



BIOMETRICS AS BIOFEEDBACK

GADGETS FOR A HEALTHIER YOU

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BIOMETRICS REFERS TO THE STATISTICAL ANALYSIS OF BIOLOGICAL DATA.

EXAMPLES: FINGERPRINTS, FACIAL RECOGNITION, DNA PATTERNS, AND VOICE RECOGNITION. BUT ALSO HEART RATE MONITORS, GLUCOSE READERS AND MORE.

BIOFEEDBACK IS A TECHNIQUE THAT INVOLVES USING VISUAL OR AUDITORY FEEDBACK TO GAIN CONTROL OVER INVOLUNTARY BODILY FUNCTIONS. THIS MIGHT INCLUDE GAINING VOLUNTARY CONTROL OVER SUCH THINGS AS HEART RATE, MUSCLE TENSION, AND BLOOD PRESSURE.

TRADITIONAL BIOFEEDBACK AS A FORM OF THERAPY

- **HEART RATE VARIABILITY (HRV) BIOFEEDBACK**
 - **DESCRIPTION:** FOCUSES ON THE VARIATIONS IN THE TIME INTERVAL BETWEEN HEARTBEATS.
 - **APPLICATION:** USED FOR STRESS REDUCTION, IMPROVING EMOTIONAL REGULATION, AND ENHANCING OVERALL CARDIOVASCULAR HEALTH.
- **ELECTROMYOGRAPHY (EMG) BIOFEEDBACK**
 - **DESCRIPTION:** MEASURES MUSCLE ACTIVITY AND TENSION.
 - **APPLICATION:** OFTEN USED IN TREATING CHRONIC PAIN, MUSCLE REHABILITATION, AND CONDITIONS LIKE TENSION HEADACHES.
- **THERMAL BIOFEEDBACK**
 - **DESCRIPTION:** MONITORS SKIN TEMPERATURE AS AN INDICATOR OF BLOOD FLOW.
 - **APPLICATION:** USED FOR STRESS AND ANXIETY MANAGEMENT, MIGRAINE RELIEF, AND IMPROVING CIRCULATION.

TRADITIONAL BIOFEEDBACK AS A FORM OF THERAPY

- **NEUROFEEDBACK (EEG BIOFEEDBACK)**

- **DESCRIPTION: FOCUSES ON BRAINWAVE PATTERNS TO TRAIN THE BRAIN.**
- **APPLICATION: APPLIED IN TREATING ADHD, DEPRESSION, EPILEPSY, AND IMPROVING COGNITIVE PERFORMANCE.**

- **RESPIRATORY BIOFEEDBACK**

- **DESCRIPTION: INVOLVES MONITORING AND CONTROLLING BREATHING PATTERNS.**
- **APPLICATION: HELPFUL IN MANAGING STRESS, ANXIETY, AND RESPIRATORY CONDITIONS LIKE ASTHMA.**

- **GALVANIC SKIN RESPONSE (GSR) BIOFEEDBACK**

- **DESCRIPTION: MEASURES THE LEVEL OF SKIN PERSPIRATION, WHICH CAN INDICATE STRESS OR AROUSAL.**
- **APPLICATION: PRIMARILY USED IN STRESS REDUCTION AND ANXIETY MANAGEMENT.**



**BIOFEEDBACK
IS JUST LISTENING
TO YOUR BODY.**

COMMON BIOMETRIC DEVICES

- **FITBIT SERIES**

- **FEATURES:** TRACKS STEPS, DISTANCE, CALORIES BURNED, SLEEP QUALITY, HEART RATE.
- **USER-FRIENDLY:** KNOWN FOR ITS USER-FRIENDLY INTERFACE AND COMMUNITY ENGAGEMENT FEATURES.
- **VARIETY:** OFFERS A RANGE OF MODELS WITH VARYING FEATURES TO SUIT DIFFERENT NEEDS AND BUDGETS.

