



Effect of Anthropometrical Measurements on Liver Span Using Ultrasonography

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ABSTRACT

Background: Various anthropometrical measurements may influence liver size. **Aim:** To study correlation of liver span according to age, sex, weight, height, and BMI. **Material and Methods:** The study was conducted on 100 healthy subjects aged 18-65 years. The Ultrasonographic liver span in MCL was then correlated with age, sex, height, weight, and BMI of the subjects. **Results:** Ultrasonographic mean liver span in males was 14.16 ± 1.32 cm while in females it was 12.79 ± 1.40 cm. Positive correlation was found with age ($r=0.268$; $p=0.007$) and weight ($r=0.4767$ and $p<0.001$) while negative with BMI ($r=-0.226$ and $p=0.0238$). Height had significantly high positive correlation ($r=0.752$; $p<0.001$). **Conclusions:** Ultrasonographic liver span had a positive correlation with age, weight, and height; while a negative correlation with BMI of the subjects was seen. Among all variables height was the major factor determining the liver span in the MCL.

Keywords: Liver span, Anthropometrical measurements, Ultrasonography

INTRODUCTION

Liver is a large, solid organ situated in right upper quadrant of abdominal cavity and extends from the fifth intercostal space in the midclavicular line to right costal margin. Liver weighs about 1400-1600 g in males and about 1200-1400 g in females. The weight of the liver comprises about 1/40th of the adult body weight [1].

Ultrasound scanning is non-invasive, usually painless, widely available, easy-to-use and less expensive than other imaging methods. Also, ultrasound imaging does not use any ionizing radiation while it gives a clear picture of soft tissues that do not show up well on x-ray images. One of the most frequent requests to sonographers by clinicians is for evaluation of hepatic size [2].

Liver span normally varies with age. Span of dullness also shows a significant correlation with body size that is with height or more specifically with estimated total lean body mass. About 10 cm liver span of liver dullness is likely to represent hepatomegaly in a 5-ft tall, 100 lb woman but is well within normal limits in a 6-ft tall, 200 lb man. This observation is not surprising since autopsy data show that the weight of the liver and of other organs correlates well with body size. The relationship of the normal liver span to age and sex has been studied in American children. The relationship of the liver span to height and weight in normal adult Americans has also been studied and in Indians in relation to age, sex, height, and weight [3].

REVIEW OF LITERATURE

Claus Neadeau examined 1000 consecutive blood donors by ultrasound and found that diameters at midclavicular line were smaller in women than in men and demonstrated a positive correlation with height and surface area [4].

Singh, et al. revealed liver span showing significant correlation to height, weight, and age. Liver span best correlated with height and additional use of weight and age by multiple linear regression did not significantly increase the coefficient of correlation [5].

According to a prospective study carried out at Jordan University Hospital between March 2007 and April 2008, the best predictor of liver span was height in case of males, body surface area in case of females, and both height and body surface area when both genders are considered [6].

MATERIALS AND METHODS

The study was conducted on 100 healthy subjects, aged 18-65 years and BMI 18.5 kg/m² - 24.9 kg/m² including attendants of patients, medical and paramedical personnel in Rajindra Hospital Patiala. The study was approved by the committee of medical ethics at Rajindra Hospital, Patiala, India.

The subjects should not have clinical evidence of any hepatic pathology, cardiovascular disease, liver infection, lymphoma or leukaemia, intestinal perforation and should not be alcoholic, overweight, and underweight.

After obtaining informed consent data on adult's height, age, weight was collected. BMI was calculated by the following formula:

$$BMI = \frac{\text{Weight in Kg}}{(\text{Ht in metres})^2}$$

USG evaluation was performed on Philips Envisor whole body MC-15601 ultrasound machine in the Department of Radiodiagnosis, Govt. Medical College and Rajindra Hospital, Patiala using real time scanning system with 5.0 MHz, frequency transducers; liver span was measured as the distance between the dome of the liver and inferior edge from the Polaroid image of the USG as described by Borner, et al. [7].

The Ultrasonographic liver span in MCL was then correlated with age, sex (Figure 1), height, weight, and BMI of the subjects. The data statistically analyzed. The statistical analysis was carried out using statistical package for the social sciences (SPSS Inc., Chicago, IL, version 15.0 for Windows).

