high activity levels from searching for high quality food such as fruits or insects, while relatively sedentary primates have the digestive adaptations to extract their energetic and nutritive needs from low quality but highly abundant leaves.

Cultural Bias

My results indicate that, with regard to macronutrient consumption, the level of physical activity has no bearing on dietary choice. Rather, culture may be a more significant factor in determining the type and quantity of food consumed. The Western food supply is inundated with carbohydrates from the sugar laden soft drinks and dessert foods, to the "healthy" whole grains, flour, starch, and cereal based food products that form the foundation of the USDA food guide pyramid (Lustig 2006, USDA 2009).

In support of cultural relevance, the macronutrient composition for my sample fit entirely within the U.S. Department of Agriculture (USDA) recommendations for adult fat, carbohydrate, and protein intake (USDA 2009). The USDA maintains that a large portion of one's diet should comprise cereals and whole grains, a food group that is almost explicitly omitted from modern, and presumably also Paleolithic, hunter-gatherer groups (Eaton et al. 2002). Also included, though to a lesser degree, are dairy products, which would not have been possible in the Paleolithic prior to animal domestication (Eaton et al. 1988, Cordain et al. 2005). However, the USDA advises a daily caloric intake of 20-35 percent fat, 45-65 percent carbohydrate and 10-35 percent protein. The mean dietary compositions of both athletic and non-athletic subjects fit well within those guidelines, indicating that even if there is a biological adaptation to a certain macronutrient distribution, it is eclipsed by culture and current nutrition education.

My finding on dietary discordance is supported by other studies and statistics on modern human diets. Cordain (2006) reported that 72.1% of total energy in Western diets comes from food sources that are largely unavailable to modern and Paleolithic hunter-gatherers. The mainstay of Western diets, according to Cordain, is dairy products, cereal grains, refined sugars, refined vegetable oil and alcohol. The sample Western population in my study predominantly ate fats and carbohydrates (28.6 and 54.6 percent respectively), which corresponds well to the literature's reported heightened consumption of cereal grains, refined sugars, and vegetable oils.

Comparing macronutrients exclusively between athletic and non-athletic subjects may not have been an effective method for illuminating dietary differences. The athletes and non-athletes were indistinguishable when compared on the basis of macronutrient consumption alone. However, a cursory look at the types of foods eaten does display interesting patterns and differences that might have bearing on overall health and athletic performance. A summary of the different foods commonly consumed per athletic subgroup can be found in Appendix D.

Relationship between Macronutrients

A few very interesting relationships stood out among the continuous variables tested: fat, protein, and carbohydrate percentage plus the TEE/RMR ratios. A regression analysis showed a striking inverse relationship between mean fat and carbohydrate intake. Comparisons between the other macronutrients also showed negative relationships, signaling a caloric balancing act of one over the other. Fat and carbohydrates exhibited the clearest linear relationship suggesting a definite trade-off in dietary emphasis. Since fats and carbohydrates make up the majority of metabolic calories, the calories used in work, as the consumption of one increases, then reliance on energy input from the other decreases and, consequently, so does consumption.

Evolutionary Relationship of Macronutrients

Cordain et al. (2000) modeled theoretical macronutrient intakes for world-wide hunter-gatherers based upon ethnographic data and physiological limitations. Their results showed that the ability to synthesize urea as a byproduct of protein consumption limits human daily intake to about 40 percent of total energy consumed. Therefore, consuming fat and carbohydrates is a necessary alternative for energy resources. Moreover, the relationship between fat and carbohydrate is understandable if we assume that rich sources of protein are also good sources of fat. This is easily exemplified by meat and eggs. Ethnographic studies show that human groups preferentially consume food sources high in protein to attain a high nutrient density (Cordain et al. 2000). However, since protein consumption at greater than around 50% of daily caloric intake can lead to excessive nitrogen, depending on the ability of the liver to synthesize urea, humans balance their energy intake by eating fat rich protein sources such as choice animal flesh or nuts (Cordain 2006). As fat and protein consumption increase, the caloric room left for carbohydrate consumption diminishes, thus explaining the negative correlation between fat and carbohydrate. However, the results also showed a negative relationship between fat and protein, which refutes Cordain et al.'s (2000) model, but may be understood by the fact that overall, protein intake is low within the sample, and carbohydrate and fat intake is high, most likely a product of the accessible food supply. Protein consumption may instead come from excessively fatty processed foods, and a high consumption of carbohydrate further limits the amount of protein in the diet (Milton 1993, Cordain 2002). Given its drug-like properties (Hammersley and Reid 1997, Isganaitis and Lustig 2005, Lustig 2006), sugar consumption has become a habituation in the daily lives of modern Western populations. Quite predictably, just as a drug user seeks the right neurochemical stimulant, people prefer quick, cheap (in modern times) energy over less rewarding protein and fat sources when the result is effective, and addictive (Pickering et al. 2009).

Health Consequences of Modern Western Diets

A large volume of literature devoted to studying the neurobiological effects of carbohydrate (or simple sugars) on cellular signaling and metabolism has become increasingly persistent about the severe health consequences attributable to poor diet. Whether it is seen as a drug, chemical, or food, sugar is rampant in the Western diet due to over consumption of refined and manufactured foods high in simple carbohydrates (Milton 1993, Hammersley and Reid, 1997, Lustig 2006). In the last 200 years, data on per capita sugar consumption in England showed a tenfold increase (6.8kg to 69kg per year), while the average Western diet is typified by an 18.6% refined sugar content, not including simple sugars from dairy and cereal (Cordain et al. 2005). The data for England are consistent with values in other Westernized countries such as the Netherlands, Sweden, Norway, Denmark and the United States (Cordain et al. 2005). Contrast modern dietary sugar content with the near absence of refined sugar just 2000 years ago and, given even a rudimentary association of sugar with “junk food”, we can immediately see the ramifications on health (Lustig 2006).

A closer look at the physiological effects of sugar may shed light on some of the observed changes in human history. In particular we observe the reduction of human cranial capacity since Cro-Magnons, increased insulin resistance, increased incidence of myopia, addiction and cravings for sugary foods (Williams 2010), and increased propensity for obesity and metabolic syndrome (Brand-Miller and Holt 1998, Eaton et al. 2002, Cordain et al. 2002). Metabolic syndrome encompasses a wide array of health problems including high insulin resistance (low sensitivity), obesity, high blood pressure (hypertension), high cholesterol and increased risk for heart disease, stroke, and diabetes (Frisancho 2009). While the exact etiology of metabolic syndrome stems from a variety of factors, the main causes are thought to hinge on diet and lifestyle, and in particular, a diet emphasizing refined grains, sugar, oils and alcohol (Cordain et al. 2005). A study by Kuo et al. (2008) showed that a high fat and high sugar diet (the main constituents of modern Western diets) combined with stress actually increased tissue levels of cortisol, changing the norepinephrine signaling to neuropeptide Y (NPY) and causing lipid deposition in the abdominal region. The overall effect was obesity and metabolic syndrome.

The prevalence of metabolic syndrome in modern society is compounded by the fact that carbohydrates make humans poor mobilzers of fat in adipose tissue. Keller et al. (2003) tested the metabolic response on human adipose tissue (fat) to exercise mediated by varying carbohydrate consumption. They found that interleukin-6 expression signals lipolysis, but is muted by carbohydrate consumption. The implication of this study is that modern diets have effectively changed human metabolism from burning fat and having high insulin sensitivity to burning carbohydrate and having low insulin sensitivity, a precursor for metabolic syndrome.

Further research from animal studies on anxiety showed a correlation between motivation for sucrose and low-anxiety behavior (Alsio et al. 2009). This study connected anxiety and novelty seeking behavior with obesity, stating that a growing body of evidence, including their own work, shows an overlap with the neurochemical aspects of obesity and drug addiction. If we can classify sugar as a “drug” based upon a mirrored neurochemical mediated response to cocaine, then truly, modern sugar consumption is a pandemic of drug addiction.

Population Physical Activity Patterns

Physical Activity Values and Comparisons

Today’s modern standards for exercise do not approach the minimum physical activity level most indigenous populations experience daily (Cordain et al. 1997, Cordain et al. 1998). Recommendations given by the American College of Sports Medicine (ACSM) and the U.S Department of Health & Human Services (DHHS) specify only a fraction of the daily energetic output of modern subsistence level populations and ancestral hunter-gatherers (Cordain 1998, ACSM 2007, DHHS 2008). The ACSM guidelines recommend at most, just less than 45 minutes per day of moderate intensity exercise. In Leonard and Robertson's (1992) study on hominin bioenergetics, hunter-gatherer activity data given for the !Kung and Ache, two of the best studied remaining indigenous groups, were compared with non-human anthropoids. Energetic ratios for the human groups greatly exceeded the anthropoids with the Ache males reaching a ratio value of 2.15 (TEE/RMR) and *P. troglodytes* exceeding the non-human primates with a ratio of 1.46. An average of the ten non-human species compared gave a ratio value of 1.3 ± 0.10 compared to 1.81 ± 0.27 for the human groups (Leonard and Robertson, 1994). A look at the daily activity budgets for both the !Kung and Ache show about 1.5 hours spent in extreme physical exertion, a level of activity not required by the ACSM or DHHS for modern fitness requirements. This level of exertion requires 7 kcal/kg/hr above RMR, compared to walking at 2.5 kcal/kg/hr. In fact, 1.5 hours daily at any activity level is three times greater than the most current recommended activity standards. Most recently, a joint statement by the ACSM, the American Heart Association (AHA) and the DHHS agreed that adults should strive for 150 minutes of exercise per week, or 30 minutes of moderate intensity activity at least five days a week (ACSM 2008).

My criteria were purposefully rigorous for defining athletic individuals in the survey sample, using the estimated TEE/RMR value of 1.8 reported for the Ache human forager population (Leonard and Robertson 1992, Cordain et al. 1998). Activity levels for the Ache are some of the highest among human populations and are considered a good representation of Paleolithic human activity levels (Leonard and Robertson 1992, Cordain et al. 1998). Activity values for sedentary Western office workers were reported as 1.37 and the “fitness enthusiast,” (equivalent to running 7.5 mph, 60 min/day) reached 1.84 (Cordain et al. 1998). This meant that I expected only a small percentage of my sample population to actually meet the Ache or “fitness enthusiast” physical activity levels. Human athletic capacity was honed over millions of years from foraging in the wild, escaping predators and avoiding other threats. However, only in the last half century has human physical output potential been quantifiable, yet laboratory tests and standards are poor comparisons to the daily rigors of indigenous life (Cordain et al. 1998).

I reported that 65% of my total sample population classified as athletic by meeting or exceeding the TEE/RMR value of 1.8. Percentages varied significantly depending on whether the subject was from the Health and Wellness or Introduction to Physical Anthropology class and whether the subject was male or female. Both subgroup populations, however, still exceeded the expected athletic frequencies reported based upon Keating et al.’s (2005) meta-analysis of college students’ physical activity. This means that the majority of the subjects surveyed reported that they experienced energy expenditure through physical activity at 1.8 times greater than their resting metabolic rate. Physical activity in this regard stands for any muscle activity beyond life-sustaining organ function and the thermal effect from food (Leonard 2000). According to the 2008 Physical Activity Guidelines for Americans (DHHS 2008), “inactivity among adults and youth remains relatively high” with less than 40% of American adults engaging in regular physically activity while 36% are not active at all. Even more surprising are findings that college students are less active than the average for the overall population of adults in

America, reaching levels of 40-50% reported inactive (Keating et al. 2005). Given that my study solely targeted a college student population, it is surprising that my sample population included an overall high percentage of athletes. My results deviated significantly from the expected values reported by the CDC (1999), Keating et al. (2005) and DHHS (2008) on physical activity frequencies in adults and college students, indicating a potential source for survey error rather than a significant or interesting sample population. Since this was a survey-based study, it is very likely that a large amount of error came from false or inaccurate reporting on the part of the subject. It is also possible that the nature of the questions, formatting, survey style, and nature of the responses may too have resulted in reporting error. For example, where I asked for the total time a subject spent engaged in vigorous physical activity, the subject's response may have been the time spent engaged in a particular sport that has brief vigorous bursts of activity, but not for any consistent duration. The inaccurate reporting likely stemmed from two weaknesses in the survey design and implementation: 1] The question design led the subject to think activity level can or should be classified by activity type, and 2] The subject was biased toward a particular response, in this case reporting higher than normal activity rates, to please or satisfy the surveyor's perceived expectations. These issues however, are inherent in any survey that calls for self reported responses. In particular, 24-hour recall validation studies on dietary intake stated that intake differed significantly between observed and recalled portions (Carter et al. 1981). However, while recall surveys are poor indicators of actual quantities, they may be suitable for estimating trends in a population (Linusson et al. 1974, Chiba et al. 2008). Further, validation comparisons between self-administered recall questionnaires and interview surveys concluded that there is no significant difference in the validity of either recall type (Beer-Borst and Amado 1995).

Paleolithic Diet Reconstructions

While agriculture had a major dietary impact for the last one tenth of modern human existence, the more recent industrialization only 200 years ago created refined food products to become the staples for much of human society (Eaton et al. 1988, Cordain 2002). Modern Western food is no longer the direct conversion of solar light captured in raw plant fibers or animal flesh to form energy, but engineered synthetic food ingredients made from reconstituted organic molecules to provide cheaper and longer lasting commodities (Gussow 1978). From an evolutionary perspective, humans are wild animals, and just as any other wild animal, optimally thrive on wild foods. A historical look at the evolutionary considerations for dietary discordance between modern food economies and ancestral human diets is relatively recent, beginning in earnest with Lee and DeVore's *Man the Hunter* (1968) and gained momentum with Eaton and Konner's 1985 publication, *Paleolithic Nutrition.* More recent endeavors to elucidate the Paleolithic past have concluded that human ancestors were actually prey to larger predators and only recently acquired top-level predator status after considerable cognitive leaps and technological innovations (Hart and Sussman 2005). In this more plausible view, Hart and Sussman (2005) reaffirmed that gathering and scavenging provided for the majority of calories consumed. Though, whether as predator or prey, by about 2.5 million years ago, human ancestors undoubtedly branched away from folivory and frugivory (with the occasion granivory) and included more energy dense animal products in their diet (Eaton et al. 2002). A thriving argument perpetuated by notable authors such as Eaton, Ungar, Teaford, Cordain, Conklin-Brittain, Leonard, and Milton agrees with the original thesis of Eaton and Konner (1985) and Eaton et al. (1988) that we are Stone Age hunter gatherers with Paleolithic genes displaced into a modern Neolithic culture very different from the one in which we evolved. Fossil evidence dates the *Homo* lineage at about 2.4 million years old with anatomically modern humans (AMH) emerging at an inconclusive 100,000-200,000 years ago (Lewin and Foley 2003, Stringer 2003). The earliest sign of agriculture by comparison dates to about 12,000 years ago, only 0.5% of the existence of *Homo* and roughly a tenth of the existence of AMH. Accordingly, when genomic changes occur much less rapidly and more linearly, certainly culture has outpaced genetic adaptation within our species.

Morphological Evidence of Meat Eating

The literature on human dietary evolution supports an increasingly meat-dependent diet beginning with *Homo habilis* and becoming more important through the *Homo* lineage, due to increasing energetic demands, but reduced cranial morphological adaptations (Leonard and Robertson 1992, Leonard and Robertson 1997, Conklin-Brittain et al. 2002, Larsen 2002, Teaford et al. 2002). Looking first at the evidence of a dietary model through history, we find clues about our ancestral diets and energy needs from multiple avenues such as craniofacial anatomy, bioarchaeological chemistry, coprolites, faunal bone assemblages, dental and oral health, paleoecology, skeletal anatomy, and behavior of extant primates (Sorensen and Leonard 1999, Ungar and Teaford 2002, Larsen 2002). Dental and craniofacial anatomy has been especially helpful in reconstructing early hominid diets. The mandibular robusticity, muscle insertions, and large molar size with thick enamel associated with the australopithecines indicate a diet heavy in tough but brittle foods, lasting through the Pleistocene (Teaford et al. 2002). Recent research has actually returned to the idea that meat was an important evolutionary factor after the shift from australopithecines to early *Homo* and a key dietary component especially at the onset of anatomically modern human (Cordain et al. 2000, Eaton et al. 2002, Hart and Sussman 2005, Ströhle et al. 2009). Even more, morphological surveys suggest that consumption of meat and other high quality foods corresponded with an increase in human brain size, as measured through cranial capacity, and decrease in overall cranial robusticity (Eaton et al. 2002).

In particular, molar size, enamel thickness, anterior pillar buttressing, and flat molar surfaces for crushing food decreased while incisors and occlusal relief increased for the *Homo* lineage (Teaford et al. 2002). Thus, the craniodental anatomy suggests a departure from, for instance, crushing seeds to tearing meat or piercing tough fruits. The essay by Eaton et al. (2002) correlated brain growth with the preformed long-chained polyunsaturated fatty acids (PUFA) derived from meat and seafood. Since peaking among the Cro-Magnons, brain size has decreased in tandem with decreased consumption of animal foods. Cranial capacity today is 11% less than our Paleolithic ancestors. Both events, the decrease in cranial capacity and consumption of animal foods, coincided with the advent of agriculture, when low quality, mass produced food replaced the diverse subsistence on wild plants and animals (Eaton et al. 2002, Eaton et al. 1988, Diamond 1987).

Isotope Analysis as Evidence of Meat Eating

From the analysis of cranial and dental structures, we presume that the diets of *Homo* and *Australopithecus* comprised very different materials or, at the least, different processing techniques (Teaford et al. 2002). Evidence from isotope analysis is slightly missleading because it shows the same carbon profile for both australopithecines and *Homo* (Teaford et al. 2002). However, according to Teaford et al. (2002) it supports the idea of niche partitioning among species. Isotope analysis obtains stable carbon and nitrogen isotope ratios that can reflect main dietary constituents. The ratios are expressed as a delta carbon atom value ($\delta^{13}C$) and their variability indicate one of three possible plant photosynthetic pathways: C3, C4, and crassulacean acid metabolism (CAM). Plants are identifiable based on these ratios as deriving from either hot and dry climates (C4 and CAM) or temperate climates (C3), so knowing the abundance of a particular carbon isotope can generalize the type of environment in which an organism lived. The CAM photosynthetic pathway is found mostly in cacti and succulents, so for primates, the research focuses on C3 and C4 evidence. The foundation of hominin diets comprised C3 plants, either directly or indirectly. While this might seem to support homogeneity in diet, the C3 plants are actually much more diverse and found in temperate climates, unlike C4 plants, which live in dry, arid environments (Larsen 2002). The interpretation of this finding is that early hominins consumed the C3 plants themselves while later species of *Homo* consumed a mixture of C3 plants along with animal consumers of those same plants, such as ungulates (herd animals) and small game (Teaford et al. 2002). Teaford et al. accepted this interpretation because the craniodental morphology suggests that *Homo* would not be as suited to process C3 plants like the earlier more robust hominins who could feed directly on hard nuts and roots for necessary nutrients. Instead, members of *Homo* had to employ tools to procure nutritious plant matter, or place more emphasis on eating C3 feeders.