- **APPLE WATCH**

- **ADVANCED HEALTH MONITORING:** INCLUDES ECG, BLOOD OXYGEN LEVEL MONITORING, AND FALL DETECTION.
- **INTEGRATION:** SEAMLESSLY INTEGRATES WITH OTHER APPLE DEVICES AND SERVICES.
- **FITNESS FOCUS:** STRONG EMPHASIS ON FITNESS TRACKING, WITH PERSONALIZED ACTIVITY GOALS AND COMPETITIONS.

- **GARMIN FITNESS TRACKERS**

- **DURABILITY:** POPULAR AMONG OUTDOOR ENTHUSIASTS FOR ITS RUGGED BUILD.
- **SPECIALIZED FEATURES:** OFFERS ADVANCED METRICS LIKE VO2 MAX, STRESS SCORE, AND PERFORMANCE CONDITION FOR ATHLETES.
- **GPS FUNCTIONALITY:** SUPERIOR GPS TRACKING FOR OUTDOOR ACTIVITIES.

- **SAMSUNG GALAXY WATCH**

- **CUSTOMIZATION:** HIGHLY CUSTOMIZABLE WATCH FACES AND STRAPS.
- **HEALTH FEATURES:** INCLUDES HEART RATE MONITORING, SLEEP TRACKING, AND STRESS MANAGEMENT TOOLS.
- **SMARTPHONE INTEGRATION:** WORKS WELL WITH SAMSUNG SMARTPHONES, OFFERING EXTENDED FUNCTIONALITIES.



SMART WATCHES!

NOT SO COMMON BIOMETRIC DEVICES

- **CONTINUOUS GLUCOSE MONITORS (CGMS)**

- **DESCRIPTION:** DEVICES THAT TRACK GLUCOSE LEVELS IN REAL-TIME OR NEAR REAL-TIME.
- **USE CASES:** ORIGINALLY DESIGNED FOR DIABETICS, BUT INCREASINGLY USED FOR MANAGING WEIGHT, ENERGY LEVELS, AND OVERALL HEALTH.
- **EXAMPLES:** DEXCOM G6, FREESTYLE LIBRE.

- **SMART RINGS**

- **DESCRIPTION:** WEARABLE TECHNOLOGY IN THE FORM OF A RING THAT TRACKS VARIOUS HEALTH METRICS.
- **UNIQUE FEATURES:** INCLUDES SLEEP TRACKING, ACTIVITY LEVELS, HEART RATE MONITORING. OFTEN PRIZED FOR DISCRETION AND COMFORT.
- **EXAMPLES:** OURA RING, MOTIV RING.

- **BRAIN SENSING HEADBANDS**

- **DESCRIPTION:** DEVICES THAT MEASURE BRAIN ACTIVITY TO PROVIDE FEEDBACK FOR MEDITATION AND STRESS REDUCTION.
- **USE CASES:** HELPS IN ENHANCING FOCUS, REDUCING STRESS, AND IMPROVING SLEEP.
- **EXAMPLES:** MUSE HEADBAND, NEUROSKY MINDWAVE.

HOW TO USE THE WATCHES

HEART RATE & EXERCISE

HEART RATE & EXERCISE

- TO MAINTAIN A HEALTHY WEIGHT, IT IS GENERALLY RECOMMENDED TO ENGAGE IN MODERATE-INTENSITY AEROBIC EXERCISE FOR AT LEAST 150 MINUTES PER WEEK, WHICH CAN INCLUDE ACTIVITIES LIKE BRISK WALKING, CYCLING, OR SWIMMING. I CONSIDER THIS ONE STEP ABOVE THE 10,000 STEPS RULE.
- FOR WEIGHT LOSS AIM FOR AT LEAST 300 MINUTES OF MODERATE-INTENSITY AEROBIC EXERCISE PER WEEK OR 150 MINUTES OF VIGOROUS-INTENSITY EXERCISE.
- YOUR MAXIMUM HEART RATE IS 220 MINUS YOUR AGE.
 - MODERATE INTENSITY = 50-70% HR MAX
 - VIGOROUS INTENSITY = 70-90% HR MAX
- INTERVAL TRAINING CAN BE EFFECTIVE FOR WEIGHT LOSS AS IT CAN HELP BURN MORE CALORIES IN A SHORTER TIME.