RESULTS

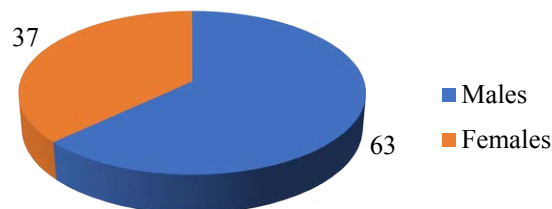


Figure 1 Demographic distribution as per sex

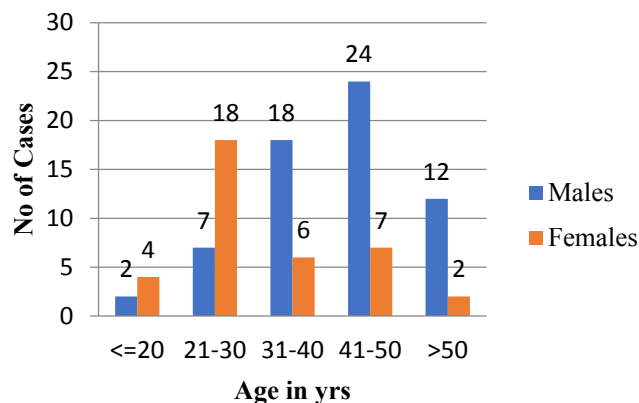


Figure 2 Demographic distribution as per age

As seen in Figure 2, The mean age of the males was 31.81 ± 11.419 years and females was 32.32 ± 11.138 years.

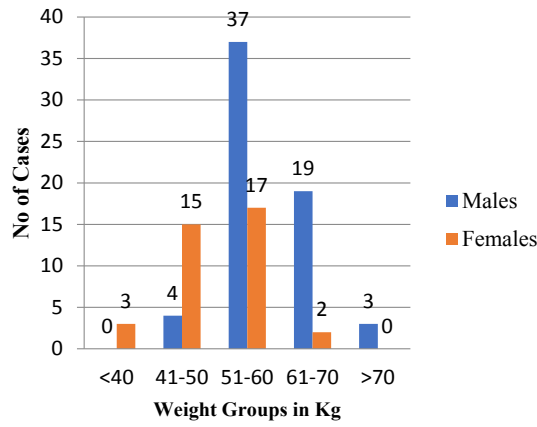


Figure 3 Demographic distribution as per weight

Figure 3 shows that amongst females mean weight was 50.7 ± 6.4 kg while in males mean weight was 59.175 ± 6.8 kg. Among females mean height was 153.28 ± 8.3 cm and among males it was 166.81 ± 7.2 cm (Figure 4).

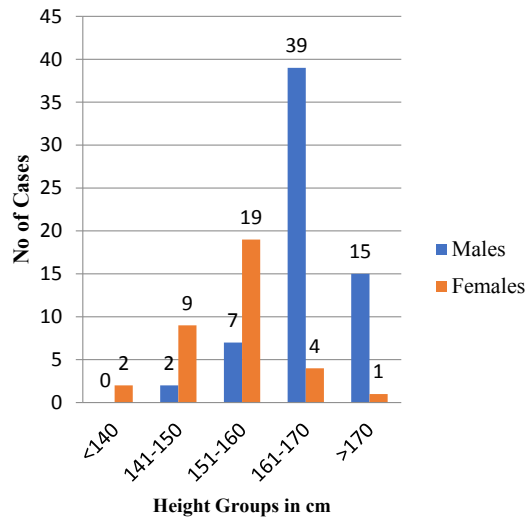


Figure 4 Demographic distribution as per height

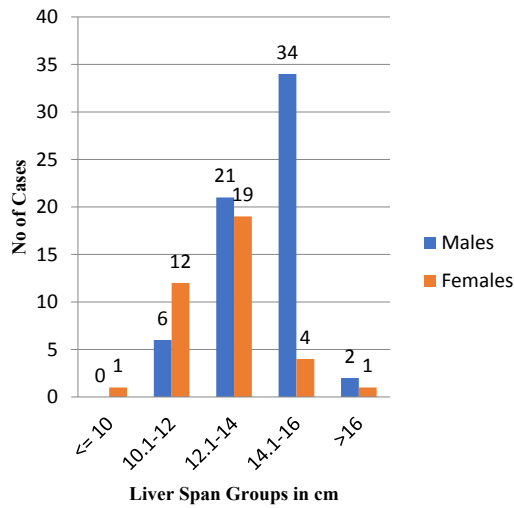


Figure 5 Ultrasonic Liver Span in cm

The mean liver span measured by ultrasonographically in mid-clavicular line in the present study was 13.65 ± 1.5 cm. Males had mean liver span of 14.16 ± 1.32 while in females it was 12.79 ± 1.40 (Figure 5).