Physiological Evidence of Meat Eating

Morphologically, we differ from our closest primate ancestors in brain size and gut size, two important organ systems that critically influence dietary needs. The human brain comprises about 25% of the adult body's total resting metabolism (higher for children) and consumes about 100-145g glucose per day (Leonard and Robertson 1992). Coupled with high activity rates, the human body demands a much higher caloric intake than any other living or non-living anthropoid, but with only a small gut to handle the high caloric load (Aiello and Wheeler 1995, Conklin-Brittain et al. 2002). The human brain mainly relies on glucose, but can utilize ketones, the products of lipid metabolism used during fasting or starvation, as a secondary energy source. The brain cannot render this fuel from macronutrients alone and is dependent upon the body to metabolize carbohydrates, fats or proteins into glucose (Lustig 2006, Westman et al. 2007, Andrews et al. 2008). Carbohydrates supply the quickest and most direct form of glucose, but according to ethnographic and fossil studies, carbohydrate rich foods are rare in the wild (Brand-Miller and Holt 1998, Cordain et al. 2000) and were almost nonexistent during the Ice Age (Eaton and Konner 1985, Brand-Miller and Colagiuri 1994, Calvin 2002). The Caribou Inuit are a prime example of what periglacial human life may have been like 30,000 years ago, particularly with the Cro-Magnons in subarctic Eurasia (Eaton and Konner 1985). Living in the heavily glaciated Western shore of the Hudson Bay, the Inuit subsist primarily on large Arctic animal species such as caribou, bears, seals and whales for 90% of their diet. Only during the summer months and in lower elevation do they gain access to sparse tundra vegetation (Eaton and Konner 1985, Lee and Daily 1999). One adaptation believed to result from this is the ability to derive sugar from fat and protein, a process called gluconeogensis that occurs in the liver (Cordain 2006, Taubes 2007). Low blood glucose levels trigger hormones released from the pancreas to stimulate lipolysis and create available free fatty acids (FFA) in the blood stream. These FFA's can be converted to sugar and stored as glycogen in the muscle for activity, or in the liver as food reserves for the brain. By tapping adipose tissue for metabolic fuel, the body tightly regulates its own blood glucose levels, but under the assumption that little to no exogenous sugar will be consumed in the form of high carbohydrate foods (Williams 2010).

Human metabolism counteracts high blood glucose by releasing insulin, which facilitates glucose from the bloodstream into tissue cells by binding to GLUT-4 receptors on cell membranes (Williams 2010). High insulin release, however, quickly rids the bloodstream of glucose, loading the muscles and liver with glycogen, but starving the brain of glucose. The tissue cells must become slightly insulin resistant and attenuate the GLUT-4 receptor expression before adequate glucose can remain in the bloodstream long enough to travel to the brain. Both mechanisms enact to mitigate brain damage either from starvation or glucose toxicity, but the latter is a reaction to an evolutionarily abnormal high blood-glucose state and a disintegration of an otherwise well refined self-regulating metabolic system (Keller et al. 2003). Paleolithic humans are thought to have consumed mostly fat, protein, fiber and water with minimal or only seasonal contribution from carbohydrates to daily calories (Brand-Miller and Colagiuri 1994). Many groups of modern hunter-gatherers still retain this dietary pattern (Eaton and Konner 1985, Cordain et al. 2000). Although it is likely that plant food contributed to a large proportion of daily calories, especially for inland human groups, wild plants contain more protein and less starch than domesticated crops (Brand-Miller and Holt 1998, Eaton et al. 1988, Milton 1993, Milton 2002). Some contemporary views on evolutionary diet suggest that humans show an adaptive predisposition to insulin resistivity in the muscles (a precursor to diabetes when the condition is chronic) while maintaining the propensity to synthesize glucose from other macronutrients and shunt it directly to the brain (Brand-Miller and Colagiuri 1994). This means that high quality protein and fat sources were most likely the staple foods for early humans with limited access to sugary, starchy or otherwise high carbohydrate and low fiber foods. The small gut and large brain meant humans had to prioritize acquisition of energetically dense foods (fat nets 9 kcal per gram versus 4 for protein and carbohydrate) in a wild and unpredictable environment.

Agricultural Legacy

While agriculture and food industrialism has brought civilization a moderately stable and abundant food supply (in the short term), it simultaneously limits dietary diversity (Brand-Miller and Holt 1998, Milton 2002, Benyshek and Watson 2005). Up to 200 different plant species can be found in the diet of even a folivore specialist, such as the gorilla (Popovich et al. 1997). For an example of food diversity in modern human hunter-gatherer groups, Brand-Miller and Holt (1998) reported the nutrient content of over 800 Australian Aboriginal (AA) traditional food resources. The Australian Aborigines live in the arid bush and desert of Western Africa, yet the food data for Aboriginal diets include around 300 different species of fruit and 150 varieties of roots and tubers. This number is even more impressive when considering that plants are subsidiary to the animal-dominant diet of AA's. For the agrarian civilizations, different geographical regions of the world specialize in producing one or two agricultural products that form the food staple for that region. Such staples include: wheat, rice, soybean, yam, millet, potato, sorghum, maize, oat, rye and beans (Brand-Miller 1998, Leonard 2000). While dietary staples offer a predictable, plentiful, and consistent food source, they also lower the need for a diversified diet (Cordain 2002, Diamond 2002). Subsisting on a diverse number of resources in the wild has several advantages that can be overlooked by inhabitants of an advanced agricultural society. Multiple plant or animal food resources helps ensure that no one resource is exhausted or extinguished. It also leaves less chance that a single organism will dominate or out-compete its cohabitants in a natural polycultural environment. Diversity helps protect against disease or crop blight, to which agricultural communities are especially susceptible. The Irish potato famine of the 1840's starved and killed thousands of farmers and their families, yet food diversity in agricultural populations is not substantially better even after over 150 years of industrial innovation (Diamond 1987, Fussell 1994). Given the interesting incidence of the human population acceleration after the Neolithic revolution and again after the Industrial revolution, there is undoubtedly a close correlation between resource abundance and population size (Calvin 2002, Jönsson 2005). Since the current state of the human population could not withstand a departure from agricultural food acquisition due to mass production, it stands to reason that population size creates a limiting factor for type of food exploited. Most human populations, particularly in large, densely populated nations, must rely on large stable crop yields from agriculture or risk famine and starvation. We can expect that a large population that requires high food quantity must obtain food of low nutritive quality (Diamond 1987, Wells 2010). Low nutritive foods in the wild include leaves, pith, bark, flowers, grasses and grains (Milton 1993, Milton

1999) and are those most commonly exploited by larger bodied animals, including the great apes (Popovich 1997, Milton 2002). Agricultural domestication enhanced the edible qualities of a select few wild grains and grasses, creating the foods we recognize as corn, wheat, sorghum, barley, soy, and rice, but their nutritional quality remains little better than their wild counter-parts (Diamond 2002).

In contrast to agricultural products, nutrient rich foods such as fruit, meat, nuts or seeds are often seasonal, unpredictable, and scattered (Conklin-Brittain et al. 1998). These foods may have supplied the majority of calories to our Paleolithic ancestors, but only when population levels were low enough to be supported on scattered resources. Given that my sample subpopulation was part of a global agrarian economy in which low quality grain based foods comprised the majority of the diet, the high consumption of carbohydrates matches the expectations of food availability within that social environment. The feasibility of promoting consumption of anything but monoculture agricultural products must have repercussions on food availability and profitability (Gussow 1978, Diamond 2002).

Future Studies and Dietary Intervention

The data lend themselves to multiple analyses through comparisons of the main groups in question (athletic and non-athletic subjects), as well as sub-groups such as university class (Health and Wellness or Introduction to Physical Anthropology), or sex. In this study the analysis of subgroups outside of my primary focus was an important step in establishing potential targets for future studies or health interventions. My results indicate that further complexities exist in dietary choice based upon a myriad of the following cultural and biological factors: socio-economic status, social identity (as an athlete or non-athlete, male or female, etc.), religious affiliation, personal experiences, allergies, pregnancy, self-image, and so forth. Ultimately, successful models for therapeutic dietary intervention and education are contingent upon understanding the experiences of the target demographic. I hope that the results of this preliminary analysis on human diet in a proxy sample Western population adequately show the disparate philosophies and educational training between traditional and evolutionary-based diet research. Ideally, these two camps can recognize the contributive value of one-another, and use their combined resources to usher health research towards beneficial and unbiased understandings of dietary health.

CHAPTER V

CONCLUSION

Studying any type of human activity both in the modern era and through archaeological, written or oral history is a complex issue laden with cultural, historical and biological factors. One consequence of human research is that the findings often open doors to further inquiry, but rarely do they satisfy the problem in the initial question. This is simultaneously exciting and frustrating. On the one hand, a study that raises more questions is a success for the inquisitive researcher; on the other hand, it may mean unsubstantiated or inconclusive results and a lack of finality for the project.

In my study, I expected the modern Western sample population to divide in both physical activity level and diet composition owing to a biological imperative for dietary needs under harsh physiological stress. I predicted that diets of athletic subjects would more closely resemble modern hunter-gatherer diets because hunting and gathering was the primary subsistence pattern for millions of years of human evolution (Eaton and Konner 1985, Hart and Sussman 2005, Wells 2010). If there is an ideal human diet, then its origins most likely lie among the 2.5 million years of the *Homo* lineage's evolutionary experience and must no doubt be influenced by metabolic activity (Leonard and Robertson 1997, Pontzer and Kamilar 2009). Since modern hunter-gatherers are the last vestiges of what was once humanity's only, and oldest, subsistence strategy, I used a modern hunter-gatherer dietary model to represent Paleolithic human diets.

I had hoped to find evidence for an underpinning physiological necessity surpassing the influence of culture. I asked whether modern Westernized athletes would revert to the diet on which hominins evolved over millions of years, or whether the agricultural and industrial revolutions truly eliminated all association with our dietary past through.

Athletic and non-athletic modern Western diets from the sampled population were more similar to each other than to the hunter-gatherer model for dietary percentages of fat, carbohydrate and protein. Rather than a division based on lifestyle, my results implied a division between the tested populations based on culture. While no single hunter-gatherer group was isolated for this study, the hunter-gatherer model derived from ethnographic research encompassed a theoretical average or best estimation of the preferred dietary concentrations of each macronutrient for all indigenous people and, presumably, Paleolithic humans (Cordain et al. 2000, Eaton et al. 2002). Therefore, the hunter-gatherer dietary model was not just a quantitative means of comparison, but also represented the collective culture of people who to this day forage from the land for wild plants and animals. The sample taken from two student populations at a single university also broadly represent their own Westernized culture separate from the modern hunter-gatherers. These students experience the domination of agribusiness, globalization of goods and resources, industry, monetary currency, modern conveniences, and a governmentally approved and controlled guideline for American living standards. The USDA dictates the amounts and types of foods Americans should eat and also, as a policy, are highly influential in the current health curriculum for students in nutritional studies (Taubes 2007, USDA 2009). Given the drastically different cultural foundations of my survey sample population and the representative population of the hunter-gatherer model, it is not surprising to find a division in lifestyle patterns based, not on hypothesized physiological demands, but on familiarity and precedence of cultural institutions.

Athletic subjects ate significantly more carbohydrates and less protein than the values predicted by the hunter gatherer model. Athletic subjects did not significantly differ from non-athletic subjects in macronutrient intake, though protein consumption differences did approach significance, possibly owing to the nutritional education of student athletes. Athleticism was not a good predictor for conformance with the hunter-gatherer dietary model as the frequency of individuals that did meet the dietary requirements deviated from the expectations of the hypothesis.

In an analysis of subgroups, consumption of protein was higher in the Health and Wellness group than the Introduction to Physical Anthropology group, presumably because of the nutritional education curriculum available to students in the Health and Wellness classes and degree plans. Differences based on sex were not significant for diet or activity level, however, the frequency of males classified as athletic was significantly higher than the frequency of females. The frequency of the total population classified as athletic was also significantly higher than expected frequencies based on the CDC (1999) and DHHS (2008) reports and the Keating et al. (2005) meta-analysis of current student and adult activity levels.

Finally, the relationships between macronutrient quantities were uniformly negative. This finding was expected and logical since there is a limited quantity of consumption for one person. If the dietary quantity of one macronutrient increases, then consumption of the other two macronutrients must decrease in order not to exceed 100% of total calories consumed. The linear inverse relationship between carbohydrate and fat consumption echoes the established logic of “low-fat/ high-carbohydrate” or “high-fat/ low-carbohydrate” dietary strategies (Karam et al. 2008). Medical studies raise concerns about patients at risk for heart disease that, when put on a high-carbohydrate diet, run the risk of limiting consumption of healthful fats and cholesterol (Taubes 2007, Feinman and Volek 2008, Karam et al. 2008). Baring disputes about the healthfulness of one diet hypothesis over another, limiting fat consumption is achievable by increasing carbohydrate consumption, and vice-versa. The hunter-gatherer macronutrient relationships also agree with this finding as groups subsisting on greater than 50% vegetation obtain less fat through decreased animal food consumption while heavy meat eaters gain most of their calories from fat and protein and markedly little from carbohydrates (Cordain et al. 2000).

There were many aspects of this study that were prone to error, some of it may have been preventable, and some of it was unavoidable, as is the nature of any survey based data collection. Due to time and funding constraints, the survey used a 24 hour recall basis for all data the subjects provided. This means that the survey prompted the subjects to answer each question only for the past 24 hours except where specified to discuss lifestyle patterns on a weekly, monthly or yearly basis. Most importantly, diet recall and activity patterns were recorded only for the prior 24 hours. A more accurate approach would have been to record diet and activity for a 72 hour period, consisting of two weekdays and one weekend day and then average the values to give a 24 hour equivalent. However, it was believed that fewer subjects would participate in a multiple day projected study versus a single day recall study without monetary compensation. Furthermore, a 72-hour self-conducted recall would be very susceptible to subject error and was also not preferred to the 24-hour self-conducted recall. If I were to repeat this study, I would allot time and funding to do a 72-hour projected study where subjects keep a daily log of both diet and activity patterns. Activity levels averaged over a 72-hour period may actually be lower and closer to the expected values for a modern Western society. Exercise patterns vary daily and over a longer time period, the subject is more likely to include a “rest-day.” Diets also change depending on whether one observes a weekend or holiday as opposed to a work day. My study did not specify what day of the week subjects needed to conduct their recall, leading to inconsistent testing environments and a source for error.

All data extraction from the survey was done by hand and recorded per subject on a spreadsheet. To prevent recording error on the part of the investigator, the survey should ideally input the subject responses directly to a spreadsheet or the program to be used for analysis. For the dietary recall, the survey should also include a prompt for the subject to record serving sizes, brand names, restaurant and menu item names and product descriptions such as low fat, low sugar, multi-grain, whole grain, raw, cooked, and etc. Without such a prompt, the investigator has to infer too much information to make any kind of accurate observation.

The hunter-gatherer macronutrient model, while effective for comparison studies, may not have been the best method for an evolutionary based analysis of modern Western diets. There is no such strict diet specialization in any population as the model presumes, and perhaps there is no one macronutrient composition that is biologically inherent to humans, especially not for a single day (Lee and Daly 1999, Ströhle et al. 2009). Over more extended time periods, certain populations may manifest different averages than other populations, which is really the heart of the message in current Paleolithic dietary reviews. Westernized populations as a whole eat more refined carbohydrates, less fiber, and less protein than most of the remaining indigenous groups (Cordain et al. 2005, Lustig 2006, Taubes 2007).

This study represents a preliminary analysis on the diets of an athletic and non-athletic Westernized subsample population. The current results reflect only a portion of the data collected, and future work should be done to implement the remaining data for more accurate and refined results. Of interest would be to further divide the subjects based on the following criteria: sports participants and activity generalists; dieters and non-dieters; age; level of competition; having received formal nutrition education or not; and socio-economic status.

The results of this study, while perhaps disappointing, were hardly unexpected. Validation of the survey methods, a more rigorous interview process for accurate dietary recall and longer recall duration would benefit a future continuation. While there is always the potential for improvements in the methodology, I believe that the scope of the study itself should be modified. The particular dietary choices are unsurprising in themselves, but why such choices continue in spite of nutritional awareness programs and research on human health could be a more enlightening approach. In particular, forays into the effects of differential diets on metabolism could elucidate the motivations for dietary behavior. My belief is that high glycemic load foods prevalent in the Western diet

(Jenkins et al. 2004, Lustig 2006) induces a perpetual state of insulin resistance and reduces glucose supply to the brain. The result is what Lustig (2006) describes as "obese starvation". The brain craves sugar, yet the presence of insulin shunts circulating blood sugar to the liver and adipose tissue (Taubes 2007, Andrews et al. 2008) rather than allowing the release of fatty acids from fat stores for energy (Keller et al. 2003). A more ethnographic approach to the carbohydrate consumption epidemic would be to analyze the impact of commercial marketing, education level, economic status, and food availability on consumer food choice.Were my results strictly impacted only by innate food choice? Is it even possible to separate subjective choice from biological preference? Such questions are difficult to answer, but are even more confounding in light of a media-controlled, westernized culture.

The lifestyle enjoyed by the majority of Westernized populations deviates in both activity levels and dietary patterns from modern hunter-gatherers and presumably Paleolithic humans (Eaton and Konner 1988, Cordain 2006). This study analyzed a subgroup of a Western population to determine whether high physical activity actually counter-acted the dietary cultural norm. However, high activity levels did not significantly alter the diets of athletic subjects as compared to their non-athletic counter parts. Nutritional education may explain the slightly increased protein consumption for the Health and Wellness subgroup. Regardless, mean protein percentages still did not meet the hunter-gatherer model requirements. I conclude that culture plays a potent role in the dietary decision-making of all humans, not only from social influence, but from the basic provisioning (or lack) of a large-scale food infrastructure. The ever growing body of information on human evolution may someday enlighten us with insights on human nutrition. What we will find is likely a spectrum of possible ideals in human nutrition, yet, the one consistent conclusion is that the more we rely on natural, wild, and sustainable foods, the healthier we make our environment and ourselves. Westernized populations around the world face a decreasing birth rate and increasing survival rate - an aging population (CIA 2009). Thus it is prudent that we look now to longevity rather than procreative productivity. Modern science and medicine, therefore, must work to not only help us live, but must also uphold the integrity of a healthy life into old age.