HEART RATE & STRESS LEVELS

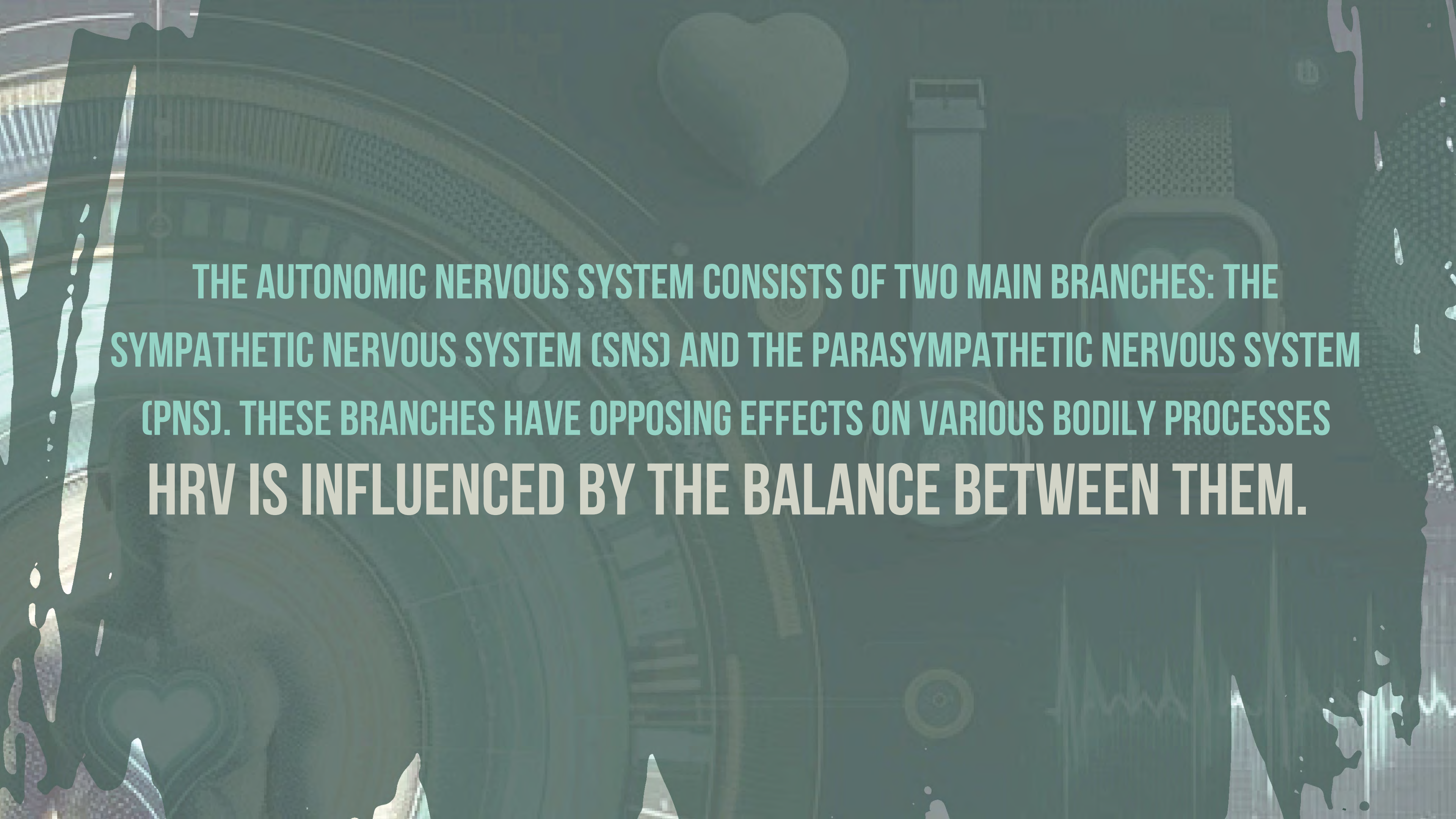
- **WALKING:**
 - 90-110 BEATS PER MINUTE
- **CASUAL CHORES: CLEANING, COOKING, LAUNDRY**
 - 70-90 BPM
- **RUNNING:**
 - 150-170 BPM
- **SITTING AND WATCHING TV:**
 - 60-100 BPM
- **SLEEPING:**
 - 40-60 BPM

