Sleep Quality, Quality of Life and Cognitive Performance among Adolescents with Type 1 Diabetes Compared to Healthy Controls

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**Introduction:** The sleep structure of adolescents with Type 1 Diabetes (T1D) differs from healthy adolescents. T1D adolescents experience poor sleep quality, longer stage 2 sleep, shorter deep sleep, and more sleep disorders. Sleep is crucial for memory, working memory, as well as establishing and consolidating long-term memory. T1D adolescents might also be affected by fatigue and a lower quality of life, and struggle with loss of cognitive performance affecting executive functions and language capabilities, which might lead to lower school grades. The link between T1D and decreased cognitive function is described well in the literature, but findings are inconsistent. However, studies highlight the relationship between quality of sleep and cognitive function.

Therefore, we hypothesized that sleep quality, quality of life, and cognitive performance (measured by executive functions, processing accuracy and speed, short-term memory, visual attention, reasoning, memory, attention and perception, along with an overall score) of T1D adolescents would be lower compared to healthy controls.

 **Method:** Eighty adolescents aged 11 to 20 (mean age 14±2.31) from both sexes (38.7 % male) were divided into two groups: A. 44 T1D, B. 36 healthy control adolescents. Participants were given several sleep quality and quality of life questionnaires. Moreover, sleep was measured objectively for one week (by actigraph, Respronix, Philp), and participants had to perform various computerized cognitive-function and pencil-and-paper tests. The Helsinki committee approved the study at the Emek Medical Center (EMC-0115-14).

**Results:** The two groups (T1D and healthy adolescents) had a shorter sleep duration (7:33) than recommended for this age (< 8:00). However, the two groups showed no significant differences in sleep duration (7:47±1:03 vs. 7:20±0:41), sleep efficiency (85±4 % vs. 85±5 %), or sleep latency (15±19 vs. 13±10 min). Additionally, no significant differences were found in subjective sleep and quality of life overall score (72±21 vs. 73±15).

Significant differences were found in several cognitive computerized indices: memory (198.3±127.6 vs. 384.8±103.5; p<0.001), attention and concentration (266.9±141.3 vs. 384.8±103.5; p<0.001), coordination (268.7±148 vs. 415.6±104.6; p<0.001), perception (315.1±108.3 vs. 425.6±65.5; p<0.001), and overall score (318.2±103.7 vs. 388.3±61.7; p<0.001) between T1D and healthy adolescents respectively. We also found considerable differences in partial executive functions, processing accuracy, and speed using pencil-and-paper tests.

 **Discussion:** The lack of disparities in sleep quality between T1D and the control group may be explained by the fact that the differences are more pronounced in the stages of sleep; however, all adolescents experienced significant sleep patterns changes. Thus, the result was sleep deprivation, feeling fatigue, and lower quality of life. Contrastingly, the T1D group is more affected by poor sleep, and cognitive performance results are lower compared to the control group, which is in line with the literature. In conclusion, the present study highlights the importance of “sleeping well” for adolescents, and particularly for individuals suffering from T1D.