APPENDIX A

SURVEY CONSENT, INTRODUCTION, AND QUESTIONS

CONSENT

Macronutrient and Exercise Survey Consent Form
IRB Application 2009S7020
Thank you for accessing the Macronutrient and Exercise Survey.
You are about to participate in a research study to analyze the dietary composition and exercise regimen of westernized populations compared to modern hunter-gatherer indigenous populations. Research is conducted by Stephanie Schnorr (ss1696@txstate.edu), a graduate student in the Texas State University Anthropology Department.
The purpose of this study is to assess if and what differences exist between modern westernized lifestyles and those of Paleolithic humans living about 20 thousand years ago. You have been asked to participate and provide information about your eating habits and exercise patterns as a member of modern society and cultural practices. This live survey will be hosted by mrInterview through DimensionsNet from March 1 through March 15, 2009 at: http://survey.education.txstate.edu. The survey data from your responses will be deleted after two years in May 2011 and all data will be kept in the form of a spreadsheet on one computer with access granted to the project lead only.
This survey is split into three sections:
1. The first section will ask you about your exercise patterns. This should take approximately 10 minutes to complete.
2. The second section will ask you about your dietary intake. This

section is slightly more involved and may take approximately 30 minutes to complete.

3. The final section will ask you general questions about your height, weight, age, etc. and should take approximately 5 minutes to complete.

All information you provide is anonymous. Your participation is voluntary and greatly appreciated. There are no risks or benefits for your participation in this study and completing the survey.

Participants may withdraw from the study at any time without prejudice or jeopardy to their standing with the University and any other relevant organization/entity with which the participant is associated. Participants may also choose not to answer any question(s) for any reason.
Pertinent questions about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Jon Lasser (512-245-3413 – lasser@txstate.edu), or to Ms. Becky Northcut, Compliance Specialist (512-245-2102).
This project is self-funded and therefore, monetary compensation will not be provided upon completion of this survey. All results of the study are accessible to participants upon completion of the study. Requests may be directed to Stephanie Schnorr (ss1696@txstate.edu).
Please check the appropriate box to continue. Participants should print a copy of this consent form for his/her records.

☐ I fully understand the consent form and its contents and agree to participate in the Macronutrient and Exercise Survey and am at least 18 years of age.

☐ I do not wish to participate in the Macronutrient and Exercise Survey and/or am not at least 18 years of age.

Greetings and welcome to the Exercise and Dietary Patterns survey. This survey is designed to extract information from you about your daily exercise and dietary habits. All responses are voluntary and will remain anonymous throughout the course of this study. Your responses will not be used to determine your identity in any way. The answers you provide will be used to compare the exercise and dietary patterns of a westernized population with those of modern hunter gatherer and Paleolithic humans.
The structure of this survey includes 3 distinct question sections:
1. Fitness Information (approximately 10 minutes)
2. Dietary Intake (approximately 20 minutes)
3. Personal Information (approximately 3 minutes)
Time estimates may vary depending on your response.

I. FITNESS INFORMATION

This section asks you about specific information regarding your physical activity routines and habits. This section should take you approximately 10 minutes to complete.

SPONSOR

Are you a professional, sponsored, or fulltime paid athlete?

- ☐ Yes
- ☐ No

ARE_YOU_VIGOROUS

**Do you do any vigorous-intensity sports, fitness, recreational, or
work-related activities that cause large increases in breathing or
heart rate for at least 10 minutes continuously? e.g. running or basketball.**

- ☐ Yes
- ☐ No

HOW_MANY_DAYS_VIG

In a typical week, how many days do you do vigorous-intensity sports, fitness, recreational, or work-related activities?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7

HOW_MANY_HOURSVIG

How many hours do you spend doing vigorous-intensity sports, fitness, recreational, or work-related activities in a typical day?
(0 - 24)

WHAT_VIGACTIVITY

**What vigorous-intensity activities do you typically do each day or
week?**

MOD_INTENSITY

**Do you do any moderate-intensity sports, fitness, recreational, or
work-related activities that cause a small increase in breathing or
heart rate for at least 10 minutes continuously? E.g. brisk walking,**

bicycling or golf?

- ☐ Yes
- ☐ No

HOW_MANY_DAYS_MOD3

In a typical week, how many days do you do moderate-intensity sports, fitness, recreational, or work-related activities?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7

HOW_MANY_HOURSMOD

How many hours do you spend doing moderate-intensity sports, fitness, recreational, or work-related activities in a typical day?

(0 - 24)

WHAT_MOD_ACTIVITIES

What moderate-intensity activities do you typically do each day or week?

TYPICAL_ACTIVITY_HOURS

In a typical 24-hour period, list how many hours you devote to the following activities. Put a 0 if you do not devote time to any particular activity. Be sure to total 24 hours:

Hours (0 - 24)

Sleeping

Sitting at a desk/computer

Sitting in a car/other transports

Watching TV

HOW_MUCH_REGIMENTED

How much of your current daily physical activity comes from regimented exercise (planned exercise)?

- ☐ All of it
- ☐ Most of it
- ☐ About half
- ☐ Much less than half
- ☐ None at all

☐ Don't Know

DO_YOU_TRAIN

Do you currently train for any type of sports or activities?

☐ Yes

☐ No

WHAT_TRAINING

What sports do you train for?

SPORTS_COMPETED

Have you recently (in the past 2 years) competed in any type of sports?

☐ Yes

☐ No

WHAT_COMPETED

In what sport?

Other sedentary activities (e.g. reading)

Vigorous exercise (e.g. running)

Moderate exercise (e.g. brisk walking)

Light activity (e.g. cooking, laundry)

WHAT_LEVEL_COMPETE

At what level of competition?

DAYS_TRAIN

How many days per week did you train?

☐ 1

☐ 2

☐ 3

☐ 4

☐ 5

☐ 6

☐ 7

COACH_PT

Do you currently receive coaching or personal training?

☐ Yes

☐ No

HOW_MUCH_COACHPT

How many days per week do you receive coaching or personal training?

☐ 1

☐ 2

- ☐ 3
- ☐ 4
- ☐ 5
- ☐ 6
- ☐ 7

HOW_LONG_PT

How long have you maintained this arrangement? Enter number of days, months and years.

FITNESS_GOALS

What are the primary goals of your fitness regimen? Check all that apply.

- ☐ Improve physical appearance
- ☐ Lose weight
- ☐ Gain weight
- ☐ Maintain weight
- ☐ Improve physical fitness
- ☐ Promote health and longevity
- ☐ Other :

II. DIETARY INTAKE

The following questions ask about your food and beverage intake. This section will take approximately 20 minutes to complete. It is important that you carefully respond to the questions regarding what specific foods and portions you consumed.

WHAT_FOOD_GROUP

If you tend to eat more of only one food group as compared to others, what group is it?

- ☐ Breads, pasta, cereals
- ☐ Beans, lentils, tubers (potatoes)
- ☐ Fresh fruits and vegetables
- ☐ Meat: red meat, chicken, pork, seafood
- ☐ I do not consume one food group more than others

PAGE

FOOD_RECALL

Number (0 - 1000)

Days
Months
Years

Now I'm going to ask you about your meal choices from the previous day. Please recall everything with as much detail as

possible including brand names, cup sizes, ingredients and time of day. For help, use the sample Diet Record provided as a guide to formatting and thinking of your responses. When you have recalled everything you ate, select "Next" to continue the survey. You do not need to fill in every box, only continue to answer the prompts until you have recalled everything you ate.
What was the first thing you ate after you woke up?

NEXT1
After that, what was the next thing you ate?

NEXT2
After that, what was the next thing you ate?

NEXT3
After that, what was the next thing you ate?

NEXT4
After that, what was the next thing you ate?

NEXT5
After that, what was the next thing you ate?

NEXT6
After that, what was the next thing you ate?

NEXT7
After that, what was the next thing you ate?

NEXT8
After that, what was the next thing you ate?

NEXT9
After that, what was the next thing you ate?

LIQUID_CONSUME
Please list what liquids you consumed the previous day beginning
with when you first woke up. Include as much detail as possible
such as brand names, cup sizes, and time of day.

HOW_MUCH_FOOD
Was the amount of food that you ate in the last 24 hours:

☐ much more than usual

☐ somewhat more than usual

☐ usual

☐ somewhat less than usual

☐ much less than usual

WAS_FOOD_TYPICAL
Was the food you ate in the last 24 hours typical of an average day?

☐ Yes

☐ No

EXPLAIN_FOOD_CHOICE
If no, explain any particular events or food choices you made that
would not typically occur.

PAGE1

TYP_FOOD_RECALL

Now think about your average daily routine in terms of the typical foods you eat most days of the week.
For an average day, give examples of all the foods you typically eat during and between each meal. Include snacks and beverages. Think about everything you eat from the time you wake up until the time you go to sleep. When you have recalled everything you typically eat in a day, select "Next" to continue the survey.
What do you typically eat when you first wake up?

TYP1

What is the next thing you typically eat?

TYP2

What is the next thing you typically eat?

TYP3

What is the next thing you typically eat?

TYP4

What is the next thing you typically eat?

TYP5

What is the next thing you typically eat?

TYP6

What is the next thing you typically eat?

TYP7

What is the next thing you typically eat?

TYP8

What is the next thing you typically eat?

TYP9

What is the next thing you typically eat?

MEALS_EAT_OUT

How many meals per day do you eat out? These are prepared away from home at food stands, vending machines, restaurants,
fast-food places, etc. Think sequentially through your day from the moment you wake.
E.g. Starbucks mocha latte at 8am; Sushi roll with salmon at 12pm; etc.

DIET_RESTRICTION

Do you currently have any special dietary restrictions or requirements, e.g. vegetarian, vegan, lactose intolerance, gluten / wheat allergies, fasting etc.?

- ☐ Yes
- ☐ No

WHAT_RESTRICT

What dietary restrictions do you have?

CURRENT_DIAGNOSED

Are you currently diagnosed with any of the following?:

- ☐ Anemia
- ☐ High Cholesterol
- ☐ Bulimia
- ☐ Anorexia nervosa
- ☐ Other :
- ☐ None of the above

DO_YOU_DIET

Do you currently follow any particular published diet plan, e.g. Atkins, Zone, South Beach, etc.?

- ☐ Yes
- ☐ No

WHAT_DIET

What diet(s) do you follow?

FOOD_CRAVE

Do you ever experience food cravings?

- ☐ Yes
- ☐ No

WHEN_DO_CRAVE

When do you experience these cravings, e.g. at night, after exercise, etc.?

WHAT_CRAVE

What do you typically crave during these times?

READ_NUTRITION

Do you ever research or read about nutrition and/or recommended dietary choices?

- ☐ Yes
- ☐ No

HOW_MANY_CAL

How many calories do you think you ate yesterday?

- ☐ <500
- ☐ 500 – 1000
- ☐ 1000- 1500
- ☐ 1500- 2000
- ☐ 2000- 2500
- ☐ 2500- 3000
- ☐ >3000

AWARE_CAL

**To what extent are you aware of the number and type of calories
you eat?**

- ☐ always aware

- ☐ often aware
- ☐ somewhat aware
- ☐ rarely aware
- ☐ not aware

HOW_CONSCIOUS_EAT

To what extent do you consciously try to eat healthy foods?

- ☐ all the time
- ☐ often
- ☐ sometimes
- ☐ rarely
- ☐ not at all

VITAMINS

Do you take any vitamins or supplements?

- ☐ Yes
- ☐ No

WHAT_VITAMINS

If yes, please list what you take, include dosage and brand names if known.

III. PERSONAL INFORMATION

The following questions will ask you for basic information about your age, height, weight and habits as well as body size information. This section should take approximately 5 minutes to complete. You are almost done!

AGE

How old are you?
(1 - 100)

WHERE_BORN

Where were you born? (City, state, country)

WHERE_RESIDE

Where do you currently reside? (city, state, country)

RELIGION_CULTURE

Do you currently practice any religious or cultural activities that require particular dietary choices?

- ☐ Yes
- ☐ No

WHAT_RELIGION

What religious or cultural practices?

SEX

What is your sex?

☐ Male

☐ Female

PREGNANT

Are you currently pregnant?

☐ Yes

☐ No

BREASTFEED

Are you breastfeeding?

☐ Yes

☐ No

HEIGHT

What is your height (feet, inches)?

WEIGHT

What is your weight (lbs)?

(50 - 400)

DO_YOU_SMOKE

Have you ever smoked, chewed or otherwise used tobacco?

☐ Yes

☐ No

WHAT_TOBACCO

Do you currently (check all that apply):

☐ Smoke cigarettes

☐ Smoke cigars

☐ Smoke a pipe

☐ Inhale snuff

☐ Chew tobacco?

☐ Do not currently use tobacco

ALCOHOL

Do you drink alcohol?

☐ Yes

☐ No

HOW_MANY_ALCOHOL

How many alcoholic drinks per week?
1 drink = standard 1oz shot of straight spirits, or = 1 small glass
of wine, or = 1 12oz can of beer

(0 - 100)

Answer the following questions to the best of your ability.

BONE_STRUCTURE

What is your bone structure?

☐ Very large,

- ☐ Large to medium
- ☐ Medium to small
- ☐ Small to frail
- ☐ Don't know

CIRCLE_WRIST

If you encircle your wrist with your other hand's middle finger and thumb:

- ☐ Middle finger and thumb do not touch
- ☐ Middle finger and thumb just touch
- ☐ Middle finger and thumb overlap

BODYTREND

Your body generally tends towards:

- ☐ Being overweight
- ☐ Maintaining weight
- ☐ Being underweight

BODYSHAPE

How would you best describe your body shape? Check all that apply.

- ☐ Overweight and generally round shaped
- ☐ Holds weight above the waist (in the torso)
- ☐ Holds weight below the waist (hips, legs & buttocks)
- ☐ Solid and stocky but not fat
- ☐ Lean with muscle tone
- ☐ Lean without muscle tone
- ☐ Very thin

CHILDWEIGHT

As a child between 5 and 7 years, were you:

- ☐ Overweight
- ☐ Normal
- ☐ Underweight
- ☐ Don't know

BODYFAT

What is your body-fat percentage?
Estimates for reference:
Men: thin/athletic = 0-10%, average = 11-18%, overweight = >19%
Women: very thin/athletic = 14-18%, average = 19-25%, overweight = >26%

(0 - 100)

BLOODPRESSURE

What is your blood pressure (systolic over diastolic, mmHg)?

e.g= 120/80

HEARTRATE

What is your resting heart rate (beats per min)?
(20 - 255)

Thank you for participating in the Exercise and Dietary Patterns survey.

APPENDIX B

PAPER SURVEY USED IN PILOT STUDY

Macronutrient and Exercise Survey Consent Form

IRB Application 2009S7020

Thank you for accessing the Macronutrient and Exercise Survey. You are about to participate in a research study to analyze the dietary composition and exercise regimen of westernized populations compared to modern hunter-gatherer indigenous populations. Research is conducted by Stephanie Schnorr (ss1696@txstate.edu), a graduate student in the Texas State University Anthropology Department.

The purpose of this study is to assess if and what differences exist between modern westernized lifestyles and those of Paleolithic humans living about 20 thousand years ago. You have been asked to participate and provide information about your eating habits and exercise patterns as a member of modern society and cultural practices. This live survey will be hosted by mrInterview through DimensionsNet from March 1 through March 15, 2009 at: http://survey.education.txstate.edu. The survey data from your responses will be deleted after two years in May 2011 and all data will be kept in the form of a spreadsheet on one computer with access granted to the project lead only.

This survey is split into three sections:

1. The first section will ask you about your exercise patterns. This should take approximately 10 minutes to complete.

2. The second section will ask you about your dietary intake. This section is slightly more involved and may take approximately 30 minutes to complete.

3. The final section will ask you general questions about your height, weight, age, etc. and should take approximately 5 minutes to complete.

All information you provide is anonymous. Your participation is voluntary and greatly appreciated. There are no risks or benefits for your participation in this study and completing the survey.

Participants may withdraw from the study at any time without prejudice or jeopardy to their standing with the University and any other relevant organization/entity with which the participant is associated. Participants may also choose not to answer any question(s) for any reason.

Pertinent questions about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Jon Lasser (512-245-3413 – lasser@txstate.edu), or to Ms. Becky Northcut, Compliance Specialist (512-245-2102).

This project is self-funded and therefore, monetary compensation will not be provided upon completion of this survey. All results of the study are accessible to participants upon completion of the study. Requests may be directed to Stephanie Schnorr (ss1696@txstate.edu).

Please sign the appropriate line to continue. Participants should print a copy of this consent form for his/her records.

I fully understand the consent form and its contents and agree to participate in the Macronutrient and Exercise Survey and am at least 18 years of age.

____

I do not wish to participate in the Macronutrient and Exercise Survey and/or am not at least 18 years of age.

____

Macronutrient and Exercise Survey

*All information will remain anonymous

**Please answer in the spaces provided or circle the most appropriate answer

I. FITNESS INFORMATION

This section asks you about specific information regarding your physical activity routines and habits. This section should take you approximately 10 minutes to complete.

1. Are you a professional, sponsored, or fulltime paid athlete? (circle one)

Yes or No

2. Do you do any **vigorous-intensity** sports, fitness, recreational, or work-related activities that cause large increases in breathing or heart rate for at least 10 minutes continuously? e.g. running or basketball.

Yes or No (if no, skip to #6)

3. **IF YES:** In a typical week, how many days do you do **vigorous-intensity** sports, fitness, recreational, or work-related activities? (Answer 1-7 days)

____

4. How many hours do you spend doing **vigorous-intensity** sports, fitness, recreational, or work-related activities in a typical day? (Answer 1-24 hours)

____

5. What **vigorous-intensity** activities do you typically do each day or week? Please list all:

6. Do you do any **moderate-intensity** sports, fitness, recreational, or work-related activities that cause a small increase in breathing or heart rate for at least 10 minutes continuously? E.g. brisk walking, bicycling or golf?

Yes or No (if no, skip to #10)

7. **IF YES:** In a typical week, how many days do you do **moderate-intensity** sports, fitness, recreational, or work-related activities? (Answer 1-7 days)

____

8. How many hours do you spend doing **moderate-intensity** sports, fitness, recreational, or work-related activities in a typical day? (Answer 1-24 hours)

____

9. What **moderate-intensity** activities do you typically do each day or week? Please list all:

10. In a typical 24-hour period, list how many hours you devote to the following activities. Put a 0 if you do not devote time to any particular activity. Be sure to total 24 hours:

Sleeping: ______

Sitting at a desk/computer: ______

Sitting in a car/other transports: ______

Watching TV: ______

Other sedentary activities (e.g. reading): ______

Vigorous exercise (e.g. running): ______

Moderate exercise (e.g. brisk walking): ______

Light activity (e.g. cooking, laundry): ______

Total Hours:______ (must equal 24 hours)

11. How much of your current daily physical activity comes from regimented exercise, e.g. planned exercise? Check one.

_____ All of it

_____ Most of it

_____ About half

_____ Much less than half

_____ None at all

12. Do you currently train for any type of sports or activities?

Yes or No

IF YES: What sports do you train for (list all)?