UNDERSTANDING RESTING HEART RATE

- RHR CAN VARY WIDELY AMONG INDIVIDUALS BUT GENERALLY FALLS WITHIN THE RANGE OF 60 TO 100 BEATS PER MINUTE (BPM) FOR ADULTS.
- A LOWER RESTING HEART RATE TYPICALLY INDICATES BETTER CARDIOVASCULAR FITNESS AND EFFICIENCY. ATHLETES AND WELL-CONDITIONED INDIVIDUALS OFTEN HAVE RHRs BELOW 60 BPM.
- SO, AS A FORM OF BIOFEEDBACK, HOW FAR OFF FROM YOUR RESTING HEART RATE ARE YOU?

HOW TO USE THE WATCHES

HEART RATE VARIABILITY



THE AUTONOMIC NERVOUS SYSTEM CONSISTS OF TWO MAIN BRANCHES: THE SYMPATHETIC NERVOUS SYSTEM (SNS) AND THE PARASYMPATHETIC NERVOUS SYSTEM (PNS). THESE BRANCHES HAVE OPPOSING EFFECTS ON VARIOUS BODILY PROCESSES HRV IS INFLUENCED BY THE BALANCE BETWEEN THEM.

SYMPATHETIC & PARASYMPATHETIC NERVOUS SYSTEM

- **SYMPATHETIC NERVOUS SYSTEM (SNS):**

- "FIGHT OR FLIGHT"
- ACTIVATION OF THE SNS LEADS TO INCREASED HEART RATE AND FORCE OF CONTRACTION, AS WELL AS THE DILATION OF BLOOD VESSELS TO MUSCLES WHILE CONSTRICTING THOSE TO NON-ESSENTIAL ORGANS LIKE THE DIGESTIVE SYSTEM.
- WHEN THE SNS IS DOMINANT, HRV TENDS TO DECREASE BECAUSE HEART RATE BECOMES MORE REGULAR AND LESS VARIABLE.

- **PARASYMPATHETIC NERVOUS SYSTEM (PNS):**

- "REST AND DIGEST"
- ACTIVATION OF THE PNS LEADS TO DECREASED HEART RATE AS WELL AS THE DILATION OF BLOOD VESSELS TO NON-ESSENTIAL ORGANS.
- WHEN THE PNS IS DOMINANT, HRV TENDS TO INCREASE BECAUSE THERE IS MORE VARIABILITY BETWEEN HEARTBEATS. THIS VARIABILITY IS INFLUENCED BY THE CONSTANT FINE-TUNING OF THE HEART RATE BY THE PNS TO ADAPT TO THE BODY'S NEEDS.

USING HRV FOR HEALTH

- **CARDIOVASCULAR HEALTH:**
 - HRV CAN SERVE AS AN EARLY WARNING SIGN OF CARDIOVASCULAR PROBLEMS.
- **EXERCISE OPTIMIZATION:**
 - ATHLETES AND FITNESS ENTHUSIASTS CAN USE HRV TO OPTIMIZE THEIR TRAINING ROUTINES. HRV CAN INDICATE IF THE BODY IS ADEQUATELY RECOVERED AND READY FOR INTENSE WORKOUTS OR IF REST IS NEEDED.
- **SLEEP QUALITY:**
 - POOR SLEEP CAN NEGATIVELY IMPACT HRV. MONITORING HRV DURING SLEEP CAN HELP IDENTIFY SLEEP DISTURBANCES OR SLEEP-RELATED DISORDERS.
- **CHRONIC ILLNESS MANAGEMENT:**
 - SOME CHRONIC ILLNESSES, SUCH AS DIABETES AND HYPERTENSION, ARE ASSOCIATED WITH REDUCED HRV. REGULAR HRV MONITORING CAN HELP INDIVIDUALS MANAGE THEIR CONDITIONS AND MAKE NECESSARY LIFESTYLE ADJUSTMENTS.
- **MENTAL HEALTH:**
 - HRV HAS BEEN STUDIED IN RELATION TO MENTAL HEALTH CONDITIONS SUCH AS ANXIETY, DEPRESSION, AND POST-TRAUMATIC STRESS DISORDER (PTSD). ALTERED HRV PATTERNS CAN BE INDICATIVE OF THESE CONDITIONS.