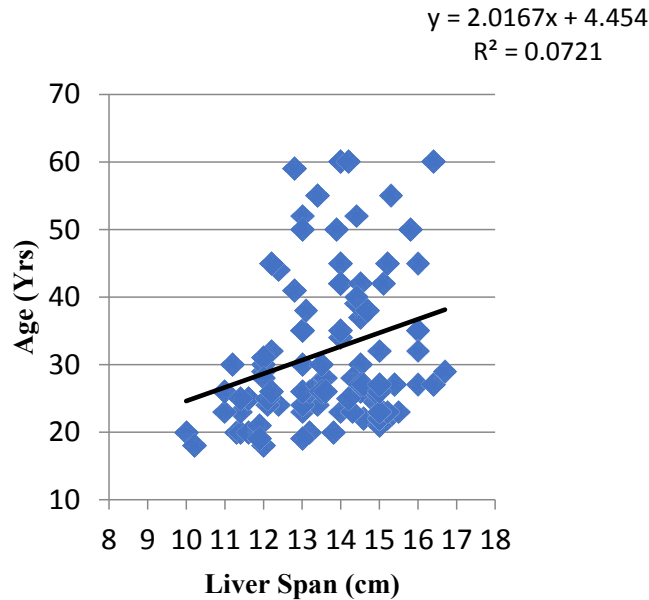


Figure 6 Ultrasonographic Liver Span vs Age

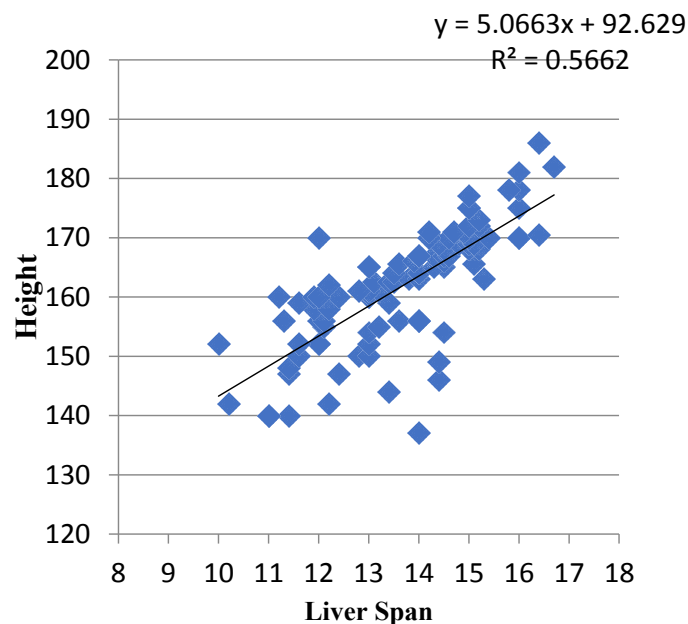


Figure 7 Ultrasonic Liver vs Height

Positive correlation ($r=0.268$) between Ultrasonographic liver span and age can be seen but it is not significant ($p=0.007$) (Figure 6). Strong significant positive correlation was observed between ultrasonographic liver span and height ($r=0.752$ and $p<0.001$) (Figure 7). Also, a positive correlation between ultrasonographic liver span and weight with $r=0.4767$ and $p<0.001$ was found as shown in Figure 8. Whereas, negative correlation between ultrasonographic liver span and BMI ($r=-0.226$ and $p=0.0238$) was found (Figure 9).