13. Have you recently (in the past 2 years) competed in any type of sports?

Yes or No

IF YES: In what sport?

At what level of competition?

How many days per week did you train? (Answer 1-7)

____

14. Do you currently receive coaching or personal training?

Yes or No

IF YES:

How many days per week? (Answer 1-7)

____

How long have you maintained this arrangement (days/months/years)?

____

15. What are the primary goals of your fitness regimen? Check all that apply.

_____ Improve physical appearance

_____ Lose weight

_____ Gain weight

_____ Maintain weight

_____ Improve physical fitness

_____ Promote health and longevity

Other:___________________________

II. DIETARY INTAKE

The following questions ask about your food and beverage intake. This section will take approximately 20 minutes to complete. It is important that you carefully respond to the questions regarding what specific foods and portions you consumed.

1. If you tend to eat more of only **one** food group as compared to others, what group is it? Check one.

_____ Breads, pasta, cereals

_____ Beans, lentils, tubers (potatoes)

_____ Fresh fruits and vegetables

_____ Meat: red meat, chicken, pork, seafood

_____ I consume foods from all groups in equal portion

2. Now I'm going to ask you about your meal choices from the previous day. Please recall everything with as much detail as possible **including brand names, cup sizes, ingredients and time of day.** When you have recalled everything you ate, circle "finished" beside the last prompt you answered.

What was the first thing you ate after you woke up?

After that, what was the next thing you ate? FINISHED

After that, what was the next thing you ate? FINISHED

After that, what was the next thing you ate? FINISHED

After that, what was the next thing you ate? FINISHED

After that, what was the next thing you ate? FINISHED

After that, what was the next thing you ate? FINISHED

After that, what was the next thing you ate? FINISHED

3. Please list all liquids you consumed the previous day beginning with when you first woke up. Include as much detail as possible such as brand names, cup sizes, and time of day.

4. Was the amount of food that you ate in the last 24 hours (check one):

_____ much more than usual

_____ somewhat more than usual

_____ usual

_____ somewhat less than usual

_____ much less than usual?

5. Was the food you ate in the last 24 hours typical of an average day?

Yes or No

If no, explain any particular events or food choices you made that would not typically occur.

6. Now think about your average daily routine in terms of the typical foods you eat most days of the week.

For an average day, give examples of all the foods you typically eat during and between each meal. Include snacks and beverages. Think about everything you eat from the time you wake up until the time you go to sleep. When you have recalled everything you ate, circle “finished” beside the last prompt you answered.

What do you typically eat when you first wake up?

What is the next thing you typically eat? FINISHED

What is the next thing you typically eat? FINISHED

What is the next thing you typically eat? FINISHED

What is the next thing you typically eat? FINISHED

What is the next thing you typically eat? FINISHED

What is the next thing you typically eat? FINISHED

What is the next thing you typically eat? FINISHED

7. How many meals per day do you eat out? These are prepared away from home at food stands, vending machines, restaurants, fast-food places, etc. Think through your day beginning from the time you wake up.

E.g. Starbucks mocha latte at 8am; Sushi roll with salmon at 12pm; etc.

8. Do you currently have any special dietary restrictions or requirements, e.g. vegetarian, vegan, lactose intolerance, gluten/wheat allergies, fasting etc.?

Yes or No

IF YES: what are your restrictions (please list)?

9. Are you currently diagnosed with any of the following? Check all that apply:

_____ Anemia

_____ High Cholesterol

_____ Bulimia

_____ Anorexia nervosa

Other:_________________

10. Do you currently follow any particular published diet plan, *e.g. Atkins, Zone, South Beach, etc.?*

Yes or No

IF YES: What diet(s) do you follow?

11. Do you ever experience food cravings?

Yes or No

IF YES: when do you experience these cravings, *e.g. at night, after exercise, etc.*?

What do you typically crave during these times?

Do you act on your cravings and eat what you crave?

Yes or No

12. Do you ever research or read about nutrition and/or recommended dietary choices?

Yes or No

13. How many calories do you think you ate yesterday? Check one:

_____ <500

_____ 500 – 1000

_____ 1000- 1500

_____ 1500- 2000

_____ 2000- 2500

_____ 2500- 3000

_____ >3000

14. To what extent are you aware of the number and type of calories you eat? Check one.

_____ always aware

_____ often aware

_____ somewhat aware

_____ rarely aware

_____ not aware

15. To what extent do you consciously try to eat healthy foods? Check one:

_____ all the time

_____ often

_____ sometimes

_____ rarely

_____ not at all

16. Do you take any vitamins or supplements?

Yes or No

IF YES: please list what you take, include dosage and brand names if known.

III. PERSONAL INFORMATION

The following questions will ask you for basic information about your age, height, weight and habits as well as body size information. This section should take approximately 5 minutes to complete. You are almost done!

1. Age: _______

2. Where were you born? (City, state, country)

3. Where do you currently reside?

4. Do you currently practice any religious or cultural activities that require particular dietary choices?

Yes or No

IF YES: what are they?

5. Sex: **M or F** (circle one)

If F, are you currently pregnant?

Yes or No

Are you breastfeeding?

Yes or No

6. Height (feet, inches)?

7. Weight (lbs)?

8. Have you ever smoked, chewed or otherwise used tobacco?

Yes or No

IF YES: do you currently… (check all that apply):

_____ Smoke cigarettes

_____ Smoke cigars

_____ Smoke a pipe

_____ Inhale snuff

_____ Chew tobacco?

9. Do you drink alcohol?

Yes or No

IF YES: how many alcoholic drinks per week?

1 drink= standard 1oz shot of straight spirits, or

= 1 small glass of wine, or

= 1 12oz can of beer

____

Answer the following questions to the best of your ability:

10. What is your bone structure? (choose one)

_____ Very large

_____ large to medium

_____ medium to small

_____ small to frail

_____ don’t know

11. If you encircle your wrist with your other hand’s middle finger and thumb… (choose one)

_____ Middle finger and thumb do not touch

_____ Middle finger and thumb just touch

_____ Middle finger and thumb overlap

12. Your body generally tends towards (choose one):

_____ Being overweight

_____ Maintaining weight

_____ Being underweight

13. How would you best describe your body shape? (choose all that apply)

_____ Overweight and generally round shaped

_____ Holds weight above the waist (in the torso)

_____ Holds weight below the waist (hips & legs)

_____ Solid and stocky but not fat

_____ Lean with muscle tone

_____ Lean without muscle tone

_____ Very thin

14. As a child between 5 and 7 years, were you:

_____ Overweight

_____ Normal

_____ Underweight

_____ Don’t know

15. What is your body-fat percentage?

Men: *thin/athletic=0-10%, average=11-18%, overweight= >19%*

Women: *very thin/athletic=14-18%, average=19-25%, overweight= >26%*

_____ %

_____ Don’t know

How do you know your body-fat percentage?

16. What is your blood pressure? (systolic over diastolic, mmHg) *e.g= 120/80*

____/____

_____ Don’t know

17. What is your resting heart rate (beats per min)?

_____ beats/min

_____ Don’t know

APPENDIX C

RECORD OF ASSUMPTIONS APPLIED TO INCONSISTENCIES DURING DIETARY ANALYSIS

1. Where no serving size or quantity indicated, serving size of food product used defaulted to 1(can, slice, cup, single serving, or indicated portion) where applicable.

2. Lunch meats and cheeses: when not specified, given a quantity of 2 slices of meat and/or 1 slice of cheese.

3. When a food item from a particular restaurant does not exist in The Food Processor database, the closest combination of ingredients or a matching food item listed with the USDA or similar restaurant chain is used.

4. Alcohol consumed is not included because the type of alcohol is not uniformly specified within a given drink, only number and type of drinks consumed.

5. All other non-alcoholic beverages are included with the diet analysis

6. When available, using online menu's and product website resources for specific food products not explicitly listed in the database.

7. Multiple ingredient foods such as "protein smoothie" that are not in database: used online listed nutrition facts for 1 serving size of specified dry powder.

8. Single entries describing only the type of food such as "Chinese food" or location of acquired food such as "Taco Bell" resulted in complete omission of all subject data.

9. For "sandwich" entries with no further description, I applied a generic sandwich construct to all necessary subjects: 2 slices of turkey breast lunchmeat, 1 slice Swiss cheese, 2 slices multigrain bread, 1 gram lettuce.

10. For "cereal" entries with no further description, I applied a generic cereal construct to all necessary subjects: 1 cup Corn Flakes brand, 1 cup 1% cow milk.

APPENDIX D

MOST COMMONLY CONSUMED FOODS

<u>Athletic</u> <u>Non-Athletic</u>

Breakfast

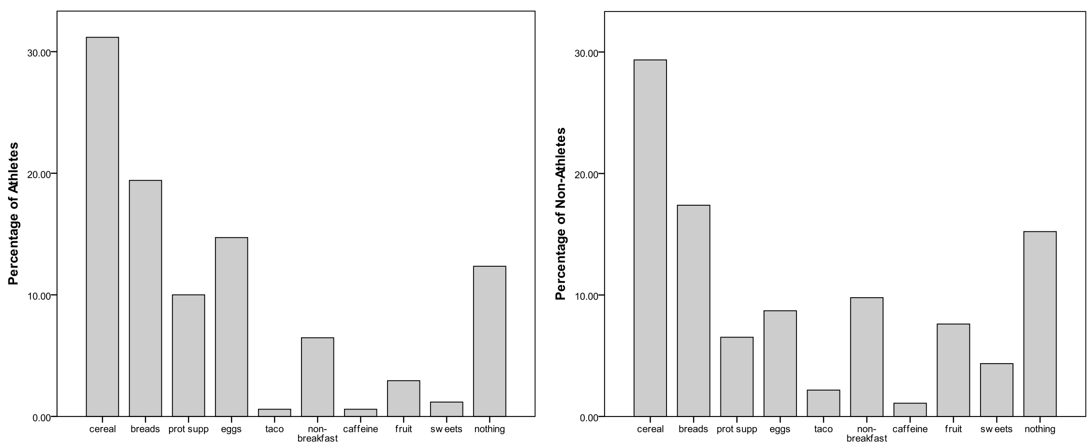

Figure 8. Breakfast food items most commonly consumed by survey participants. Categories were created based on typical breakfast items such as cereal, breads, eggs, fruit, and caffeine. The nature of survey responses dictated the last remaining categories: protein supplement (prot supp), taco, non-breakfast food item, sweets, and nothing. Non-breakfast food items were meals or food items not typically associated with breakfast food items. Categories listed pertain to a broader classification of many different food items than those specifically classified in the figure. In particular, cereal included all cold and hot breakfast cereals as well as granola bars, cereal bars, granola, and any cereal grain based products not classified as bread. Breads included toast, bagels, pastries, strudels, rolls, kolaches, croissants, pancakes, and waffles. Protein supplement included protein bars, shakes, powders, milks, or yogurt. Sweets included candies or confectionary items, and fruit pertained to both whole fruits and fruit juice.

Lunch

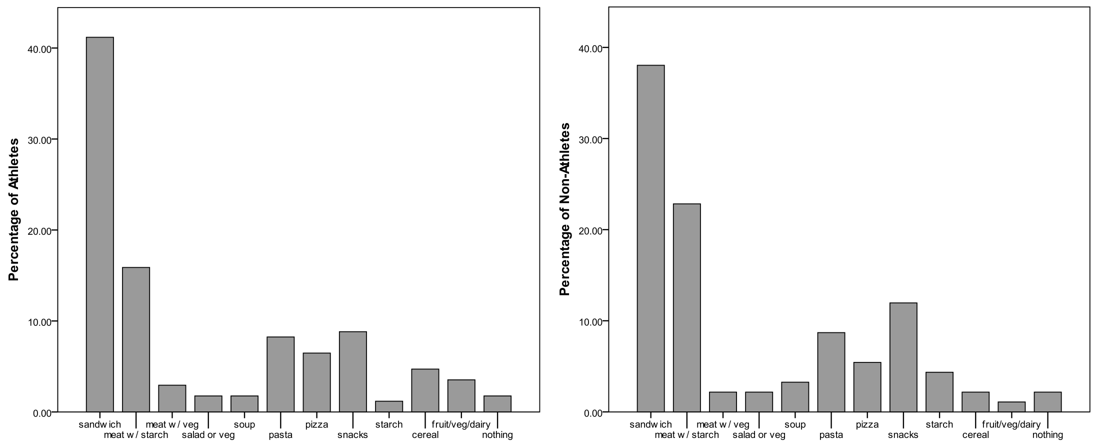

Figure 9. Lunch foods most commonly listed by survey participants for both athletic and non-athletic subjects. Foods were categorized using the same method as for breakfast food items. The most prevalent lunch food items were listed, and remaining categories were created after an initial assessment of the entire response set. Categories also included a broader menu of foods than is depicted by the category name alone. For instance, “sandwich” included burgers, wraps, pitas, tacos, or most any other food “sandwiched” by a bread item. Meat dishes were classified by whether they contained predominantly starch or vegetable sides. Snacks included most packaged, refined, immediately consumable foods with no preparation required. The starch category were meals consisting solely of a starch food such as baked potatoes, rice, corn, or beans.

Dinner

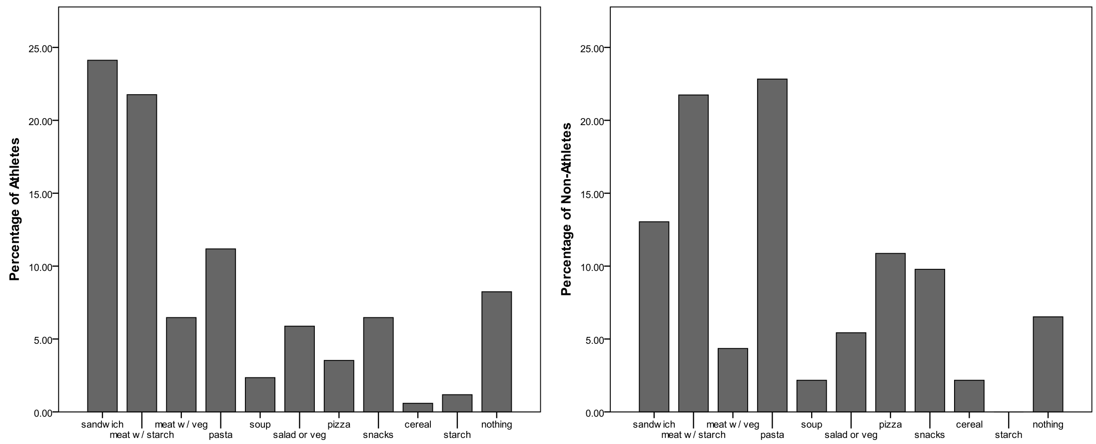

Figure 10. Dinner foods most commonly reported on survey participants' food recalls. Foods were categorized using the same method as for the breakfast and lunch food items. The most prevalent dinner food items were listed, and remaining categories were created after an initial assessment of the entire response set. Categories also included a broader menu of foods than is depicted by the category name alone. Most of the categories are identical to the lunch categories and included the same broad categorization of non-specific food items

APPENDIX E

HEALTH AND WELLNESS GROUP DATA

Physical activity data set: pg. 111 – 115
Dietary data set: pg. 116 - 119

Subject	Respondent ID	Sex	Age	Height (inches)	Height (m)	Weight (lbs)	Weight (kg)	Body Fat (%)	subj. assesment	BMI	RMR (kcal/min)	Vigorous (hrs)	kcal vig	Moderate (hrs)	kcal mod	Light (hrs)	kcal light	Rest (hrs)	kcal rest	TEE (kcal)	TEE/RMR
1	1099	M	21	73	1.85	168	76.104	7		22.16	1.32	2	1223.97	3	1265.17	3	523.15	16	1572.49	4584.78	2.41
2	1021	F	21	66	1.68	140	63.42	20		22.59	1.02	2	1010.85	1	346.87	1	140.76	20	1546.78	3045.26	2.06
3	1115	F	21	62	1.57	108	48.924	22		19.75	0.81	0	0.00	2	537.55	2	219.55	20	1217.00	1974.10	1.69
4	1101	M	21	74	1.88	190	86.07	19		24.39	1.34	2	1365.69	1	467.67	1	187.94	20	2037.45	4058.76	2.10
5	1058	F	22	64.5	1.64	138	62.514	22		23.32	0.99	1	497.19	2	681.81	1	137.74	20	1504.46	2821.20	1.97
6	1045	F	20	64	1.63	168	76.104	26		28.83	1.14	1	600.98	1	410.72	2	326.77	20	1745.59	3084.06	1.88
7	1004	M	30	71	1.80	215	97.395	18		29.98	1.50	1	771.85	1	528.36	1	211.82	21	2403.01	3915.03	1.81
8	1073	F	21	65	1.65	123	55.719	22		20.47	0.90	3	1332.42	2	609.68	3	371.27	16	1088.58	3401.95	2.62
9	1015	F	21	65	1.65	112	50.736	20	Average	18.64	0.85	2	812.78	2	559.10	2	229.32	18	1150.64	2751.85	2.24
10	1026	F	23	67	1.70	190	86.07	25	Plump	29.75	1.28	1	679.37	1	464.20	2	368.94	20	1967.97	3480.48	1.89
11	1044	M	25	67	1.70	148	67.044	10	Average	23.18	1.17	1	539.51	1	371.90	3	462.02	19	1652.27	3025.70	1.80
12	1023	F	21	66	1.68	170	77.01	24		27.44	1.17	1	609.21	1	416.69	2	332.81	20	1787.92	3146.63	1.87
13	1107	M	21	71	1.80	187	84.711	15.3		26.08	1.36	2	1348.75	1	462.60	2	374.58	19	1948.98	4134.91	2.12
14	1053	F	23	65	1.65	145	65.685	22		24.13	1.04	0	0.00	1	357.74	3	432.78	20	1571.53	2362.05	1.58
15	1095	F	21	73	1.85	200	90.6	25		26.38	1.34	0	0.00	3	1464.72	4	775.16	17	1754.22	3994.10	2.07
16	1057	M	22	70	1.78	175	79.275	15		25.11	1.29	1	632.11	3	1301.76	2	352.55	18	1746.04	4032.47	2.18
17	1122	F	22	67	1.70	150	67.95	23		23.49	1.06	1	539.06	2	738.36	4	593.37	17	1366.68	3237.47	2.13
18	1029	F	21	63	1.60	120	54.36	18		21.25	0.92	1	435.85	1	299.95	2	246.55	20	1378.30	2360.64	1.78
19	1050	F	22	64	1.63	115	52.095	20	Average	19.74	0.87	1	417.00	2	573.53	3	352.37	18	1176.51	2519.41	2.01
20	1106	F	21	64	1.63	117	53.001	19		20.08	0.89	0	0.00	1	292.15	3	359.70	20	1337.98	1989.83	1.55
21	1051	F	29	62	1.57	105	47.56	17		19.	0.84	1	383.3	2	528.9	3	329.6	18	1121.	2363.	1.95