BIOFEEDBACK AND RELAXATION TRAINING

HRV BIOFEEDBACK INVOLVES MONITORING HRV IN REAL-TIME AND LEARNING TO CONTROL IT THROUGH RELAXATION TECHNIQUES, DEEP BREATHING, AND MEDITATION. PRACTICING HRV BIOFEEDBACK CAN HELP INDIVIDUALS REDUCE STRESS, ANXIETY, AND IMPROVE THEIR OVERALL MENTAL AND PHYSICAL WELL-BEING.

BUT THE BEST WAY TO REGULATE HRV IS TO

move

BODY

CONTINUOUS GLUCOSE MONITORS

MEASURING THE CHEMICAL MESSENGERS

CONTINUOUS GLUCOSE MONITORS



MEASURING THE CHEMICAL MESSENGERS

HOW TO GET ONE (IF YOU DON'T HAVE DIABETES)

- **ABBOTT'S FREESTYLE LIBRE:** ABBOTT OFFERS THE FREESTYLE LIBRE FAMILY OF CGM PRODUCTS. THEY PROVIDE VARIOUS PROGRAMS, INCLUDING TRIAL OFFERS, THAT MAY REDUCE THE OUT-OF-POCKET COSTS FOR PATIENTS. THE FREESTYLE LIBRE 2 AND FREESTYLE LIBRE 3 SYSTEMS ARE AVAILABLE, AND THEY OFFER REAL-TIME GLUCOSE ALARMS AND CONTINUOUS GLUCOSE MONITORING WITHOUT THE NEED FOR FINGERSTICKS UNDER CERTAIN CONDITIONS.
- **US MED:** THIS SITE OFFERS VARIOUS CGM DEVICES, INCLUDING THE FREESTYLE LIBRE AND DEXCOM G6 SYSTEMS. US MED ALSO PROVIDES INFORMATION ABOUT INSURANCE COVERAGE AND ELIGIBILITY FOR MEDICARE. THEIR WEBSITE HIGHLIGHTS THE BENEFITS OF CGM SYSTEMS, SUCH AS REDUCING OR ELIMINATING FINGER STICKS, TRACKING GLUCOSE LEVELS OVER TIME, AND HELPING TO LOWER A1C LEVELS.
- **DEXCOM:** THEY OFFER THE DEXCOM G7 AND G6 CGM SYSTEMS. DEXCOM G7 IS KNOWN FOR ITS ACCURACY AND EASE OF USE, PROVIDING REAL-TIME GLUCOSE READINGS WITHOUT THE NEED FOR FINGERSTICKS IN CERTAIN SITUATIONS. THEY ALSO OFFER A COMPARISON OF THEIR PRODUCTS, AND YOU CAN REQUEST A FREE 10-DAY SAMPLE OF DEXCOM G7 FROM THEIR WEBSITE.
- **MEDTRONIC'S GUARDIAN CONNECT:** THIS CGM SYSTEM IS DESIGNED FOR USE WITH BOTH TYPE 1 AND TYPE 2 DIABETES. IT PROVIDES REAL-TIME GLUCOSE LEVEL UPDATES ON A MOBILE DEVICE, AND THE SYSTEM INCLUDES A SENSOR AND A TRANSMITTER. THE GUARDIAN CONNECT SYSTEM OFFERS CUSTOMIZABLE ALERTS AND PREDICTIVE ALERTS UP TO 60 MINUTES IN ADVANCE OF A HIGH OR LOW GLUCOSE EVENT.