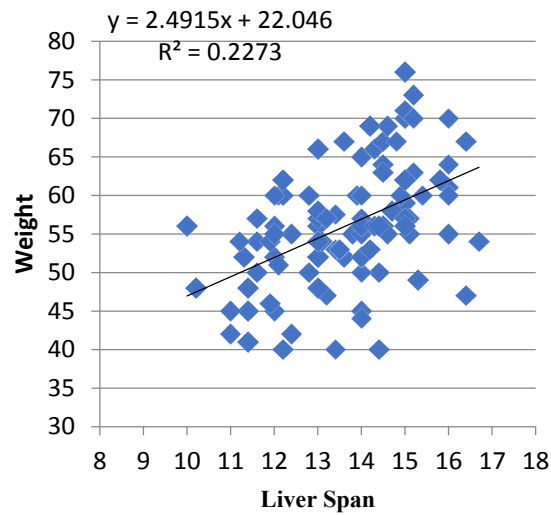


Figure 8 Ultrasonic Liver Span vs Weight

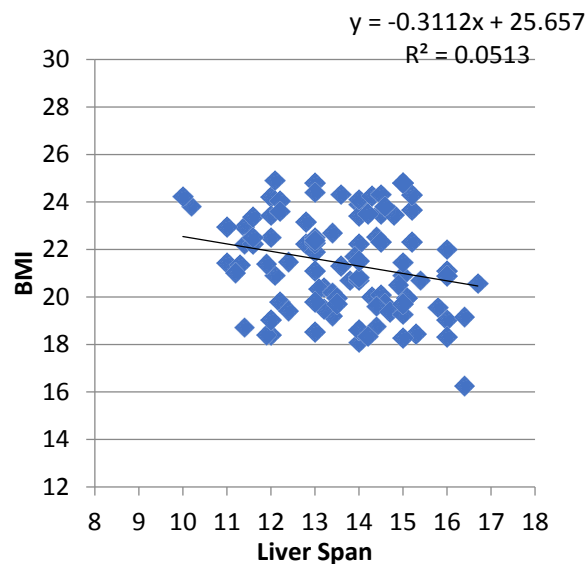


Figure 9 Ultrasonic Liver Span vs BMI

DISCUSSION

In our study, the ultrasonographic liver span in mid-clavicular line was less in case of females than in males. This is in line with the study conducted by Niederau [4], Singh, et al. [5], Kratzer, et al. [2] and Emad, et al. [6] which showed larger diameter of liver in men compared to women.

We found a positive correlation between ultrasonic liver span with the age of the subjects ($r=0.268$; $p>0.05$); as also found by Singh, et al. [5] and Kratzer, et al. [2].

A statistically significant positive correlation was found between liver span and height ($r=0.752$; $p<0.001$) in our study which is in accordance with the studies conducted by Singh et al in 1985, Niederau, [4], Zoli, [9], Kratzer, et al. [2] and Emad, et al. [6].

Weight also correlated significantly with the liver span in our study ($r=0.4767$; $p<0.001$) as was also shown by the studies conducted by Singh, et al., Kratzer, et al. [2] and Emad, et al. [6].

BMI in our study was found to have a negative correlation ($r=-0.226$; $p>0.025$) with the ultrasonographic liver span in

the MCL as opposed to the previous studies conducted by, Kratzer, et al. [2] and Emad, et al. [6]. This was probably due to inclusion of obese and underweight individuals in their studies while such individuals had been excluded from our study. So, the exact correlation between the liver span and BMI could not be calculated in our present study.

CONCLUSION

After applying the regression analysis keeping ultrasonographic liver span in the MCL as an independent variable, among all the anthropometric factors, we found maximum correlation of ultrasonic liver span in MCL with the height. Various studies done in past by Neiderau [4], Singh, et al. [5] and Emad, et al. [6] had also shown the similar results.

Conflict of Interest

The authors and planners have disclosed no potential conflicts of interest, financial or otherwise.

REFERENCES

- [1] Chaurasia, B. D. *BD Chaurasia's Human Anatomy*. CBS Publishers & Distributors Pvt Ltd., 2010.
- [2] Kratzer, Wolfgang, et al. "Factors affecting liver size." *Journal of Ultrasound in Medicine* 22.11 (2003): 1155-1161.
- [3] Rosenfield, Arthur T., Igor Laufer, and Peter B. Schneider. "The significance of a palpable liver: a correlation of clinical and radioisotope studies." *American Journal of Roentgenology* 122.2 (1974): 313-317.
- [4] Niederau, C., et al. "Sonographic measurements of the normal liver, spleen, pancreas, and portal vein." *Radiology* 149.2 (1983): 537-540.
- [5] Singh, V., et al. "Liver span--a comparative appraisal of various methods." *Tropical gastroenterology: official Journal of the Digestive Diseases Foundation* 19.3 (1998): 98-99.
- [6] Tarawneh, Emad S., et al. "Ultrasound measurement of liver span in Jordanian adults: a preliminary experience." *Jordan Medical Journal* 43.3 (2010).
- [7] Börner N, Schwerk W, Braun B. Leber. In: Braun B, Günther R, Schwerk WB (eds). *Ultraschalldiagnostik*. Landsberg, Germany: Ecomed; 1987:1-18.
- [8] Singh K, Bhasin DK, Reddy DN, et al. "Liver span in normal Indians." *Indian Journal of Gastroenterology* 4 (1985): 73-75.
- [9] Zoli, Marco, et al. "Physical examination of the liver: is it still worth it?" *American Journal of Gastroenterology* 90.9 (1995):1428-1432.