							5			20			7		2		2		54	45	
22	1005	F	23	64	1.63	128	57.984	21		21.97	0.94	1	462.40	2	634.89	1	128.99	20	1420.22	2646.50	1.95
23	1018	M	22	71	1.80	160	72.48	10		22.31	1.24	1	581.95	1	400.75	2	330.38	20	1854.22	3167.30	1.77
24	1039	F	21	62	1.57	110	49.83	19		20.12	0.85	0	0.00	1	275.32	2	226.75	21	1334.45	1836.52	1.50
25	1092	F	19	60	1.52	98	44.394	19		19.14	0.78	1	357.46	2	492.94	1	102.19	20	1155.92	2108.51	1.88
26	1087	F	22	67	1.70	150	67.95	23		23.49	1.06	1	539.06	1	369.18	2	296.69	20	1607.86	2812.78	1.85
27	1124	F	20	66	1.68	132	59.796	19		21.30	0.99	0	0.00	1	328.22	2	267.76	21	1555.79	2151.77	1.52
28	1116	M	24	71	1.80	175	79.275	10	Average	24.40	1.33	2	1270.01	3	1310.45	3	537.52	16	1598.36	4716.33	2.45
29	1111	F	21	69	1.75	140	63.42	18		20.67	1.04	0	0.00	2	696.06	1	141.92	21	1648.44	2486.42	1.65
30	1009	F	21	63	1.60	140	63.42	19		24.80	1.03	1	506.00	2	694.91	11	1554.72	10	779.18	3534.81	2.37
31	1024	M	23	74	1.88	270	122.31	12		34.66	1.89	2	1939.69	2	1328.14	2	533.13	18	2596.56	6397.51	2.34
32	1077	M	22	70	1.78	205	92.865	21.9		29.41	1.40	1	734.22	1	502.06	3	600.73	19	2040.22	3877.23	1.92
33	1117	M	23	75	1.91	205	92.865	14		25.62	1.48	0	0.00	0	0.00	4	819.28	20	2239.08	3058.36	1.44
34	1125	M	23	76	1.93	235	106.455	32		28.60	1.49	3	2503.43	1	568.34	1	222.36	19	2202.19	5496.32	2.56
35	1066	F	20	59	1.50	111	50.283	16		22.42	0.89	1	405.17	1	279.46	1	116.04	21	1380.99	2181.67	1.71
36	1067	F	21	64	1.63	135	61.155	29		23.17	0.91	0	0.00	1	329.64	2	261.78	21	1464.38	2055.80	1.57
37	1063	F	21	66	1.68	235	106.455	30	Fat	37.93	1.51	0	0.00	2	1138.99	2	447.04	20	2341.26	3927.28	1.81
38	1075	F	22	63	1.60	147	66.591	26		26.04	1.01	1	526.71	2	720.46	4	575.24	17	1312.72	3135.12	2.16
39	1129	M	31	71	1.80	215	97.395	25		29.98	1.43	1	767.79	1	524.30	2	415.54	20	2207.52	3915.16	1.90
40	1084	F	21	67.5	1.71	155	70.215	23		23.92	1.09	1	556.74	1	381.20	2	306.01	20	1655.77	2899.72	1.85
41	1060	M	21	75	1.91	165	74.745	21		20.62	1.17	1	593.27	1	406.40	1	163.48	21	1863.48	3026.64	1.80
42	1130	M	25	72	1.83	190	86.07	15	Plump	25.77	1.38	0	0.00	4	1879.94	4	761.03	16	1667.02	4308.00	2.17
43	1019	M	22	68.75	1.75	162	73.386	10		24.09	1.26	1	589.02	2	811.12	3	501.17	18	1686.04	3587.35	1.98

44	1098	F	21	64	1.63	120	54.36	20	Average	20.60	0.90	0	0.00	2	597.57	10	1221.17	12	813.09	2631.83	2.02
45	1012	F	21	61	1.55	125	56.625	23		23.62	0.90	0	0.00	0	0.00	3	375.12	21	1436.73	1811.85	1.39
46	1003	M	23	73	1.85	155	70.215	8		20.45	1.23	1	565.42	1	389.89	3	485.07	19	1737.99	3178.37	1.79
47	1025	M	22	73	1.85	283	128.199	21		37.33	1.89	1	1010.61	2	1380.23	3	820.41	18	2614.86	5826.12	2.14
48	1112	F	22	65	1.65	120	54.36	18		19.97	0.92	1	435.85	1	299.95	2	246.55	20	1378.30	2360.64	1.78
49	1071	F	22	65	1.65	150	67.95	20	Average	24.96	1.09	1	540.79	4	1483.67	6	900.48	13	1067.69	3992.63	2.55
50	1132	M	19	69	1.75	235	106.455	19		34.70	1.61	2	1684.01	2	1151.73	4	919.55	16	1974.91	5730.19	2.47
51	1085	M	21	70	1.78	180	81.54	22		25.82	1.25	2	1291.48	2	883.78	2	353.77	18	1716.20	4245.23	2.36
52	1119	M	22	70	1.78	195	88.335	18		27.98	1.38	1	701.11	2	960.54	2	386.36	19	1992.09	4040.11	2.03
53	1123	M	26	72	1.83	190	86.07	15		25.77	1.38	1	685.16	1	469.99	4	761.03	18	1875.40	3791.58	1.91
54	1017	M	34	67	1.70	220	99.66	23		34.45	1.48	2	1573.27	1	537.48	1	213.59	20	2278.59	4602.93	2.15
55	1038	M	22	71	1.80	215	97.395	13		29.98	1.55	3	2324.22	4	2125.01	1	214.72	16	1877.18	6541.13	2.93
56	1131	F	22	63	1.60	140	63.42	24		24.80	0.99	1	503.11	1	344.56	2	276.89	20	1500.46	2625.01	1.85
57	1110	F	21	64	1.63	140	63.42	23		24.03	1.00	0	0.00	0	0.00	3	417.07	21	1587.64	2004.71	1.40
58	1096	F	22	69	1.75	155	70.215	21		22.89	1.11	2	1115.80	1	382.36	1	154.16	20	1678.93	3331.24	2.09
59	1126	F	28	65	1.65	153	69.309	26		25.46	1.05	0	0.00	1	374.66	1	149.40	22	1762.05	2286.11	1.52
60	1008	F	28	66	1.68	137	62.061	21		22.11	1.00	1	494.23	1	339.08	4	549.53	18	1355.81	2738.66	1.91
61	1086	M	26	68	1.73	215	97.395	20	Fat	32.69	1.48	0	0.00	1	527.20	1	210.67	22	2491.96	3229.83	1.51
62	1016	F	22	59	1.50	105	47.565	19		21.21	0.82	2	764.43	1	263.30	1	108.71	20	1222.99	2359.44	2.00
63	1065	F	23	67	1.70	160	72.48	24		25.06	1.11	1	573.84	2	785.29	2	314.17	19	1607.49	3280.80	2.06
64	1027	F	23	68.5	1.74	140	63.42	15		20.98	1.07	1	508.32	2	699.54	5	718.27	16	1283.74	3209.87	2.08
65	1105	F	21	64	1.63	120	54.36	23		20.60	0.87	1	432.95	2	594.10	3	361.14	18	1188.36	2576.55	2.05
66	1011	M	21	70	1.78	195	88.33	18		27.	1.38	1	701.1	0	0.00	2	386.3	21	2201.	3289.	1.66

							5			98			1				6		79	26	
67	1081	M	21	71	1.80	175	79.275	23		24.40	1.21	1	627.48	1	429.29	3	514.94	19	1755.03	3326.74	1.91
68	1040	F	22	67	1.70	120	54.36	20	Average	18.79	0.90	1	434.69	1	298.79	1	122.12	21	1422.90	2278.49	1.75
69	1047	M	22	72	1.83	203	91.959	15	Plump	27.53	1.46	1	731.14	4	2004.97	1	202.38	18	1987.50	4925.99	2.35
70	1030	M	23	67	1.70	153	69.309	16		23.96	1.14	1	553.72	2	760.89	2	310.38	19	1631.78	3256.78	1.98
71	1049	M	30	70	1.78	225	101.925	23		32.28	1.51	2	1608.64	1	549.51	4	873.00	17	1977.52	5008.67	2.30
72	1076	F	23	60	1.52	128	57.984	26		25.00	0.89	1	459.51	2	629.10	4	504.40	17	1157.97	2750.97	2.14
73	1133	F	20	63	1.60	96	43.488	15	Thin	17.00	0.80	0	0.00	2	487.96	0	0.00	22	1301.39	1789.34	1.54
74	1037	M	22	70	1.78	177	80.181	18		25.39	1.27	1	637.45	1	436.99	3	529.21	19	1828.25	3431.90	1.88
75	1001	M	22	71	1.80	225	101.925	23		31.38	1.51	0	0.00	0	0.00	1	218.25	23	2675.47	2893.72	1.33
76	1113	F	22	66	1.68	140	63.42	17		22.59	1.05	2	1014.32	3	1045.83	1	142.50	18	1423.37	3626.02	2.39
77	1048	F	21	66	1.68	133	60.249	18		21.46	1.00	1	481.82	1	331.20	1	135.39	21	1578.01	2526.43	1.75
78	1054	F	20	63	1.60	130	58.89	18		23.03	0.98	2	942.43	4	1295.95	1	132.60	17	1253.00	3623.98	2.56
79	1118	M	22	78	1.98	200	90.6	17		23.11	1.42	1	719.37	1	492.87	3	595.26	19	2048.61	3856.12	1.89
80	1097	F	22	64	1.63	140	63.42	23		24.03	1.00	1	503.69	1	345.14	12	1668.26	10	756.02	3273.11	2.28
81	1079	M	22	76	1.93	228	103.284	16		27.75	1.60	2	1637.96	1	560.77	2	450.20	19	2314.49	4963.42	2.15
82	1055	M	21	72	1.83	178	80.634	10		24.14	1.35	1	645.61	1	444.03	9	1637.72	13	1317.35	4044.71	2.08
83	1069	F	24	61	1.55	127	57.531	22		23.99	0.93	0	0.00	2	628.92	3	382.45	19	1329.10	2340.47	1.75
84	1036	F	22	67	1.70	138	62.514	23		21.61	0.98	1	496.61	4	1361.31	3	411.47	16	1194.30	3463.70	2.45
85	1080	M	22	70	1.78	185	83.805	18		26.54	1.32	1	665.74	1	456.23	1	183.86	21	2101.18	3407.01	1.79
86	1104	M	27	76	1.93	172	77.916	15		20.93	1.27	1	621.50	1	426.71	2	346.96	20	1911.30	3306.47	1.81
87	1090	M	25	71	1.80	240	108.72	20		33.47	1.63	1	859.11	1	587.31	1	233.97	21	2630.21	4310.60	1.83
88	1013	M	22	70	1.78	200	90.6	15	Plump	28.69	1.44	2	1441.06	2	988.06	2	399.16	18	1961.63	4789.91	2.31

89	1002	F	22	66	1.68	165	74.745	24		26.63	1.14	1	591.53	2	809.33	1	161.75	20	1740.01	3302.61	2.01
90	1078	F	21	70	1.78	148	67.044	21		21.23	1.06	2	1066.28	6	2193.18	2	295.27	14	1128.30	4683.03	3.06
91	1061	M	22	67	1.70	165	74.745	15	Plump	25.84	1.23	3	1790.22	1	409.88	4	667.83	16	1475.38	4343.30	2.46
92	1109	F	22	62	1.57	124	56.172	16		22.68	0.97	0	0.00	1	310.72	2	256.32	21	1511.78	2078.82	1.49
93	1070	M	23	75	1.91	220	99.66	15		27.50	1.56	0	0.00	2	1084.23	8	1745.77	14	1659.86	4489.86	2.00
94	1089	F	22	69	1.75	142	64.326	21		20.97	1.03	0	0.00	3	1053.31	2	284.09	19	1476.65	2814.04	1.90
95	1091	F	22	70	1.78	205	92.865	29		29.41	1.33	2	1460.22	2	995.89	1	196.13	19	1962.11	4614.35	2.40
96	1007	M	23	69	1.75	170	77.01	18		25.10	1.23	1	612.69	2	840.32	4	679.52	17	1578.79	3711.32	2.10
97	1028	M	22	70	1.78	189	85.617	10		27.12	1.42	1	684.52	2	940.95	8	1537.77	13	1385.86	4549.10	2.22

Subject	Respondent ID	Fat (g)	Fat (cal)	Carb (g)	Carb (cal)	Protein (g)	Protein (cal)	Total Cal	% Fat	% Carb	% Protein	Typical? (Y/N)
1	1099	132.25	1190.25	381.01	1524.04	76.81	307.24	3021.53	39.39%	50.44%	10.17%	Y
2	1021	26.97	242.73	93.02	372.08	14.83	59.32	674.13	36.01%	55.19%	8.80%	N
3	1115	58.98	530.82	297.89	1191.56	68.07	272.28	1994.66	26.61%	59.74%	13.65%	Y
4	1101	90.64	815.76	394.64	1578.56	126.65	506.6	2900.92	28.12%	54.42%	17.46%	Y
5	1058	58.77	528.93	145.15	580.6	54.26	217.04	1326.57	39.87%	43.77%	16.36%	N
6	1045	10.79	97.11	81.64	326.56	34.07	136.28	559.95	17.34%	58.32%	24.34%	Y
7	1004	44.89	404.01	252.45	1009.8	77.29	309.16	1722.97	23.45%	58.61%	17.94%	Y
8	1073	80.93	728.37	228.32	913.28	73.67	294.68	1936.33	37.62%	47.17%	15.22%	Y
9	1015	85.19	766.71	233.6	934.4	53.2	212.8	1913.91	40.06%	48.82%	11.12%	Y
10	1026	27.15	244.35	166.68	666.72	108.03	432.12	1343.19	18.19%	49.64%	32.17%	Y
11	1044	85.63	770.67	312.18	1248.72	136.88	547.52	2566.91	30.02%	48.65%	21.33%	Y
12	1023	24.58	221.22	127.62	510.48	36.24	144.96	876.66	25.23%	58.23%	16.54%	Y
13	1107	54.31	488.79	132.48	529.92	24.85	99.4	1118.11	43.72%	47.39%	8.89%	Y
14	1053	43.51	391.59	188.02	752.08	109.69	438.76	1582.43	24.75%	47.53%	27.73%	Y
15	1095	27.16	244.44	141.59	566.36	65.53	262.12	1072.92	22.78%	52.79%	24.43%	Y
16	1057	77.49	697.41	230.63	922.52	47.62	190.48	1810.41	38.52%	50.96%	10.52%	Y
17	1122	34.92	314.28	187.66	750.64	57.42	229.68	1294.6	24.28%	57.98%	17.74%	Y
18	1029	31.67	285.03	180.48	721.92	108.85	435.4	1442.35	19.76%	50.05%	30.19%	Y
19	1050	62.01	558.09	159.53	638.12	92.43	369.72	1565.93	35.64%	40.75%	23.61%	Y
20	1106	248.55	2236.95	474.71	1898.84	97.24	388.96	4524.75	49.44%	41.97%	8.60%	N
21	1051	53.34	480.06	175.36	701.44	102.45	409.8	1591.3	30.17%	44.08%	25.75%	Y
22	1005	76.63	689.67	211.59	846.36	141.6	566.4	2102.43	32.80%	40.26%	26.94%	Y
23	1018	82.24	740.16	313.84	1255.36	93.69	374.76	2370.28	31.23%	52.96%	15.81%	N
24	1039	62.71	564.39	234.64	938.56	62.78	251.12	1754.07	32.18%	53.51%	14.32%	Y
25	1092	84.37	759.33	328.96	1315.84	55.41	221.64	2296.81	33.06%	57.29%	9.65%	Y
26	1087	30.01	270.09	206.33	825.32	68.2	272.8	1368.21	19.74%	60.32%	19.94%	Y

27	1124	89.39	804.51	230.72	922.88	118.03	472.12	2199.51	36.58%	41.96%	21.46%	Y
28	1116	146.02	1314.18	570.07	2280.28	180.4	721.6	4316.06	30.45%	52.83%	16.72%	N
29	1111	56.17	505.53	272.36	1089.44	36.57	146.28	1741.25	29.03%	62.57%	8.40%	Y
30	1009	69.29	623.61	88.92	355.68	48.79	195.16	1174.45	53.10%	30.28%	16.62%	Y
31	1024	38.56	347.04	83.27	333.08	38.28	153.12	833.24	41.65%	39.97%	18.38%	Y
32	1077	93.16	838.44	317.98	1271.92	143.33	573.32	2683.68	31.24%	47.39%	21.36%	Y
33	1117	X	#VALUE!	X	#VALUE!	X	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	Y
34	1125	25.18	226.62	301.6	1206.4	74.82	299.28	1732.3	13.08%	69.64%	17.28%	Y
35	1066	22.62	203.58	155.75	623	37.43	149.72	976.3	20.85%	63.81%	15.34%	N
36	1067	50.89	458.01	145.3	581.2	50.42	201.68	1240.89	36.91%	46.84%	16.25%	N
37	1063	61.94	557.46	183.59	734.36	34.64	138.56	1430.38	38.97%	51.34%	9.69%	N
38	1075	15.58	140.22	141.36	565.44	53.09	212.36	918.02	15.27%	61.59%	23.13%	Y
39	1129	118.19	1063.71	441.39	1765.56	112.37	449.48	3278.75	32.44%	53.85%	13.71%	Y
40	1084	28.6	257.4	255.24	1020.96	73.42	293.68	1572.04	16.37%	64.94%	18.68%	Y
41	1060	29.67	267.03	197.61	790.44	58.85	235.4	1292.87	20.65%	61.14%	18.21%	Y
42	1130	11.16	100.44	115.94	463.76	85.68	342.72	906.92	11.07%	51.14%	37.79%	N
43	1019	32.76	294.84	165.16	660.64	94.61	378.44	1333.92	22.10%	49.53%	28.37%	N
44	1098	28.86	259.74	212.05	848.2	39.23	156.92	1264.86	20.54%	67.06%	12.41%	N
45	1012	92.71	834.39	225.5	902	69.11	276.44	2012.83	41.45%	44.81%	13.73%	Y
46	1003	37.52	337.68	198.4	793.6	45.45	181.8	1313.08	25.72%	60.44%	13.85%	Y
47	1025	20.7	186.3	103.76	415.04	30.95	123.8	725.14	25.69%	57.24%	17.07%	Y
48	1112	30.51	274.59	138.25	553	46.43	185.72	1013.31	27.10%	54.57%	18.33%	Y
49	1071	50.26	452.34	203.3	813.2	61.86	247.44	1512.98	29.90%	53.75%	16.35%	Y
50	1132	58.79	529.11	205.65	822.6	63.77	255.08	1606.79	32.93%	51.20%	15.88%	N
51	1085	32.28	290.52	235.67	942.68	43.53	174.12	1407.32	20.64%	66.98%	12.37%	Y
52	1119	X	#VALUE!	X	#VALUE!	X	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	Y
53	1123	53.47	481.23	285.26	1141.04	67.41	269.64	1891.91	25.44%	60.31%	14.25%	Y