CONTINUOUS GLUCOSE MONITORS

Sugar Sugar

MEASURING THE CHEMICAL MESSENGERS

COMMON BLOOD SUGAR FLUCTUATIONS & EFFECTS

- **HORMONAL CHANGES:**
 - **DAWN PHENOMENON:** MANY PEOPLE EXPERIENCE A NATURAL RISE IN BLOOD SUGAR LEVELS IN THE EARLY MORNING HOURS, KNOWN AS THE DAWN PHENOMENON.
 - **HORMONAL CHANGES DURING THE MENSTRUAL CYCLE CAN AFFECT BLOOD SUGAR REGULATION IN SOME WOMEN**
- **STRESS AND EMOTIONS:**
 - **THE BODY'S STRESS RESPONSE CAN LEAD TO THE RELEASE OF STRESS HORMONES, SUCH AS CORTISOL, WHICH CAN TEMPORARILY RAISE BLOOD SUGAR LEVELS.**
 - **EMOTIONAL STRESS MAY LEAD TO UNHEALTHY EATING HABITS, CAUSING SPIKES IN BLOOD SUGAR IF INDIVIDUALS CONSUME HIGH-SUGAR OR HIGH-CARBOHYDRATE COMFORT FOODS.**
- **SLEEP PATTERNS:**
 - **IRREGULAR SLEEP PATTERNS OR INSUFFICIENT SLEEP CAN DISRUPT THE BODY'S CIRCADIAN RHYTHMS, POTENTIALLY LEADING TO BLOOD SUGAR FLUCTUATIONS. ADEQUATE, REGULAR SLEEP IS IMPORTANT FOR MAINTAINING STABLE GLUCOSE LEVELS.**
- **ILLNESS AND INFECTION:**
 - **ILLNESSES AND INFECTIONS CAN TRIGGER AN INFLAMMATORY RESPONSE IN THE BODY, WHICH MAY TEMPORARILY RAISE BLOOD SUGAR LEVELS AS PART OF THE IMMUNE SYSTEM'S REACTION.**

COMMON BLOOD SUGAR FLUCTUATIONS & EFFECTS

- **DIET AND MEAL TIMING:**
 - **POST-MEAL SPIKE:** AFTER CONSUMING A MEAL, BLOOD SUGAR LEVELS NATURALLY RISE AS CARBOHYDRATES ARE DIGESTED AND CONVERTED INTO GLUCOSE.
 - **LOW BLOOD SUGAR BETWEEN MEALS:** AS THE BODY UTILIZES GLUCOSE FOR ENERGY, BLOOD SUGAR LEVELS CAN GRADUALLY DECLINE BETWEEN MEALS.
- **PHYSICAL ACTIVITY:**
 - **PHYSICAL ACTIVITY CAN EITHER RAISE OR LOWER BLOOD SUGAR LEVELS DEPENDING ON ITS INTENSITY AND DURATION. MODERATE TO INTENSE EXERCISE CAN LEAD TO A TEMPORARY INCREASE IN BLOOD SUGAR DUE TO THE RELEASE OF STRESS HORMONES LIKE ADRENALINE, WHILE PROLONGED EXERCISE CAN LOWER BLOOD SUGAR AS MUSCLES USE GLUCOSE FOR ENERGY.**