54	1017	120.12	1081.08	505.18	2020.72	148.44	593.76	3695.56	29.25%	54.68%	16.07%	N
55	1038	50.09	450.81	267.74	1070.96	83.24	332.96	1854.73	24.31%	57.74%	17.95%	Y
56	1131	25.14	226.26	212.92	851.68	47.17	188.68	1266.62	17.86%	67.24%	14.90%	N
57	1110	17.92	161.28	184.15	736.6	33.55	134.2	1032.08	15.63%	71.37%	13.00%	Y
58	1096	X	#VALUE!	X	#VALUE!	X	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	N
59	1126	75.49	679.41	290.84	1163.36	69.77	279.08	2121.85	32.02%	54.83%	13.15%	N
60	1008	49.23	443.07	292.56	1170.24	67.62	270.48	1883.79	23.52%	62.12%	14.36%	Y
61	1086	18.29	164.61	135.05	540.2	97.62	390.48	1095.29	15.03%	49.32%	35.65%	N
62	1016	40.25	362.25	260.81	1043.24	52.24	208.96	1614.45	22.44%	64.62%	12.94%	Y
63	1065	47.25	425.25	296.48	1185.92	52.15	208.6	1819.77	23.37%	65.17%	11.46%	Y
64	1027	52.68	474.12	245.05	980.2	161.8	647.2	2101.52	22.56%	46.64%	30.80%	Y
65	1105	16.24	146.16	124.81	499.24	26.7	106.8	752.2	19.43%	66.37%	14.20%	Y
66	1011	49.81	448.29	191.7	766.8	92.14	368.56	1583.65	28.31%	48.42%	23.27%	Y
67	1081	46.6	419.4	189.89	759.56	59.76	239.04	1418	29.58%	53.57%	16.86%	Y
68	1040	33.8	304.2	231.31	925.24	31.81	127.24	1356.68	22.42%	68.20%	9.38%	Y
69	1047	19.88	178.92	134.63	538.52	59.04	236.16	953.6	18.76%	56.47%	24.77%	N
70	1030	58	522	327.54	1310.16	86.55	346.2	2178.36	23.96%	60.14%	15.89%	Y
71	1049	47.94	431.46	185.96	743.84	72.71	290.84	1466.14	29.43%	50.73%	19.84%	Y
72	1076	43.89	395.01	368.52	1474.08	74.87	299.48	2168.57	18.22%	67.97%	13.81%	Y
73	1133	36.56	329.04	185.09	740.36	58.98	235.92	1305.32	25.21%	56.72%	18.07%	Y
74	1037	28.16	253.44	117.2	468.8	51.51	206.04	928.28	27.30%	50.50%	22.20%	Y
75	1001	91.85	826.65	234.77	939.08	154.39	617.56	2383.29	34.69%	39.40%	25.91%	N
76	1113	29.14	262.26	113.77	455.08	35.95	143.8	861.14	30.45%	52.85%	16.70%	N
77	1048	48.32	434.88	228.05	912.2	91.63	366.52	1713.6	25.38%	53.23%	21.39%	Y
78	1054	55.7	501.3	124.54	498.16	62.95	251.8	1251.26	40.06%	39.81%	20.12%	Y
79	1118	6.96	62.64	112.9	451.6	50.32	201.28	715.52	8.75%	63.11%	28.13%	Y
80	1097	45.82	412.38	97.97	391.88	28.88	115.52	919.78	44.83%	42.61%	12.56%	N

81	1079	57.18	514.62	207.86	831.44	243.44	973.76	2319.82	22.18%	35.84%	41.98%	Y
82	1055	60.7	546.3	133.88	535.52	169.13	676.52	1758.34	31.07%	30.46%	38.47%	Y
83	1069	26.77	240.93	221.35	885.4	42.97	171.88	1298.21	18.56%	68.20%	13.24%	Y
84	1036	52.42	471.78	186.83	747.32	67	268	1487.1	31.72%	50.25%	18.02%	Y
85	1080	25	225	138.4	553.6	8.36	33.44	812.04	27.71%	68.17%	4.12%	N
86	1104	41.36	372.24	197.34	789.36	31.57	126.28	1287.88	28.90%	61.29%	9.81%	Y
87	1090	84.54	760.86	357.83	1431.32	93.09	372.36	2564.54	29.67%	55.81%	14.52%	Y
88	1013	52.64	473.76	275.5	1102	120.54	482.16	2057.92	23.02%	53.55%	23.43%	Y
89	1002	61.47	553.23	110.5	442	88.33	353.32	1348.55	41.02%	32.78%	26.20%	Y
90	1078	25.39	228.51	175.35	701.4	23.29	93.16	1023.07	22.34%	68.56%	9.11%	Y
91	1061	28.4	255.6	178.58	714.32	74.84	299.36	1269.28	20.14%	56.28%	23.59%	Y
92	1109	37.8	340.2	345.74	1382.96	110.34	441.36	2164.52	15.72%	63.89%	20.39%	Y
93	1070	35.48	319.32	260.55	1042.2	49.51	198.04	1559.56	20.48%	66.83%	12.70%	Y
94	1089	44.07	396.63	194.04	776.16	46.49	185.96	1358.75	29.19%	57.12%	13.69%	Y
95	1091	17.98	161.82	115.05	460.2	30.31	121.24	743.26	21.77%	61.92%	16.31%	N
96	1007	74.03	666.27	282.26	1129.04	116.61	466.44	2261.75	29.46%	49.92%	20.62%	N
97	1028	86.26	776.34	190.44	761.76	128.5	514	2052.1	37.83%	37.12%	25.05%	N

APPENDIX F

INTRODUCTION TO PHYSICAL ANTHROPOLOGY DATA

Physical Activity data set: pg. 121 – 129
Dietary data set: pg. 130 – 136

Subject	Respondent ID	Sex	Age	Height (inches)	Height (m)	Weight (lbs)	Weight (kg)	Body Fat (%)	subj. assesment	BMI	RMR (kcal/min)	Vigorous (hrs)	kcal vig	Moderate (hrs)	kcal mod	Light (hrs)	kcal light	Rest (hrs)	kcal rest	TEE (kcal)	TEE/RMR
112		F	23	66	1.68	140	63.42	20		22.59	1.02	1	505.42	3	1040.62	2	281.52	18	1392.1	3219.67	2.18
113		M	26	71	1.8	225	101.93	20	Obese	31.38	1.54	0	0	0	0	0	0	24	2833.49	2833.49	1.28
114		F	20	64	1.63	125	56.63	22		21.45	0.91	2	902.43	2	619.3	2	251.24	18	1241.9	3014.87	2.29
115		M	22	71	1.8	170	77.01	10	Normal	23.71	1.3	1	617.32	1	424.79	3	523.54	19	1852.53	3418.18	1.82
116		F	24	60	1.52	98	44.39	15		19.14	0.82	1	359.77	3	746.36	1	104.51	19	1142.13	2352.77	2
117		F	23	62.5	1.59	123	55.72	20	Normal	22.14	0.92	0	0	1	306	1	124.91	22	1522.28	1953.19	1.47
118		M	44	70	1.78	195	88.34	19		27.98	1.37	0	0	0	0	4	770.41	20	2085.36	2855.77	1.45
119		F	21	68	1.73	120	54.36	15	Underweight	18.24	0.95	1	437.58	2	603.36	2	250.02	19	1342.39	2633.36	1.92
120		M	20	72	1.83	155	70.22	10	Normal	21.02	1.21	1	564.27	1	388.73	2	321.06	20	1806.31	3080.36	1.76
121		M	19	64	1.63	126	57.08	10		21.63	1.04	2	923.4	0	0	2	267	20	1528.43	2718.83	1.82
122		F	21	68	1.73	128	57.98	20	Normal	19.46	0.95	1	462.98	3	954.07	1	129.57	19	1360.21	2906.83	2.12
123		F	29	62	1.57	115	52.1	23		21.03	0.84	1	415.27	6	1710.17	4	462.88	13	827.12	3415.44	2.81
124		M	19	69	1.75	124	56.17	7		18.31	1.05	0	0	0	0	3	400.12	21	1621.21	2021.33	1.33
125		M	23	69	1.75	145	65.69	10	Normal	21.41	1.15	1	528.9	4	1458.74	4	604.84	15	1282.87	3875.35	2.34
126		F	19	62	1.57	135	61.16	21		24.69	0.98	0	0	1	334.27	3	406.56	20	1487.29	2228.12	1.57
127		F	19	65	1.65	103	46.66	17		17.14	0.83	0	0	10	2596.5	8	864.07	6	368.1	3828.67	3.21
128		M	23	72	1.83	180	81.54	10	Normal	24.41	1.37	1	652.69	1	448.84	2	367.67	20	2045.85	3515.04	1.79
129		F	19	66	1.68	190	86.07	27		30.66	1.26	0	0	2	926.08	1	183.31	21	2042.05	3151.44	1.73
130		M	25	68	1.73	250	113.25	19		38.01	1.71	1	895.06	1	611.93	3	731.6	19	2481.75	4720.34	1.92
131		F	20	62	1.57	156	70.67	30		28.53	1.03	0	0	0	0	10	1498.82	14	1109	2607.83	1.77

132		M	21	71	1.8	191	86.52	14		26.64	1.39	0	0	2	945.94	8	1534.16	14	1473.45	3953.55	1.97
134		M	21	66	1.68	165	74.75	15	Overweight	26.63	1.23	2	1193.48	1	409.88	2	333.91	19	1752.01	3689.29	2.09
135		F	18	65	1.65	130	58.89	20	Normal	21.63	0.96	1	470.06	4	1291.32	3	394.31	16	1160.77	3316.46	2.39
136		M	28	68	1.73	214	96.94	21		32.54	1.47	4	3066.29	3	1572.65	3	627.46	14	1570.98	6837.38	3.24
137		F	20	64	1.63	115	52.1	16		19.74	0.91	0	0	2	578.16	2	239.55	20	1353.55	2171.26	1.66
138		M	21	73	1.85	140	63.42	6		18.47	1.16	0	0	1	354.98	3	446.59	20	1708.9	2510.47	1.5
139		F	24	66	1.68	135	61.16	25		21.79	0.95	0	0	1	331.96	3	399.61	20	1440.97	2172.54	1.59
140		F	20	61	1.55	130	58.89	20	Normal	24.56	0.96	1	470.06	2	645.66	2	262.88	19	1378.41	2757.01	1.99
141		F	20	61	1.55	115	52.1	22		21.73	0.85	0	0	1	285.61	3	348.9	20	1284.07	1918.58	1.56
142		M	20	75	1.91	185	83.81	14		23.12	1.36	1	668.06	3	1375.63	1	186.18	19	1945.07	4174.93	2.14
143		F	25	64	1.63	130	58.89	20	Normal	22.31	0.96	0	0	1	322.83	2	262.88	21	1523.51	2109.22	1.52
144		M	26	71	1.8	165	74.75	10	Normal	23.01	1.27	2	1199.27	2	825.55	2	339.7	18	1711.91	4076.43	2.22
145		F	21	63	1.6	145	65.69	25	Overweight	25.68	1.01	0	0	1	356	5	712.62	18	1383.11	2451.73	1.69
146		F	22	70	1.78	195	88.34	25	Overweight	27.98	1.31	0	0	1	476.22	1	189.13	22	2217.47	2882.82	1.53
147		F	18	61	1.55	112	50.74	20	Normal	21.16	0.85	0	0	3	838.66	3	343.98	18	1150.64	2333.28	1.9
148		F	25	65	1.65	135	61.16	25		22.46	0.95	0	0	1	331.96	2	266.41	21	1513.02	2111.38	1.55
149		F	22	66	1.68	190	86.07	30	Obese	30.66	1.23	0	0	1	461.3	2	363.15	21	2005.58	2830.02	1.59
150		F	20	61	1.55	115	52.1	20	Normal	21.73	0.87	0	0	2	573.53	2	234.91	20	1307.23	2115.68	1.68
151		M	20	63	1.6	205	92.87	20	Obese	36.31	1.42	0	0	0	0	4	805.38	20	2169.6	2974.98	1.45
152		F	22	63	1.6	133	60.25	20	Normal	23.56	0.98	0	0	1	330.04	2	268.47	21	1553.69	2152.2	1.52
153		F	42	67	1.7	174	78.82	25	Overweight	27.25	1.18	2	1245.56	0	0	2	339.11	20	1814.66	3399.34	1.99
154		F	19	62	1.57	143	64.78	26		26.15	0.99	0	0	0	0	1	140.08	23	1731.95	1872.03	1.32

155		M	21	65	1.65	160	72.48	18		26.62	1.17	1	577.32	1	396.12	3	481.68	19	1673.5	3128.61	1.86
156		F	19	63	1.6	120	54.36	19		21.25	0.91	0	0	1	299.37	1	122.7	22	1503.39	1925.46	1.47
157		F	19	59	1.5	180	81.54	30	Obese	36.35	1.17	3	1923.32	3	1311.77	3	516.76	15	1360.69	5112.54	3.03
158		M	19	67	1.7	190	86.07	15	Overweight	29.75	1.38	2	1370.32	2	939.97	1	190.26	19	1979.58	4480.14	2.26
159		M	23	71	1.8	196	88.79	18		27.33	1.39	2	1409.29	0	0	1	194.11	21	2211.85	3815.25	1.91
160		F	19	66	1.68	150	67.95	25		24.21	1.04	1	537.9	1	368.02	1	147.18	21	1663.93	2717.04	1.82
161		F	19	62	1.57	115	52.1	19		21.03	0.88	1	417.58	3	862.03	4	472.14	16	1055.05	2806.81	2.21
162		M	19	71	1.8	154	69.76	10	Normal	21.48	1.21	1	560.73	2	772.65	6	957.59	15	1347.54	3638.51	2.09
163		F	29	68	1.73	140	63.42	23		21.28	1	0	0	2	690.27	3	417.07	19	1436.44	2543.78	1.77
164		F	20	65	1.65	130	58.89	20	Normal	21.63	0.96	0	0	0	0	4	525.75	20	1450.96	1976.71	1.42
165		F	19	66	1.68	160	72.48	25	Overweight	25.82	1.1	1	573.27	2	784.13	2	313.01	19	1596.49	3266.9	2.07
166		F	21	62	1.57	120	54.36	20	Normal	21.95	0.9	0	0	1	298.79	2	244.23	21	1422.9	1965.92	1.51
167		F	19	63	1.6	130	58.89	20	Normal	23.03	0.96	2	940.11	3	968.49	3	394.31	16	1160.77	3463.69	2.5
168		F	21	61	1.55	120	54.36	12		22.67	0.98	1	439.32	4	1213.68	4	507	15	1085.84	3245.83	2.3
169		M	23	71	1.8	140	63.42	10	Normal	19.52	1.12	1	511.21	1	352.66	2	293.1	20	1662.58	2819.56	1.75
170		F	22	62	1.57	104	47.11	20	Normal	19.02	0.81	5	1890.49	5	1301.59	2	214.41	12	721.1	4127.58	3.56
171		F	24	68	1.73	135	61.16	18		20.52	1.01	1	488.9	1	336.01	0	0	22	1674.23	2499.14	1.71
172		F	19	74	1.88	168	76.1	16		21.57	1.23	2	1213.54	1	416.51	3	507.52	18	1675.25	3812.83	2.15
173		F	20	68	1.73	155	70.22	20	Normal	23.57	1.12	1	558.48	2	765.88	4	618.96	17	1436.93	3380.25	2.1
174		F	21	65	1.65	150	67.95	25	Overweight	24.96	1.04	1	537.9	2	736.04	1	147.18	20	1584.7	3005.83	2.01
175		F	21	63	1.6	160	72.48	25		28.34	1.1	1	573.27	1	392.07	3	469.52	19	1596.49	3031.34	1.92
176		M	23	75	1.91	275	124.58	26		34.37	1.79	1	979.42	1	667.99	3	789.35	19	2632.31	5069.07	1.97

177		F	25	68	1.73	160	72.48	22		24.33	1.13	2	1150.01	1	393.8	1	158.24	20	1715.26	3417.31	2.1
178		F	21	64	1.63	140	63.42	17		24.03	1.05	1	507.16	1	348.61	1	142.5	21	1660.6	2658.86	1.75
179		F	20	68	1.73	190	86.07	27		28.89	1.26	0	0	1	463.04	3	549.93	20	1944.81	2957.78	1.63
180		F	19	69	1.75	125	56.63	15	Underweight	18.46	0.98	1	455.27	1	313.7	2	259.35	20	1460.95	2489.27	1.76
181		F	20	66	1.68	50	22.65	VOID	VOID	8.07	#VALUE!	0	#VALUE!	3	#VALUE!	2	#VALUE!	19	#VALUE!	#VALUE!	#VALUE!
182		M	21	75	1.91	157	71.12	8.8		19.62	1.24	0	0	4	1576.93	6	978.54	14	1287.56	3843.02	2.16
183		M	20	69	1.75	165	74.75	15		24.36	1.23	0	0	4	1639.51	4	667.83	16	1475.38	3782.72	2.14
184		F	21	70	1.78	234	106	38		33.57	1.42	0	0	1	562.46	3	653.86	20	2239.03	3455.36	1.68
185		F	19	66	1.68	160	72.48	25		25.82	1.1	0	0	5	1960.33	2	313.01	17	1428.44	3701.78	2.34
186		M	20	68	1.73	160	72.48	10	Normal	24.33	1.24	3	1745.85	4	1603	2	330.38	15	1390.66	5069.9	2.83
187		M	29	80	2.03	190	86.07	18		20.87	1.35	0	0	1	468.25	4	754.09	19	1946.58	3168.92	1.63
188		F	19	70	1.78	145	65.69	20		20.8	1.06	2	1046.22	4	1435.58	3	436.26	15	1196.02	4114.07	2.71
189		F	51	68	1.73	240	108.72	30	Obese	36.49	1.54	0	0	1	581.52	3	684.53	20	2389.17	3655.22	1.65
190		F	21	68	1.73	145	65.69	22		22.04	1.04	1	521.95	2	715.48	2	288.52	19	1492.95	3018.9	2.02
191		F	20	66	1.68	120	54.36	20	Normal	19.37	0.9	2	869.37	2	597.57	2	244.23	18	1219.63	2930.81	2.25
192		F	19	61	1.55	101	45.75	20	Normal	19.08	0.79	1	367.49	1	253.1	1	104.41	21	1231.74	1956.74	1.73
193		F	19	67	1.7	160	72.48	22		25.06	1.13	1	575	2	787.61	3	474.73	18	1543.73	3381.07	2.08
194		F	20	62	1.57	110	49.83	22		20.12	0.82	0	0	3	820.76	8	893.11	13	803.51	2517.37	2.13
195		M	25	76	1.93	155	70.22	7		18.87	1.24	1	566	1	390.47	1	162.27	21	1933.1	3051.84	1.71
196		M	19	72	1.83	135	61.16	5	Underweight	18.31	1.14	1	496.42	3	1030.61	6	868.7	14	1170.8	3566.54	2.17
197		F	20	64	1.63	125	56.63	19		21.45	0.94	1	452.95	2	622.78	4	509.43	17	1202.44	2787.59	2.05
198		F	21	66	1.68	125	56.63	20	Normal	20.17	0.93	2	904.74	3	932.43	2	253.56	17	1192.59	3283.32	2.44

199		M	19	69	1.75	202	91.51	15		29.83	1.45	0	0	2	997.68	1	201.44	21	2308.69	3507.81	1.68
200		F	25	66.5	1.69	130	58.89	17		20.67	0.99	1	471.79	1	324.57	1	133.18	21	1559.99	2489.52	1.74
201		F	19	67	1.7	124	56.17	21		19.42	0.92	1	448.26	1	307.83	2	250.53	20	1381.89	2388.5	1.81
202		F	21	66	1.68	128	57.98	24		20.66	0.91	2	921.33	1	315.71	2	254.52	19	1316.2	2807.76	2.14
203		M	20	68	1.73	145	65.69	15		22.04	1.1	1	526	4	1447.16	2	296.63	17	1404.7	3674.5	2.31
204		F	34	62	1.57	200	90.6	26		36.58	1.33	0	0	0	0	2	386.42	22	2257.43	2643.85	1.38
205		F	18	61	1.55	125	56.63	20	Normal	23.62	0.93	1	452.37	1	310.81	1	126.78	21	1473.2	2363.16	1.76
206		F	22	65	1.65	130	58.89	21		21.63	0.95	1	469.48	1	322.25	6	785.15	16	1151.51	2728.39	1.99
207		F	24	66	1.68	145	65.69	28		23.4	0.98	1	518.48	1	354.26	1	140.79	21	1577.15	2590.68	1.84
208		M	19	70	1.78	147	66.59	6		21.09	1.2	1	538.29	3	1115.43	1	155.39	19	1687.17	3496.28	2.02
209		M	19	69	1.75	130	58.89	10	Normal	19.2	1.06	4	1903.38	2	657.24	2	274.46	16	1253.41	4088.49	2.68
210		F	28	67	1.7	120	54.36	20	Normal	18.79	0.9	0	0	1	298.79	1	122.12	22	1490.66	1911.56	1.47
211		F	20	63	1.6	156	70.67	25	Overweight	27.63	1.07	2	1118.24	1	382.45	1	152.78	20	1642.19	3295.65	2.13
212		M	19	71	1.8	190	86.07	15	Overweight	26.5	1.38	2	1370.32	2	939.97	1	190.26	19	1979.58	4480.14	2.26
213		F	20	63	1.6	92	41.68	15	Underweight	16.3	0.78	1	338.55	2	468.72	4	395.65	17	973.04	2175.96	1.94
214		F	19	62	1.57	125	56.63	19		22.86	0.94	3	1358.85	2	622.78	2	254.71	17	1202.44	3438.78	2.53
215		F	21	65	1.65	160	72.48	25	Overweight	26.62	1.1	0	0	1	392.07	4	626.02	19	1596.49	2614.58	1.65
216		F	24	61	1.55	115	52.1	19		21.73	0.88	1	417.58	1	287.34	3	354.11	19	1252.87	2311.91	1.82
217		M	22	70	1.78	165	74.75	13		23.67	1.24	1	597.9	1	411.04	1	168.11	21	1960.76	3137.8	1.75
219		F	22	64	1.63	120	54.36	19		20.6	0.91	1	435.27	2	598.73	1	122.7	20	1366.72	2523.42	1.92
220		F	20	67	1.7	155	70.22	22		24.27	1.1	0	0	1	381.78	1	153.58	22	1834.08	2369.45	1.5
222		F	21	65	1.65	132	59.8	20	Normal	21.96	0.98	0	0	1	327.64	5	666.51	18	1323.11	2317.26	1.65

223		F	22	62	1.57	170	77.01	26		31.09	1.15	1	608.06	2	831.06	3	495.74	18	1588.28	3523.14	2.13
224		M	18	70	1.78	166	75.2	12		23.82	1.26	4	2408.06	1	414.02	1	169.63	18	1699.69	4691.39	2.58
225		M	20	70	1.78	232	105.1	20	Obese	33.28	1.59	0	0	1	568.07	0	0	23	2792.56	3360.63	1.47
226		F	19	63	1.6	180	81.54	21		31.88	1.26	3	1938.96	2	884.94	6	1064.78	13	1247.01	5135.68	2.83
227		M	21	72	1.83	140	63.42	3		18.99	1.19	0	0	0	0	6	903.61	18	1569.28	2472.89	1.44
228		F	18	68	1.73	125	56.63	22		19	0.91	1	451.21	3	928.95	6	753.72	14	965.92	3099.81	2.36
229		F	20	65	1.65	122	55.27	20		20.3	0.91	1	441.76	4	1214.38	5	619.91	14	962.01	3238.07	2.46
230		F	19	62	1.57	135	61.16	12		24.69	1.07	1	492.37	1	339.48	2	281.46	20	1591.51	2704.83	1.75
231		F	21	68	1.73	138	62.51	19		20.98	1.02	1	498.93	1	342.64	1	139.47	21	1616.16	2597.2	1.76
232		M	54	72	1.83	191	86.52	15	Overweight	25.9	1.38	0	0	1	472.39	4	764.76	19	1988.69	3225.84	1.62
234		F	21	67	1.7	187	84.71	20	Overweight	29.29	1.31	3	2014.97	0	0	5	922.84	16	1597.7	4535.51	2.4
235		M	19	72	1.83	180	81.54	10	Normal	24.41	1.37	1	652.69	2	897.68	2	367.67	19	1943.56	3861.59	1.96
236		F	20	60	1.52	110	49.83	20	Normal	21.48	0.84	0	0	0	0	5	563.98	19	1196.36	1760.34	1.45
237		F	22	60	1.52	165	74.75	30	Obese	32.22	1.08	1	588.06	5	2005.96	3	474.81	15	1252.89	4321.73	2.78
238		M	23	72	1.83	185	83.81	15		25.09	1.35	1	667.48	1	457.96	2	371.2	20	2035.86	3532.5	1.82
239		M	20	68	1.73	145	65.69	10		22.04	1.15	3	1586.69	5	1823.43	3	453.63	13	1111.82	4975.57	3
240		F	21	63	1.6	115	52.1	20	Normal	20.37	0.87	1	417	2	573.53	4	469.83	17	1111.15	2571.51	2.05
241		F	19	63	1.6	214	96.94	26		37.9	1.42	2	1527.35	4	2085.29	2	412.52	16	1749.09	5774.24	2.83
242		M	21	69	1.75	140	63.42	11		20.67	1.11	0	0	1	352.08	7	1021.79	16	1320.8	2694.67	1.68
243		M	21	68	1.73	120	54.36	5	Underweight	18.24	1.05	2	886.74	1	307.47	3	392.41	18	1375.96	2962.58	1.96
244		F	22	61	1.55	128	57.98	20		24.18	0.95	1	462.98	1	318.02	2	259.15	20	1431.8	2471.95	1.8
245		F	22	66	1.68	165	74.75	22		26.63	1.16	0	0	1	405.82	2	325.81	21	1851.32	2582.96	1.55

246		F	20	73	1.85	249	112.8	30	Obese	32.85	1.59	1	885.15	1	603.16	1	236.57	21	2599.17	4324.05	1.89
247		M	24	70	1.78	145	65.69	11		20.8	1.14	1	528.32	5	1820.53	6	903.78	12	1019.35	4271.98	2.6
248		M	24	71	1.8	150	67.95	10		20.92	1.18	1	546.58	0	0	1	155.87	22	1934.24	2636.69	1.55
249		F	20	60	1.52	95	43.04	20	Normal	18.55	0.75	1	346.27	3	716.04	2	197.63	18	1004.04	2263.97	2.1
250		F	23	62	1.57	108	48.92	16		19.75	0.87	1	394.56	1	272.25	2	226.5	20	1286.48	2179.79	1.74
251		F	20	69	1.75	158	71.57	24		23.33	1.1	0	0	4	1551.34	4	620.88	16	1338.35	3510.57	2.22
252		F	21	70	1.78	125	56.63	17		17.93	0.96	0	0	0	0	4	514.06	20	1437.79	1951.85	1.41
253		F	21	67	1.7	130	58.89	20	Normal	20.36	0.96	0	0	2	645.66	3	394.31	19	1378.41	2418.39	1.74
254		M	26	67	1.7	150	67.95	10	Normal	23.49	1.18	2	1093.16	2	753.41	2	311.74	18	1582.56	3740.88	2.2
255		F	21	61	1.55	117	53	18		22.1	0.9	0	0	1	292.73	9	1084.31	14	944.69	2321.73	1.78
256		F	25	67	1.7	140	63.42	20		21.92	1.02	2	1010.85	4	1387.5	4	563.04	14	1082.75	4044.13	2.74
257		M	25	70	1.78	175	79.28	11		25.11	1.32	0	0	0	0	2	357.19	22	2185	2542.19	1.33
259		F	20	62	1.57	115	52.1	17		21.03	0.9	0	0	3	865.51	1	119.19	20	1341.97	2326.67	1.79
260		M	25	66	1.68	200	90.6	20	Obese	32.28	1.39	1	717.63	2	982.27	3	590.05	18	1909.52	4199.48	2.1
261		M	27	74	1.88	179	81.09	10	Normal	22.98	1.36	2	1298.3	4	1785.73	6	1097.4	12	1221.76	5403.2	2.76
262		F	20	66	1.68	124	56.17	21		20.01	0.92	0	0	0	0	2	250.53	22	1520.08	1770.61	1.34
263		M	21	71.5	1.82	164	74.29	10	Normal	22.55	1.27	2	1192.2	4	1641.47	4	675.68	14	1324.78	4834.13	2.65
264		F	24	64	1.63	113	51.19	21		19.39	0.85	1	409.35	1	281.38	1	115.01	21	1340.31	2146.06	1.75
265		M	19	73	1.85	185	83.81	13		24.41	1.37	2	1337.27	2	918.24	1	186.76	19	1956.07	4398.34	2.23
266		F	20	68	1.73	124	56.17	19		18.85	0.94	2	898.83	2	617.97	2	252.85	18	1264.55	3034.19	2.25
267		F	19	63	1.6	120	54.36	20	Normal	21.25	0.9	0	0	6	1792.72	3	366.35	15	1016.36	3175.43	2.44
268		M	20	65	1.65	128	57.98	9		21.3	1.06	2	938.7	2	648.78	2	271.89	18	1403.26	3262.63	2.14

269		F	21	67	1.7	140	63.42	20		21.92	1.02	0	0	0	0	2	281.52	22	1701.46	1982.98	1.34
270		M	19	69	1.75	165	74.75	12		24.36	1.25	2	1196.95	1	411.61	5	843.47	16	1503.17	3955.21	2.19
271		M	20	73.5	1.87	165	74.75	10	Normal	21.47	1.27	0	0	2	825.55	0	0	22	2092.34	2917.88	1.59
272		F	19	69	1.75	145	65.69	20	Normal	21.41	1.06	0	0	2	717.79	2	290.84	20	1594.69	2603.32	1.71
274		F	20	67	1.7	150	67.95	25		23.49	1.04	0	0	1	368.02	3	441.55	20	1584.7	2394.28	1.6
275		M	21	73	1.85	185	83.81	15		24.41	1.35	0	0	1	457.96	1	185.6	22	2239.45	2883.01	1.49
276		F	20	63	1.6	140	63.42	25		24.8	0.98	0	0	3	1031.94	3	413.59	18	1339.99	2785.52	1.98
278		F	20	64	1.63	120	54.36	20		20.6	0.9	2	869.37	1	298.79	2	244.23	19	1287.39	2699.78	2.08
279		F	23	69	1.75	167	75.65	23		24.66	1.16	3	1797.55	2	820.11	3	492.57	16	1416.6	4526.82	2.71
281		F	25	62	1.57	108	48.92	17		19.75	0.86	1	393.98	1	271.67	2	225.34	20	1274.9	2165.89	1.75
283		F	21	64	1.63	110	49.83	20	Normal	18.88	0.84	0	0	1	274.74	2	225.59	21	1322.29	1822.63	1.5
284		F	22	2-May		117	22-Feb	20		0	0.88	1	424.08	2	583.15	3	357.96	18	1193.76	2558.94	2.01
285		M	23	70	1.78	170	77.01	13		24.39	1.28	2	1231.16	1	423.06	5	863.87	16	1532.24	4050.33	2.21
286		F	22	68	1.73	149	67.5	21		22.65	1.07	1	536.68	1	367.93	1	148.57	21	1702.51	2755.69	1.79
287		M	20	72	1.83	220	99.66	16		29.83	1.55	3	2372.06	1	541.54	0	0	20	2359.65	5273.25	2.36
289		F	20	64	1.63	120	54.36	20	Normal	20.6	0.9	0	0	0	0	2	244.23	22	1490.66	1734.89	1.33
290		M	27	72	1.83	160	72.48	10	Normal	21.7	1.24	2	1163.9	0	0	5	825.95	17	1576.08	3565.94	1.99
291		F	22	62	1.57	115	52.1	14		21.03	0.93	0	0	4	1160.96	3	362.79	17	1170.21	2693.96	2.01
292		F	23	63	1.6	145	65.69	25	Overweight	25.68	1.01	2	1040.43	1	356	1	142.52	20	1536.79	3075.74	2.12
293		M	23	68	1.73	195	88.34	15	Overweight	29.65	1.41	1	702.85	2	964.02	1	194.92	20	2131.68	3993.46	1.97
294		M	22	67	1.7	180	81.54	15		28.19	1.32	0	0	0	0	1	180.94	23	2286.15	2467.08	1.3
295		M	19	73	1.85	190	86.07	2		25.06	1.5	1	692.69	5	2387.57	3	593.36	15	1675.73	5349.35	2.47

296		M	19	74	1.88	185	83.81	10	Normal	23.75	1.4	10	6703.72	2	921.72	0	0	12	1256.26	8881.7	4.42

Subject	Fat (g)	Fat (cal)	Carb (g)	Carb (cal)	Protein (g)	Protein (cal)	Total Cal	% Fat	% Carb	% Protein	Typical ? (Y/N)
112	37.12	334.08	138.86	555.44	96.46	385.84	1275.36	26.19%	43.55%	30.25%	1
113	39.28	353.52	219.06	876.24	37.59	150.36	1380.12	25.62%	63.49%	10.89%	2
114	52.58	473.22	191.92	767.68	75.83	303.32	1544.22	30.64%	49.71%	19.64%	2
115	32.16	289.44	138.29	553.16	95.01	380.04	1222.64	23.67%	45.24%	31.08%	1
116	46.19	415.71	247.53	990.12	58.31	233.24	1639.07	25.36%	60.41%	14.23%	1
117	79.12	712.08	189.54	758.16	50.21	200.84	1671.08	42.61%	45.37%	12.02%	1
118	52.67	474.03	303.2	1212.8	30.63	122.52	1809.35	26.20%	67.03%	6.77%	1
119	30.27	272.43	82.22	328.88	32.94	131.76	733.07	37.16%	44.86%	17.97%	1
120	123.15	1108.35	456.22	1824.88	137.37	549.48	3482.71	31.82%	52.40%	15.78%	1
121	63.03	567.27	134.21	536.84	90.79	363.16	1467.27	38.66%	36.59%	24.75%	1
122	55.94	503.46	334.33	1337.32	73.05	292.2	2132.98	23.60%	62.70%	13.70%	1
123	42.89	386.01	217.41	869.64	55.16	220.64	1476.29	26.15%	58.91%	14.95%	1
124	61.44	552.96	152.16	608.64	55.31	221.24	1382.84	39.99%	44.01%	16.00%	1
125	95.78	862.02	380.03	1520.12	90.35	361.4	2743.54	31.42%	55.41%	13.17%	1
126	82.49	742.41	229.57	918.28	71.83	287.32	1948.01	38.11%	47.14%	14.75%	1
127	92.5	832.5	320.09	1280.36	121.15	484.6	2597.46	32.05%	49.29%	18.66%	2
128	29.66	266.94	274.56	1098.24	95.55	382.2	1747.38	15.28%	62.85%	21.87%	1
129	53.3	479.7	286.6	1146.4	42.86	171.44	1797.54	26.69%	63.78%	9.54%	1
130	33.87	304.83	209.6	838.4	57.92	231.68	1374.91	22.17%	60.98%	16.85%	1
131	25.85	232.65	199.4	797.6	18.27	73.08	1103.33	21.09%	72.29%	6.62%	2
132	31.51	283.59	206.23	824.92	79.38	317.52	1426.03	19.89%	57.85%	22.27%	1
134	34.51	310.59	126.62	506.48	17.8	71.2	888.27	34.97%	57.02%	8.02%	1
135	7.71	69.39	150.84	603.36	13.58	54.32	727.07	9.54%	82.99%	7.47%	1
136	33.89	305.01	355.03	1420.12	71.89	287.56	2012.69	15.15%	70.56%	14.29%	1
137	66.77	600.93	203.37	813.48	67.35	269.4	1683.81	35.69%	48.31%	16.00%	1
138	49.12	442.08	121.85	487.4	26.11	104.44	1033.92	42.76%	47.14%	10.10%	2