**REGULAR
PHYSICAL ACTIVITY
LOWERS
BLOOD GLUCOSE LEVELS**

EXERCISE & GLUCOSE MANAGEMENT

- **IMMEDIATE EFFECTS:** AFTER A 30-MINUTE SESSION OF MODERATE-INTENSITY AEROBIC EXERCISE, SOME INDIVIDUALS MAY EXPERIENCE A TEMPORARY REDUCTION IN BLOOD SUGAR LEVELS OF APPROXIMATELY 20-50 MG/DL. THIS CAN VARY DEPENDING ON FACTORS SUCH AS YOUR INITIAL BLOOD SUGAR LEVEL, THE INTENSITY OF THE EXERCISE, AND YOUR BODY'S RESPONSE.
- **LONG-TERM EFFECTS:** REGULAR EXERCISE, WHEN INCORPORATED INTO A CONSISTENT ROUTINE OVER WEEKS OR MONTHS, CAN LEAD TO MORE SIGNIFICANT REDUCTIONS IN BLOOD SUGAR LEVELS. OVER TIME, IT CAN HELP LOWER FASTING BLOOD SUGAR LEVELS BY 10-30 MG/DL OR MORE, PARTICULARLY IN INDIVIDUALS WITH CONDITIONS LIKE PREDIABETES OR TYPE 2 DIABETES.
- **AS A ROUGH ESTIMATE, CONSUMING ABOUT 5 GRAMS OF CARBOHYDRATES IS OFTEN ASSOCIATED WITH AN INCREASE IN BLOOD SUGAR LEVELS OF APPROXIMATELY 20-50 MG/DL WITHIN 30 MINUTES AFTER CONSUMPTION IN SOME INDIVIDUALS.**
- **IT'S IMPORTANT TO NOTE THAT THIS ESTIMATE CAN VARY WIDELY BASED ON FACTORS SUCH AS THE TYPE OF CARBOHYDRATES CONSUMED (SIMPLE SUGARS VS. COMPLEX CARBOHYDRATES), INDIVIDUAL METABOLISM, INSULIN SENSITIVITY, AND THE PRESENCE OF OTHER NUTRIENTS OR FACTORS THAT MAY INFLUENCE BLOOD SUGAR RESPONSE (E.G., FIBER, PROTEIN, FAT).**

CONTINUOUS GLUCOSE MONITORS

Stress

MEASURING THE CHEMICAL MESSENGERS

CORTISOL (STRESS) & GLUCOSE LEVELS

- **CORTISOL INCREASES GLUCOSE PRODUCTION, RAISING BLOOD SUGAR LEVELS.**
- **TIMELINE OF GLUCOSE CHANGES POST-CORTISOL RELEASE**
 - **INITIAL RESPONSE (0-30 MINUTES)**
 - **PEAK RESPONSE (30-60 MINUTES)**
- **NORMALIZATION OF GLUCOSE LEVELS**
 - **GRADUAL CLEARANCE (1-2 HOURS)**
 - **RETURN TO BASELINE (2-4 HOURS)**
 - **FACTORS AFFECTING CLEARANCE: THE TIMELINE CAN VARY BASED ON INDIVIDUAL HEALTH, THE INTENSITY OF THE STRESSOR, AND OTHER PHYSIOLOGICAL FACTORS.**

NORMAL BLOOD SUGAR LEVELS

IT'S IMPORTANT TO NOTE THAT NORMAL BLOOD SUGAR LEVELS CAN VARY FROM PERSON TO PERSON. TYPICALLY, FASTING BLOOD SUGAR LEVELS (BEFORE EATING) ARE CONSIDERED NORMAL WHEN THEY RANGE FROM ABOUT 70 TO 100 MG/DL. POST-MEAL LEVELS MAY VARY BUT SHOULD GENERALLY RETURN TO NEAR-NORMAL RANGES WITHIN A FEW HOURS.

NORMAL BLOOD SUGAR LEVELS

IN NON-DIABETIC INDIVIDUALS, BLOOD GLUCOSE LEVELS USUALLY PEAK ABOUT 1 HOUR AFTER EATING. IT'S NORMAL FOR BLOOD SUGAR TO RISE AFTER A MEAL, BUT IT GENERALLY DOESN'T GO ABOVE 140 MG/DL. WITHIN 2 TO 3 HOURS AFTER EATING, IT SHOULD RETURN TO PRE-MEAL LEVELS.

BIOFEEDBACK AND GLUCOSE MONITORING

The image features a dark teal background with a large, faint clock face. Overlaid on this are several semi-transparent icons: a heart at the top center, a smartwatch with a heart icon on its screen to the right, a person's silhouette on the left, and a pulse line at the bottom right.

WE WANT
flexibility

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