139	50.27	452.43	280.17	1120.68	64.46	257.84	1830.95	24.71%	61.21%	14.08%	1
140	85.39	768.51	198.61	794.44	62.17	248.68	1811.63	42.42%	43.85%	13.73%	2
141	67.75	609.75	275.27	1101.08	66.6	266.4	1977.23	30.84%	55.69%	13.47%	2
142	77.45	697.05	272.21	1088.84	92.86	371.44	2157.33	32.31%	50.47%	17.22%	1
143	59.46	535.14	231.44	925.76	57	228	1688.9	31.69%	54.81%	13.50%	2
144	58.16	523.44	270.7	1082.8	107.31	429.24	2035.48	25.72%	53.20%	21.09%	1
145	69.21	622.89	178.93	715.72	64.66	258.64	1597.25	39.00%	44.81%	16.19%	1
146	24.35	219.15	192.87	771.48	52.19	208.76	1199.39	18.27%	64.32%	17.41%	1
147	53.65	482.85	275.29	1101.16	65.01	260.04	1844.05	26.18%	59.71%	14.10%	1
148	65.4	588.6	155.78	623.12	35.36	141.44	1353.16	43.50%	46.05%	10.45%	1
149	32.26	290.34	136.01	544.04	39.2	156.8	991.18	29.29%	54.89%	15.82%	1
150	101.26	911.34	274.22	1096.88	92.59	370.36	2378.58	38.31%	46.11%	15.57%	1
151	20.27	182.43	253.59	1014.36	54.06	216.24	1413.03	12.91%	71.79%	15.30%	1
152	65.98	593.82	259.14	1036.56	70.83	283.32	1913.7	31.03%	54.17%	14.80%	1
153	22.63	203.67	32.17	128.68	10.4	41.6	373.95	54.46%	34.41%	11.12%	1
154	74.97	674.73	244.68	978.72	66.3	265.2	1918.65	35.17%	51.01%	13.82%	1
155	137.01	1233.09	259.3	1037.2	88.75	355	2625.29	46.97%	39.51%	13.52%	2
156	18.27	164.43	131.48	525.92	21.31	85.24	775.59	21.20%	67.81%	10.99%	2
157	40.63	365.67	220.6	882.4	48.44	193.76	1441.83	25.36%	61.20%	13.44%	1
158	50.13	451.17	196.54	786.16	60.84	243.36	1480.69	30.47%	53.09%	16.44%	1
159	90.31	812.79	250.49	1001.96	159.75	639	2453.75	33.12%	40.83%	26.04%	1
160	19.5	175.5	112	448	28	112	735.5	23.86%	60.91%	15.23%	1
161	12.3	110.7	134.2	536.8	24.2	96.8	744.3	14.87%	72.12%	13.01%	2
162	86.27	776.43	278.36	1113.44	84.03	336.12	2225.99	34.88%	50.02%	15.10%	1
163	93.39	840.51	199.62	798.48	62.92	251.68	1890.67	44.46%	42.23%	13.31%	1
164	25.52	229.68	176.11	704.44	21.32	85.28	1019.4	22.53%	69.10%	8.37%	1
165	66.41	597.69	327.26	1309.04	57.21	228.84	2135.57	27.99%	61.30%	10.72%	2

166	8.67	78.03	130.39	521.56	26.85	107.4	706.99	11.04%	73.77%	15.19%	1
167	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	2
168	5.57	50.13	121.77	487.08	35.68	142.72	679.93	7.37%	71.64%	20.99%	2
169	56.9	512.1	108.22	432.88	40.95	163.8	1108.78	46.19%	39.04%	14.77%	1
170	33.18	298.62	139.69	558.76	50.88	203.52	1060.9	28.15%	52.67%	19.18%	1
171	87.96	791.64	274.15	1096.6	110.11	440.44	2328.68	34.00%	47.09%	18.91%	2
172	31.5	283.5	214	856	38	152	1291.5	21.95%	66.28%	11.77%	1
173	67.16	604.44	124.17	496.68	73.47	293.88	1395	43.33%	35.60%	21.07%	1
174	25.35	228.15	165.32	661.28	27.43	109.72	999.15	22.83%	66.18%	10.98%	2
175	70.17	631.53	196.35	785.4	84.87	339.48	1756.41	35.96%	44.72%	19.33%	1
176	50.64	455.76	315.29	1261.16	72.14	288.56	2005.48	22.73%	62.89%	14.39%	2
177	22.47	202.23	193.83	775.32	52.77	211.08	1188.63	17.01%	65.23%	17.76%	1
178	75.71	681.39	238.33	953.32	75.63	302.52	1937.23	35.17%	49.21%	15.62%	1
179	19.35	174.15	103.41	413.64	39.33	157.32	745.11	23.37%	55.51%	21.11%	2
180	54.74	492.66	300.55	1202.2	75.88	303.52	1998.38	24.65%	60.16%	15.19%	1
181	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	1
182	97.13	874.17	322.86	1291.44	106.97	427.88	2593.49	33.71%	49.80%	16.50%	1
183	15.89	143.01	88.64	354.56	11.74	46.96	544.53	26.26%	65.11%	8.62%	1
184	31.67	285.03	202.39	809.56	56.85	227.4	1321.99	21.56%	61.24%	17.20%	1
185	3.11	27.99	91.8	367.2	12.33	49.32	444.51	6.30%	82.61%	11.10%	2
186	53.13	478.17	236.61	946.44	49.51	198.04	1622.65	29.47%	58.33%	12.20%	1
187	17.49	157.41	356.4	1425.6	52.91	211.64	1794.65	8.77%	79.44%	11.79%	1
188	65.63	590.67	241.57	966.28	75.75	303	1859.95	31.76%	51.95%	16.29%	2
189	75.22	676.98	113.23	452.92	65.95	263.8	1393.7	48.57%	32.50%	18.93%	1
190	15.14	136.26	149.41	597.64	37.72	150.88	884.78	15.40%	67.55%	17.05%	1
191	126.17	1135.53	292.33	1169.32	83.27	333.08	2637.93	43.05%	44.33%	12.63%	2
192	10.47	94.23	84.17	336.68	10.48	41.92	472.83	19.93%	71.21%	8.87%	1

193	21.77	195.93	244.79	979.16	82.06	328.24	1503.33	13.03%	65.13%	21.83%	2
194	48.35	435.15	188.36	753.44	65.29	261.16	1449.75	30.02%	51.97%	18.01%	1
195	48.92	440.28	206	824	51.59	206.36	1470.64	29.94%	56.03%	14.03%	1
196	27.42	246.78	143.13	572.52	28.58	114.32	933.62	26.43%	61.32%	12.24%	1
197	54.2	487.8	81.52	326.08	57.03	228.12	1042	46.81%	31.29%	21.89%	1
198	34.91	314.19	163.36	653.44	74.68	298.72	1266.35	24.81%	51.60%	23.59%	1
199	50.79	457.11	184.61	738.44	56.23	224.92	1420.47	32.18%	51.99%	15.83%	2
200	156.95	1412.55	296.71	1186.84	117.97	471.88	3071.27	45.99%	38.64%	15.36%	1
201	95.07	855.63	146.72	586.88	85.86	343.44	1785.95	47.91%	32.86%	19.23%	2
202	40.67	366.03	153.14	612.56	18.85	75.4	1053.99	34.73%	58.12%	7.15%	1
203	14.4	129.6	226.83	907.32	40.12	160.48	1197.4	10.82%	75.77%	13.40%	1
204	103.96	935.64	261.8	1047.2	111.08	444.32	2427.16	38.55%	43.15%	18.31%	1
205	78.91	710.19	276.97	1107.88	58.67	234.68	2052.75	34.60%	53.97%	11.43%	2
206	44.54	400.86	142.23	568.92	35.04	140.16	1109.94	36.12%	51.26%	12.63%	2
207	9.73	87.57	104.24	416.96	35.55	142.2	646.73	13.54%	64.47%	21.99%	2
208	73.43	660.87	169.74	678.96	58.63	234.52	1574.35	41.98%	43.13%	14.90%	1
209	VOID	#VALUE!	VOID	#VALUE!	VOID	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	2
210	82.95	746.55	311.84	1247.36	79.98	319.92	2313.83	32.26%	53.91%	13.83%	2
211	83.98	755.82	402.89	1611.56	60.99	243.96	2611.34	28.94%	61.71%	9.34%	2
212	83.14	748.26	493.98	1975.92	101.66	406.64	3130.82	23.90%	63.11%	12.99%	1
213	44.91	404.19	309.4	1237.6	36.84	147.36	1789.15	22.59%	69.17%	8.24%	1
214	144.73	1302.57	409.97	1639.88	78.62	314.48	3256.93	39.99%	50.35%	9.66%	1
215	47.94	431.46	254.65	1018.6	101.54	406.16	1856.22	23.24%	54.87%	21.88%	2
216	63.63	572.67	93.5	374	50.6	202.4	1149.07	49.84%	32.55%	17.61%	1
217	26.24	236.16	185.4	741.6	40.97	163.88	1141.64	20.69%	64.96%	14.35%	2
219	42.07	378.63	125.55	502.2	37.61	150.44	1031.27	36.71%	48.70%	14.59%	2
220	34.14	307.26	156.78	627.12	35.34	141.36	1075.74	28.56%	58.30%	13.14%	1

222	20.87	187.83	91.51	366.04	31.33	125.32	679.19	27.66%	53.89%	18.45%	2
223	51.09	459.81	163.47	653.88	101.16	404.64	1518.33	30.28%	43.07%	26.65%	1
224	23.05	207.45	159.27	637.08	50.93	203.72	1048.25	19.79%	60.78%	19.43%	1
225	68.26	614.34	253.6	1014.4	62.1	248.4	1877.14	32.73%	54.04%	13.23%	1
226	21.24	191.16	310.94	1243.76	25.21	100.84	1535.76	12.45%	80.99%	6.57%	1
227	66.67	600.03	328.19	1312.76	62.46	249.84	2162.63	27.75%	60.70%	11.55%	1
228	38.55	346.95	72.17	288.68	25.28	101.12	736.75	47.09%	39.18%	13.73%	1
229	30.04	270.36	134.97	539.88	47.72	190.88	1001.12	27.01%	53.93%	19.07%	2
230	56.26	506.34	251.91	1007.64	73.11	292.44	1806.42	28.03%	55.78%	16.19%	2
231	24.03	216.27	303.56	1214.24	57.59	230.36	1660.87	13.02%	73.11%	13.87%	1
232	74.15	667.35	152.73	610.92	70.84	283.36	1561.63	42.73%	39.12%	18.15%	1
234	38.92	350.28	373.82	1495.28	96.36	385.44	2231	15.70%	67.02%	17.28%	2
235	66.3	596.7	308.88	1235.52	103.95	415.8	2248.02	26.54%	54.96%	18.50%	1
236	70.22	631.98	292.09	1168.36	140.02	560.08	2360.42	26.77%	49.50%	23.73%	1
237	27.23	245.07	54.75	219	23.63	94.52	558.59	43.87%	39.21%	16.92%	1
238	76.72	690.48	130.34	521.36	64.33	257.32	1469.16	47.00%	35.49%	17.51%	1
239	47.79	430.11	141.35	565.4	46.37	185.48	1180.99	36.42%	47.88%	15.71%	1
240	32.62	293.58	96.2	384.8	31.64	126.56	804.94	36.47%	47.80%	15.72%	2
241	123.47	1111.23	376.31	1505.24	67.39	269.56	2886.03	38.50%	52.16%	9.34%	1
242	23.07	207.63	214.67	858.68	80.95	323.8	1390.11	14.94%	61.77%	23.29%	1
243	20.11	180.99	188.53	754.12	21.29	85.16	1020.27	17.74%	73.91%	8.35%	2
244	16.59	149.31	109.65	438.6	75.95	303.8	891.71	16.74%	49.19%	34.07%	1
245	9.3	83.7	108.71	434.84	16.64	66.56	585.1	14.31%	74.32%	11.38%	2
246	17.84	160.56	179.05	716.2	44.6	178.4	1055.16	15.22%	67.88%	16.91%	1
247	82.86	745.74	341.2	1364.8	88.51	354.04	2464.58	30.26%	55.38%	14.37%	1
248	85.91	773.19	232.14	928.56	105.5	422	2123.75	36.41%	43.72%	19.87%	1
249	14.96	134.64	108.23	432.92	56.81	227.24	794.8	16.94%	54.47%	28.59%	1

250	11	99	42	168	27	108	375	26.40%	44.80%	28.80%	1
251	64.64	581.76	277.63	1110.52	69.81	279.24	1971.52	29.51%	56.33%	14.16%	1
252	77.9	701.1	183.79	735.16	49.73	198.92	1635.18	42.88%	44.96%	12.17%	1
253	52.12	469.08	442.79	1771.16	103.52	414.08	2654.32	17.67%	66.73%	15.60%	2
254	37.33	335.97	190.67	762.68	69.2	276.8	1375.45	24.43%	55.45%	20.12%	1
255	58.57	527.13	167.84	671.36	49.16	196.64	1395.13	37.78%	48.12%	14.09%	2
256	31.09	279.81	158.23	632.92	41.98	167.92	1080.65	25.89%	58.57%	15.54%	1
257	56.93	512.37	243.64	974.56	69.38	277.52	1764.45	29.04%	55.23%	15.73%	2
259	63.62	572.58	370.76	1483.04	96.68	386.72	2442.34	23.44%	60.72%	15.83%	1
260	73.36	660.24	270.15	1080.6	72.46	289.84	2030.68	32.51%	53.21%	14.27%	2
261	56.5	508.5	190.25	761	30.1	120.4	1389.9	36.59%	54.75%	8.66%	1
262	20.6	185.4	113.43	453.72	23.08	92.32	731.44	25.35%	62.03%	12.62%	1
263	10.05	90.45	143.8	575.2	25.53	102.12	767.77	11.78%	74.92%	13.30%	1
264	41.9	377.1	294.38	1177.52	62.33	249.32	1803.94	20.90%	65.27%	13.82%	1
265	19	171	155	620	33	132	923	18.53%	67.17%	14.30%	1
266	54.64	491.76	261.35	1045.4	56.66	226.64	1763.8	27.88%	59.27%	12.85%	1
267	61.47	553.23	291.21	1164.84	65	260	1978.07	27.97%	58.89%	13.14%	1
268	72.33	650.97	119.18	476.72	101.86	407.44	1535.13	42.40%	31.05%	26.54%	1
269	11.11	99.99	72.18	288.72	28.03	112.12	500.83	19.96%	57.65%	22.39%	1
270	88.64	797.76	97.94	391.76	96.89	387.56	1577.08	50.58%	24.84%	24.57%	1
271	72.61	653.49	195.33	781.32	87.2	348.8	1783.61	36.64%	43.81%	19.56%	1
272	41.07	369.63	155.76	623.04	39.3	157.2	1149.87	32.15%	54.18%	13.67%	1
274	VOID	#VALUE!	VOID	#VALUE!	VOID	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	2
275	129.65	1166.85	253.03	1012.12	102.26	409.04	2588.01	45.09%	39.11%	15.81%	1
276	39.1	351.9	108.43	433.72	35.08	140.32	925.94	38.00%	46.84%	15.15%	2
278	28.34	255.06	255.2	1020.8	69.62	278.48	1554.34	16.41%	65.67%	17.92%	1
279	72.05	648.45	279.78	1119.12	85.92	343.68	2111.25	30.71%	53.01%	16.28%	1

281	104.42	939.78	192.31	769.24	119.91	479.64	2188.66	42.94%	35.15%	21.91%	1
283	8.48	76.32	153.29	613.16	37.14	148.56	838.04	9.11%	73.17%	17.73%	1
284	10.1	90.9	134.43	537.72	21.08	84.32	712.94	12.75%	75.42%	11.83%	2
285	58.51	526.59	290.5	1162	156.95	627.8	2316.39	22.73%	50.16%	27.10%	1
286	54.06	486.54	191.72	766.88	60.18	240.72	1494.14	32.56%	51.33%	16.11%	2
287	97.13	874.17	217.94	871.76	64.99	259.96	2005.89	43.58%	43.46%	12.96%	2
289	6	54	85	340	21	84	478	11.30%	71.13%	17.57%	2
290	27.54	247.86	65.66	262.64	52.65	210.6	721.1	34.37%	36.42%	29.21%	1
291	VOID	#VALUE!	VOID	#VALUE!	VOID	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	1
292	28.96	260.64	145.46	581.84	52.53	210.12	1052.6	24.76%	55.28%	19.96%	1
293	92.36	831.24	285.9	1143.6	105.24	420.96	2395.8	34.70%	47.73%	17.57%	2
294	VOID	#VALUE!	VOID	#VALUE!	VOID	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	1
295	VOID	#VALUE!	VOID	#VALUE!	VOID	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	1
296	21.36	192.24	39.58	158.32	15.08	60.32	410.88	46.79%	38.53%	14.68%	1

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VITA

Stephanie Laurel Schnorr was born in Dallas, Texas on August 15, 1984 and grew up in North Texas between small towns, Little Elm and The Colony. In September of 2002, she began her undergraduate education at Boston University in Boston, Massachusetts, graduating with a B.A. in Anthropology and a minor in Biology in May of 2006. During her time at BU, Stephanie dabbled in Astronomy, Math, and Philosophy while concentrated heavily in the subjects of Physics, Neuroscience, and Endocrinology among the other prerequisites of her major's track. Stephanie was also an avid participant in the sports running, gymnastics and kayaking, competing in the disciplines of whitewater slalom and kayak polo as well as completing the 2004 Boston Marathon. It is with kayak polo that she achieved national and international success through the USA Women's teams and Boston women's club team. Other activities included competing on the BU gymnastics club team during her sophomore and junior year as well as playing in the BU concert band on trumpet during her junior and senior year. Upon graduating from Boston University, Stephanie took two years off from continued education and moved to Austin, Texas to train for and compete with the USA Women's team at the 2006 and 2008 World Championships held in Amsterdam and Edmonton respectively. She has been employed with the University of Texas at Austin since 2006 as a full time administrative worker to fund these passions, and was able to continue her employment throughout her enrollment in graduate school. In August 2008, Stephanie entered the Anthropology program at Texas State University-San Marcos, focusing on Physical Anthropology. She received her Master of Arts in Anthropology from Texas State in August 2010.

Permanent Address: 6502 Sunnysky Way

Austin, Texas 78745

stephanie.schnorr@gmail.com

This thesis was typed by Stephanie L. Schnorr.